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Exposé oral

Mémoire du Projet de transparence nucléaire

In the Matter of the

À l'égard d'

Ontario Power Generation Inc.

Ontario Power Generation Inc.

Applicability of the Darlington New Nuclear Project environmental assessment and plant parameter envelope to selected reactor technology

Applicabilité de l'évaluation environnementale et de l'enveloppe des paramètres de la centrale à la technologie de réacteur sélectionnée pour le projet de nouvelle centrale nucléaire de Darlington

Commission Public Hearing

Audience publique de la Commission

January 2024

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Canada

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Submitted via email

November 20, 2023

To Members of the Canadian Nuclear Safety Commission,

Re: Commission consideration of whether a new Environmental Assessment is required for Ontario Power Generation's proposed Darlington New Nuclear Project

We would like to begin by thanking the Commission for this opportunity to provide comments on this matter.

NTP recognizes this is a significant precedent-setting hearing that may set the tone for future Commission Tribunal consideration of new nuclear applications elsewhere. We submit that a robust and rigorous, transparent, diverse and open process is crucial for a comprehensive, responsible, and equitable decision. At this time, we submit a new environmental assessment would be the best way to achieve this.

Given the complex and varied aspects of the current proposal, NTP's submission has been scoped fairly narrowly. We wish to express appreciation for other intervenors and agencies who have addressed aspects of the proposal we were not able to address ourselves.

We would also like to thank and recognize the efforts of CNSC staff throughout this process (especially for the workshop they organized for intervenors last April as well as their helpful Commission Member Document for this hearing). We also thank Canadian civil society organizations, and Indigenous Nations and organizations for their informative publicly available materials and submissions on this matter. Finally, we are grateful for CNSC staff and OPG responses to all our information requests to date and appreciate the tour of the DNNP site OPG provided us with last week on November 13th. Our submissions are indebted to all these efforts.

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About NTP

The Nuclear Transparency Project (NTP) is a Canadian-registered not-for-profit organization dedicated to supporting open, informed, and equitable public discourse on nuclear technologies. NTP advocates for robust public access to data and other types of information and helps to produce accessible analysis of publicly available information, all with a view to supporting greater transparency in the Canadian nuclear sector.

NTP is comprised of a multi-disciplinary group of experts who work to examine the economic, ecological, and social facets and impacts of Canadian nuclear energy production. We are committed to interdisciplinary, cross-sectoral, and equitable collaborations and dialogue between regulators, industry, Indigenous nations and communities, civil society, members of host and potential host communities, and academics from a variety of disciplines.

About this intervention

NTP's intervention was made possible by CNSC funding through its Participant Funding Program (PFP). These submissions were drafted by NTP founder and coordinator Pippa Feinstein in collaboration with biologist (environmental toxicology) Dr. Shamaila Fraz and hydroecologist (biogeochemistry) Dr. Ekaterina Markelova. Dr. Fraz and Dr. Markelova's reports are also provided separately as appendices to these submissions.

Given the complex and varied aspects of the current OPG proposal, our organization has only focused on certain aspects of the BWRX-300 reactor design and its relation to the 2006-2010 Environmental Impact Statement (EIS) by OPG and 2009-2011 environmental assessment report by the Joint Review Panel (JRP) for the Darlington New Nuclear Project (DNNP). These primarily concern potential releases to the environment as well as design features that may impact local ecology. At times, this focus means we are also well-placed to note potential impacts to the public and workers, though this was not a focus of our intervention.

The same is true for issues relating to potential criticality and emergency scenarios involving BWRX-300 reactor designs. While those areas were not a focus of this intervention, we have included brief comments relating to how various scenarios may impact local ecology and in certain cases require further study. Generally, however, we defer to other intervenors' expertise in this regard.

Additionally, while we comment on waste composition and decommissioning issues in relation to environmental protection, we do not discuss waste management and decommissioning issues more broadly. Again, we appreciate the efforts of other intervenors focusing on those areas in their assessments.

Finally, NTP's submissions do not explicitly address Indigenous Nations and communities' comments relating to this proposal. NTP has consistently supported Indigenous intervenors' assessments of proposed nuclear projects in their homelands – and continues to do so in this instance. We also recognize Indigenous intervenors as relevant decision-makers with the authority to determine allowable activities by nuclear industry in their territories. NTP acknowledges the applicability of Indigenous laws and governance systems over these Nations' homelands on which OPG's Darlington facilities operate. We do not understand this CNSC review process to override Indigenous jurisdiction, nor do we believe it to indicate the paramountcy of Canadian law and regulation of the Darlington site. A formalized process by which Indigenous Peoples' authority and jurisdiction is observed is necessary to determine a just outcome of these matters and should be defined by these rights holders.

A note on the context for this assessment

Before discussing the main technical contributions of NTP's intervention in this matter, there are four contextual factors that we will canvas. They are: the precedent-setting nature of this regulatory review; the experimental nature of the BWRX-300 reactor design; the need for Commissioners to be clear and consistent in their approach to considering climate change; and the larger federal and provincial moves to promote and finance modular nuclear reactors. Each of these will be discussed in turn below.

This is the first CNSC review for a 'modular' reactor technology

This is effectively the first regulatory review of a 'modular' nuclear energy reactor by the CNSC Commission Tribunal.[1] As such, the current review is a precedent-setting case that can effectively set the tone for future reviews of other modular rector applications elsewhere. OPG also recognizes that its new build modular reactors, if approved, would "pave the way for the deployment of this technology elsewhere in Canada and abroad".[2] As such, a robust and rigorous assessment of the selected BWRX-300 reactor is crucial and OPG should be held to a high standard. NTP is concerned with any move to base the deployment of modular reactors on a 13-year old environmental assessment that never considered them specifically.

The evidentiary basis for any ultimate decision by the CNSC Commission Tribunal must be fulsome and NTP argues a new environmental assessment would be a helpful way to ensure this. NTP calls for a transparent, diverse, and open process to structure public involvement in these deliberations. Again, a new environmental assessment may facilitate this due to its institutionalized procedural benefits for intervenors, including proactive information disclosure via a specialized assessment registry. Ultimately, a review of the BWRX-300 reactor technology for the DNNP must result in a comprehensive, responsible, and equitable decision and provide a high-water mark for future reviews of modular technologies – a new environmental assessment can help achieve this.

[1] NTP notes that these reactors are referred to as "small" and "modular" reactors by OPG and the CNSC. However, we understand the modular nature of these reactors may be contingent on the scale of their development (i.e. number of units). Further, their size is relative: while smaller than existing CANDU reactors, international and ecological perspectives may characterize these rectors differently.

[2] Ontario Power Generation, online: https://www.opg.com/projects-services/projects/nuclear/smr/darlington-smr/.

The BWRX-300 reactor is a theoretical and untested technology

It remains difficult to discern how the BWRX-300 reactor will operate at the Darlington site, including its expected environmental performance, and the specifics of its management. There is no data relating to actual monitored and measured operating conditions in the real world as this reactor model has never been built before. Should this reactor be built at the Darlington Nuclear site, it would be the first in the world. As such, predicted operating conditions and potential impacts needed to be modelled with robust accompanying descriptions of modelling methodologies. As NTP's submissions discuss below, not all potential pathways have been modelled, and other modelling work is still ongoing and not yet available for public review. There remain many unknowns, from the exact construction footprint, to the operation of the once-through cooling system, to stormwater management.

Further, our attempts to understand the BWRX-300 design have on occasion been frustrated by a series of redactions made to requested reports. OPG argues certain design specifics of the reactor are sensitive proprietary information, redacted to protect the competitive edge of the reactor's designers. This proprietary interest is at odds, however, with the CNSC's own principle that environmental information (i.e. information characterizing environmental releases and other impacts) cannot be held to be proprietary if it speaks directly to the health and wellbeing of local human and ecological communities. As NTP discusses further below, intervenors and the public at large require more information to determine whether to shoulder the potential costs of hosting this experimental project. If OPG and CNSC staff are proposing the Darlington Nuclear site (including the ecosystem it is embedded within and the communities it neighbours) to be the global test site for this new technology, the evidentiary basis must be strong enough to support properly informed decisions by potentially affected Nations, communities, and organizations.

Properly characterizing the context of climate change in this review

NTP understands that the current decision-making process for the proposed BWRX-300 reactor design is being made in the context of a changing climate that requires both attention and action by government and industry. At the same time, NTP submits that the urgency of climate change should not factor as a consideration to expedite the current decision-making process. A new environmental assessment should not be confused with a delay on climate action.

The need for new nuclear energy generation to address climate change remains highly contested. In its Commission Member Document (CMD), OPG states that nuclear energy is immediately required to address climate change.[3] On OPG's webpage for the new build, the company asserts modular nuclear technologies are "critical" to electrification efforts required to achieve governments' climate change objectives.[4] At the same time, several

[3] Ontario Power Generation, Written submission re: the applicability of the Darlington New Nuclear Project environmental assessment and plant parameter envelope to selected reactor technology, CMD 24-H2.1, at p 1, online: https://nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD24/CMD24-H2-1.pdf.
[4] https://www.opg.com/projects-services/projects/nuclear/smr/darlington-smr/

organizations, including the Ontario Clean Air Alliance, have developed analyses canvassing the many ways new nuclear may not be required to meet climate targets.[5]

NTP understands the CNSC's mandate permits the Commission Tribunal to consider assessments of how climate change could help shape potential environmental impacts of the proposed BWRX-300 reactor. We also understand this mandate could extend to assessments of potential impacts of the changing environment on BWRX-300 operations. NTP has limited its climate analysis to these questions in our submissions.

More difficult to discern, however, is the extent to which the CNSC, as a Canadian regulatory authority, can wade into issues of energy planning at the federal or provincial level. The 2011 environmental assessment for the DNNP required an assessment of the need for, and purpose of, the project.[6] However, the JRP at that time also had to adhere to its EIS Guidelines which explicitly prohibited a review of Ontario's energy plan, placing that topic outside of the JRP's mandate. Still, the JRP inquired further about the provincial plan and ultimately deemed it was acceptable not to examine or assess it further on the grounds that the plan was subject to a separate public comments process where questions about Ontario's supply mix could be addressed.[7] When navigating this jurisdictional tension, NTP submits that CNSC Commissioners should maintain a consistent approach: either scope out of this current review any references to climate change as it relates to energy supply mixes; or else include references to climate change and energy supply mixes but along clearly demarcated lines that include opportunities for the provision and evaluation of expert evidence by intervenors.

During the recent relicensing hearing for OPG's site preparation licence for the potential new build, Commissioners stated that questions relating to energy supply mixes did not fall within the Commission's mandate. However, interactions between intervenors and Commissioners did not strictly adhere to this approach. The transcripts from that proceeding indicate that Commissioners tended to express more concern over intervenor comments opposing new nuclear capacity as a measure to address climate change, compared to Commissioners' more permissive attitudes towards intervenor comments in favour of new nuclear capacity.[8]

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[5] Ontario Clean Air Alliance, "Darlington New Nuclear Project: An Economic, Climate and Safety Analysis", August 1, 2023, online: https://www.cleanairalliance.org/wp-content/uploads/2023/08/Darlington-New-Nuclear-Report-ONLINE-aug-01-v_02.pdf.

[6] See: Joint Review Panel Environmental Assessment Report, August 2011, at pp 7 and 157, online https://iaac-aeic.gc.ca/archives/evaluations/29525/documents/55381/55381E.pdf. The assessment of the underlying need of and/or purpose for projects has continued to be a requirement through subsequent amendments to this legislation: *Canadian Environmental Assessment Act*, RSC 1992, c 37, ss. 16(1) and 16(2), *Canadian Environmental Assessment Act*, 2012, RSC 2012, c 19, ss 19(1)(f), and *Impact Assessment Act*, RSC 2019, c 28, s 22(1)(d).

[7] Joint Review Panel Environmental Assessment Report, August 2011, at pp 41-42, online https://iaac-aeic.gc.ca/archives/evaluations/29525/documents/55381/55381E.pdf.

[8] See transcripts from Commission hearing June 10, 2021 at pp 146, 105, 125-137, 220; and transcripts June 11, 2021 at pp 129-132, 154, 162.

The federal Action Plan for Small Modular Reactors and government financing

Similar to the arguments made above, NTP cautions Commissioners against references to the federal Action Plan on Small Modular Reactors[9] as grounds to expedite the regulatory review process for the BWRX-300 reactor. Further, proposed government financing for the construction of BWRX-300 reactors should not be used to evidence larger public support for this technology. Rather, NTP submits that the public interest is most furthered by a robust and comprehensive review of the BWRX-300 reactor design on its own merits.

PART ONE:
The "fundamentally different" threshold for a new Environmental Assessment

In the 2011 JRP environmental assessment report, the panel determined that,

> "prior to construction, the Canadian Nuclear Safety Commission will determine whether this environmental assessment is applicable to the reactor technology selected by the Government of Ontario for the Project. Nevertheless, if the selected reactor technology is fundamentally different from the specific reactor technologies bounded by the plant parameter envelope, the Panel recommends that a new environmental assessment be conducted".[10]

As such, this current hearing is meant to determine whether the original environmental assessment sufficiently encompasses the currently proposed BWRX-300 reactor.

<u>Concerns with this threshold and its application</u>

NTP has three main concerns with the application of this "fundamental difference threshold" for determining whether a new environmental assessment may be required for the BWRX-300 reactor: 1) there is no accompanying legal definition of the kinds of changes the JRP would have found to be 'fundamental'; 2) it remains unclear whether the JRP would have permitted such a delayed reliance on their report's recommendation; and 3) the focus of this regulatory review on the comparison between the BWRX-300 reactor and other reactor designs studied in the 2006 – 2011 environmental assessment obscures the ability for CNSC staff, the Commissioners, and intervenors to assess the BWRX-300 reactor on its own merits. Each of these concerns will be discussed in turn below.

Lack of clarity and definition in the 'fundamentally different' threshold

There were 198 parameters in the original Plant Parameter Envelope (PPE) used to collectively assess the reactor designs that came before the JRP in 2011. OPG now argues, and CNSC staff agree, that 130 parameters of the BWRX-300 reactor are

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[9] See: https://smractionplan.ca/.

[10] Joint Review Panel Environmental Assessment Report, August 2011, at p iv, online https://iaac-aeic.gc.ca/archives/evaluations/29525/documents/55381/55381E.pdf.

consistent with the original 198. Already that indicates that there is only a 68% cross-over between the BWRX-300 reactor design and all reactor designs assessed by the JRP. OPG and CNSC staff have found that 60 parameters from the 2011 environmental assessment do not apply to the BWRX-300 reactor design. They also find that there are 8 parameters for which the BWRX-300 design falls outside the 2011 reactor characteristics: 1) the greater maximum short-term rate of withdrawal from Lake Ontario for fighting fires on site; 2) the larger quantity of water stored in the water supply system on site; 3) the deeper foundations required for the BWRX-300; 4) the lower minimum height at which contaminants would be emitted into the air; 5) the different proportions of radionuclides in air emissions; 6) the different proportions and volumetric activity of BWRX-300 solid wastes; 7) the higher radioactivity of spent fuel and the need for heavier casks for storing this waste; and 8) a difference in wind load for the BWRX-300 design. NTP will discuss several of these differences, as well as additional differences we have identified, in further detail in these submissions below.

However, it is clear from the above that the BWRX-300 does not easily fit the original PPE from the 2011 environmental assessment. The question remains whether these differences can be considered to be 'fundamental' or not. Unfortunately, no legal definition of the term is provided by the JRP, and as such term remains highly subjective and thus unwieldy for the current Commission proceeding. For our own analysis, we have turned to the common meaning of this phrase and the Oxford dictionary definition of fundamental: indicating "of basic importance", core… central… and essential.[11] At the same time, we remain concerned about the considerable discretion and uncertainty inherent in this threshold.

Silence on timeframes for continued use of the JRP report

CNSC staff state in their CMD that the final decision of the JRP does not have an expiry date.[12] However, it remains unclear whether the JRP could have expected the project to be revived over a decade after it was indefinitely deferred. There are no provisions in the text of the JRP or its EIS Guidelines that speak to such significant temporal interruptions. Rather than assuming the decision remains valid indefinitely, NTP understands that the JRP report is merely silent on the subject of a potential expiry date. As an organization dedicated to nuclear transparency, we are concerned over the principle (and potential precedent) of environmental assessment decisions being frozen in time and then reinstituted at any unspecified future period.

The current approach to this review is an obstacle to assessing BWRX-300 on its merits

NTP appreciates the time we have had to prepare these submissions, beginning with the intervention preparations we undertook last winter to provide comments to CNSC staff on this matter. Over this time, it has become apparent that a simpler and more efficient review could have been undertaken if NTP could simply review materials specific to the BWRX-300 design and its potential environmental impacts. The question of the continuing

[11] Oxford Dictionary and Thesaurus, 3d ed (Oxford: Oxford University Press, 2009).
[12] Canadian Nuclear Safety Commission staff, CMD 24-H2, at p 6, online: https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD24/CMD24-H2.pdf.

applicability of the 2011 environmental assessment has significantly increased the volume of materials we have had to study, requiring us to undertake considerable comparative analysis between BWRX-300 reactors and the already-discarded technologies assessed by the JRP. It has also complicated information request processes which will be discussed in greater detail in part three of these submissions below.

This comparative aspect of our work also effectively renders all our findings more relative (and theoretical) than would otherwise have been the case. We question whether it is in the public interest to forsake a focused assessment of potential effects of the BWRX-300 in favour of a comparative study of these effects in relation to previous reactor designs no longer being considered.

The benefits of this comparative approach for the CNSC and OPG are similarly opaque. OPG has commissioned and performed additional site-specific studies since 2011. NTP submits it would have been in all parties' interests for OPG to just present the BWRX-300 reactor design with all related studies for CNSC and public review. Were this to be done as part of a new environmental assessment, intervenors would also be able to obtain this information more easily as it would be proactively posted to a centralized registry. Such an approach would not have required additional work from OPG and it could have avoided the inefficiencies and uncertainties that have characterized the current regulatory approach.

Fundamental differences of the BWRX-300

Despite the concerns NTP has with the "fundamental difference" threshold, we have identified six ways in which the BWRX-300 reactor design may fundamentally differ from all other designs assessed by the JRP in 2011. These include: 1) the fundamentally different engineering due to the BWRX-300's boiling water reactor; 2) the fundamentally different construction footprint requiring deeper embedment and underground reactor; 3) fundamentally different emissions to air and the lower height at which these emissions will be released into the environment; 4) the fundamentally different liquid effluent design; 5) fundamentally different thermal emissions; and 6) the fundamentally different solid wastes and waste management practices. Each will be discussed in turn below.

Fundamentally different engineering: the Boiling Water Reactor

Four reactor designs were before the JRP for consideration. All of these were pressurized water or pressurized heavy water reactors. None of these reactor designs included a boiling water reactor. During the JRP process, there was an awareness of boiling water reactors, however, OPG noted they did not include an assessment of boiling water reactor technologies at that time due to "insufficient information… available for OPG to do so".[13] OPG assured the JRP that an update of the plant parameters would be required should

[13] Joint Review Panel Environmental Assessment Report, August 2011, at p 12, online https://iaac-aeic.gc.ca/archives/evaluations/29525/documents/55381/55381E.pdf.

boiling water reactors be proposed and selected for construction at the Darlington site in the future.[14]

As CNSC staff note, OPG has since updated its PPE to include boiling water reactors.[15] However, it is important to underscore that as these were not included in the original environmental assessment they have not been subject to the same detailed public review afforded the technologies previously assessed by the JRP.

Dr. Markelova's report canvasses some of the significant design differences between the boiling water reactor of the BWRX-300 design and other reactor designs assessed in the 2011 environmental assessment.[16] Significantly, she notes NTP has not yet found a comprehensive assessment comparing the potential environmental significance of design differences – including the cooling system, which OPG notes it is still in the process of developing.[17]

Fundamentally different footprint: deeper embedment

The BWRX-300 requires a significantly deeper foundation than any other reactor design reviewed in the 2011 JRP environmental assessment. While 2011-assessed reactors generally required a depth of 13.5 m, the BWRX-300 requires a foundation almost three times as deep at 38 m below ground.

No Canadian power rector has ever been built below ground before. This alone raises many questions about how construction operation, and decommissioning protocols may differ to fully address this design difference. As Dr. Fraz notes, several activities could impact groundwater levels and flow: dewatering for deeper foundations, utility trenches, hard water surfaces, stormwater management facilities, and interception of groundwater by condenser circulating water system in the forebay channel.[18] None of these concerns were considered by the JRP in its 2011 report. Further, Dr. Markelova has found that while the BWRX-300 interactions with groundwater would be "drastically" different to those from 2011-assessed reactor technologies,[19] it is still premature to compare these different reactors as groundwater modelling was based on a different set of assumptions for different types of reactors.[20]

Fundamentally different emissions to air and different emission height

There are three primary ways in which emissions to the air from BWRX-300 reactors are fundamentally different from any reactor design assessed in the 2011 JRP report: 1) the proportions of released radionuclides are different for the BWRX-300 which emits more

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[14] *Ibid.*
[15] Canadian Nuclear Safety Commission staff, CMD 24-H2, at p 9, online: https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD24/CMD24-H2.pdf.
[16] Dr. Markelova expert report, Appendix C to these submissions, at p 5.
[17] *Ibid* at pp 4-5.
[18] Dr. Fraz expert report, Appendix B to these submissions, at p 6.
[19] Dr. Markelova expert report, Appendix C to these submissions, at p 9.
[20] *Ibid* at p 11.

radioiodines than other considered reactor designs; 2) the BWRX-300 appears to release 35 isotopes no other 2011-assessed reactor designs would emit; and 3) these substances will be released by the BWRX-300 at a lower height compared to any other 2011-assessed reactor designs. Each of these issues will be discussed further below.

First, the BWRX-300 design would release the largest_amounts of three radioisotopes including iodines (I-132. I-134, I-135) and Fe-59 compared with any 2011 JERP-assessed reactor designs. More specifically, C14 and radioiodines are 1.25 and 1.01 times higher than emissions to air from reactor technologies assessed in the 2009 EIS.[21] OPG and CNSC staff state that the overall radioactivity may not change. Though Dr. Markelova, examining the same data, notes even if overall dose from iodine is calculated to be lower per year, "net emissions are still higher".[22]

OPG only provides estimated public dose values to evaluate impacts from these emissions. However, Dr. Fraz notes that the effects of potential exposures to human and non-human receptors can differ significantly, depending on the type of radionuclide. As such, she finds it troubling that there is no publicly available assessment of the distinct potential impacts of human and ecological exposure to a different mixture of radionuclides (in terms of chemical composition, component ratios, and toxicity) than what was used in the EIS. Available materials have also failed to comprehensively characterize non-radioactive emissions to the air from the BWR-300 reactor. Knowing about the radioactivity and chemical toxicity of emissions, separately and combined, is crucial to understanding how they might behave when released into the air and how they might interact with people and the environment.[23]

Second, Dr. Fraz has noted that it appears as though 35 isotopes will be released from BWRX-300 reactor buildings that no other reactor designs would produce. These are: Kr-83m, Kr-89, Xe-137, I-132, I-134, I-135, Na-24, P-32, Mn-56, Fe-55, Ni-63, Cu-64, Zn-65, Rb-89, Y-90, Sr-91, Sr-92, Y-91, Y-92, Y-93, Mo-99, Tc-99m, Rh-103m, Rh-106, Ag-110m, Sb-124, Te-129m, Te-131m, Te-132, Cs-138, La-140, Ce-144, Pr-144, W-187, Np-239.[24] Neither OPG's nor CNSC staff's CMDs address these additional radioisotopes in detail.

Finally, the emission height from where these airborne contaminants will be released is 28% lower for the BWRX-300 than it would have been for any 2011-assessed reactor design: 35m rather than 48.8m. This lower release height may have implications for the movement of these contaminants in the environment. However, there is no assessment of this possibility in available environmental studies. More generally there is no information relating to whether effects on terrestrial and soil biota of these radionuclides have been, or will be, evaluated for dry and wet deposition – in other words, once released, it remains unclear how the particles may fall to the ground (on their own or via precipitation), and how plants, animals, and soil may be exposed to these emissions.[25] During our visit to the Darlington site, OPG representatives said they expect negligible to no emissions and exposures.[26] However, if this

[21] Dr. Fraz expert report, Appendix B to these submissions, at p 6.
[22] Dr. Markelova expert report, Appendix C to these submissions, at pp 14-15.
[23] Dr. Fraz expert report, Appendix B to these submissions, at p 6.
[24] *Ibid.*
[25] *Ibid* at pp 6-7.
[26] Darlington site visit, November 13, 2023.

is the case, it needs to be explained and supported with modelling and data on the public record.

Fundamentally different liquid effluent design

The CNSC staff CMD clearly describes the significant differences between plans for liquid effluent in the 2011 JRP report and those for the BWRX-300 including 2011 plans for cooling towers that OPG argues are no longer relevant. NTP submits that in and of themselves, these changes in design are significant.

Further, between OPG's earlier EIS for the BWRX-300 and later revisions, designs for the liquid effluent system for low level waste has changed significantly. At first OPG plans were for direct discharge after treatment. Then this changed to a system where effluent would be recycled and discharges of radioactive substances to the environment would only be expected in situations where liquid waste could not be recycled.[27] To date, however, it remains unclear in which scenarios effluent may be released into the environment, how often this might happen, and what control measures there would be to handle such situations.

Finally, there is still no clear characterization of liquid effluent and their potential environmental effects on local surface water quality and aquatic ecosystem, which is also discussed in more detail below in part two of these submissions. It appears as though designs and assessments in this area will continue to change for years to come: OPG has indicated in responses to NTP information requests that the design of the once-through cooling system may only be finalized as late as 2026.[28]

Fundamentally different thermal emissions

The 2011 JRP-assessed reactors had significantly different cooling systems compared with what we know about current plans for the BWRX-300 reactors. The former were going to use cooling towers for the reactor's heat sink, while the latter will use Lake Ontario as its heat sink. 34 of the 198 PPEs were devoted to cooling towers and thus constituted a fundamental aspect of their design. The latest revisions of the EIS and supporting documents do not include descriptions of, or evaluations for why, this change in design was proposed between the different reactors. Similarly, there is no discussion of whether alternatives were considered to prevent Lake Ontario from constituting the sole heat sink for the BWRX-300 reactors. As explained further in these submissions below, there remain many uncertainties concerning the final design for the BWRX-300 once-through cooling system. However, this issue of the cooling systems for the respective reactor designs remains a fundamental one.

[27] Dr. Fraz expert report, Appendix B, at p 7.
[28] Dr. Markelova expert report, Appendix C, at p 5.

Fundamentally different solid wastes

From OPG materials, it appears the volumetric activity for BWRX-300 solid wastes are 2.75 times higher than the wastes for any reactor designs reviewed in the 2011 JRP environmental assessment.[29] Dr. Markelova has also referenced IAEA materials that show boiling water reactors can produce twice as much solid waste volume per gigawatt of electricity generated (GWe) than pressurized water reactors and five times more solid waste beta-gamma activity per GWe than pressurized water reactors.[30]

Further, Dr. Fraz has also noted that it appears as though 36 isotopes may be exclusively present in solid wastes generated by BWRX-300 designs. These include Am-241, Am-242m, Am-243, Cm242, Cm243, Cm244, Cm245, Cm246, Cs-136, Cu-64, I-129, I-132, I-134, I-135, Mn-56, Mo-99, Np-237, Np-239, P-32, Pu-238, Pu-239, Pu-242, Rh-103m, Sr-89, Sr-91, Sr-92, Tc-99m, Te-129m, Te-131m, Te-132, W-187, Y-90, Y-91, Y-92, Y-93 and Zn-65.[31] However, there is no fulsome assessment of any potentially different management needs for this unique waste composite.

OPG and CNSC CMDs recognize there will be an increase in the size and weight of storage casks for BWRX-300 wastes compared with 2011-assessed reactor designs. This added size and weight will also require on-site roads to be reinforced to support the added weight.[32] This will require a unique construction footprint compared with the construction that would have been required for the 2011-assessed reactor designs.

Finally, BWRX-300 used fuel bundles may require less time to cool in fuel bays and might therefore handled more frequently by workers. Given the unique characterization of BWRX-300 wastes, this may also pose unique management requirements for nuclear energy workers.

PART TWO:
Public interest reasons for a new Environmental Assessment

In addition to assessing the potentially fundamental differences of the BWRX-300 reactor, the CNSC's public notice for this hearing explains that the CNSC Commission Tribunal will also have to consider whether the predictions of the 2011 environmental assessment remain valid more generally:

> The purpose of the first public hearing is for the Commission to consider and decide on the applicability of the DNNP EA with respect to OPG's selected BWRX-300 small modular reactor technology, as per the Government of Canada response to recommendation #1 of the joint review panel's 2012 report. In deciding on the

[29] Dr. Markelova expert report, Appendix C, at p 15.
[30] *Ibid* at p 15.
[31] Dr. Fraz expert report, Appendix B, at p 7.
[32] Canadian Nuclear Safety Commission staff, CMD 24-H2, at p 16, online: https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD24/CMD24-H2.pdf.

> applicability of the DNNP EA, the Commission will consider the information in OPG's environmental impact statement review report along with the updated plant parameter envelope. The Commission will also consider whether the predictions of the EA remain valid.[33] [emphasis added]

To address this broader issue of the continued validity of the original 2011 environmental assessment, NTP has put together analysis relating to the revised EIS and PPE documents assembled by OPG. In this part of NTP's submissions, we will explain the concerns we have relating to the quality of assessments in the revised EIS and PPE as well as supporting documents. In particular, we will discuss the lack of quantitative assessments in those documents and the reliance on subjective language to characterize potential environmental effects.

In this portion of our submission we will also canvas identified information and data gaps in the revised EIS, PPE, and supporting documents. In particular, we will summarize perceived deficiencies relating to listed Valued Ecosystem Components (VECs), groundwater effects, the BWRX-300 once-through cooling system, stormwater management, the release of non-radioactive hazardous substances, solid waste management, cumulative effects assessments, decommissioning plans, and sustainability assessments. In these discussions we also address several areas in which outdated information is continuing to be referenced on the public record including issues relating to climate change modelling, species at risk designations, and assessments of cumulative effects. We will proceed to discuss each of these in turn.

Quality concerns with the revised EIS and PPE documents

There is much more qualitative analysis in available technical documents than there are quantitative assessments. As a result, both Dr. Fraz and Dr. Markelova found many of the assessments they reviewed to be highly subjective, obscuring potentially better measured or modelled (and thus verifiable) technical assessments. The tiered approach OPG took to determining when quantitative assessments were required may have limited the generation of more detailed analysis. This in turn may have led to an overreliance on subjective and qualitative language where hard values are required by the public to assess potential environmental effects, as explained below.

Lack of quantitative assessments

Qualitative assessments are by necessity more subjective and relative, often requiring subsequent quantitative assessments to verify their characterization of potential environmental effects.[34] Dr. Fraz explains how OPG's EIS methodology contains several tiered criteria for assessing expected environmental effects. Quantitative assessments,

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[33] Canadian Nuclear Safety Commission, Notice of Public Hearing and Funding "CNSC to conduct a public hearing on applicability of the Darlington New Nuclear Project environmental assessment and plant parameter envelope to the selected reactor technology", 2024-H-02, April 3, 2023 online: https://www.cnsc-ccsn.gc.ca/eng/the-commission/pdf/NoticeHearingPFP-OPG-DNNP-EA-Jan2024-e.pdf.

[34] Dr. Fraz expert report, Appendix B, at p 14.

such as fieldwork and monitoring, are only required when initial qualitative assessments appear to indicate the chance of a more significant environmental effect.[35]

NTP understands that quantitative assessments may require more time and financial resources than qualitative assessments. At the same, time they are the best mechanisms by which real-world site conditions can be understood and can ensure greater accuracy in the assessment of potential environmental effects. Significantly more transparency can also be achieved via quantitative assessments rather than qualitative ones. While we understand it may not be feasible to conduct exhaustive quantitative studies for all potential environmental parameters, the paragraphs that follow illustrate how crucial information about potentially significant environmental effects from the BWRX-300 are being obscured by purely qualitative assessments (and the ambiguous minimizing, and relative language they can employ).

Concerns over unsupported, subjective, and relative language

We have compiled four examples of subjective qualitative descriptions of potentially significant environmental effects relating to the BWRX-300. These examples are meant to illustrate how difficult it can be to verify these kinds of evaluations. They also briefly discuss the transparency concerns associated with this environmental assessment methodology.

First, OPG uses ambiguous language to explain the BWRX-300 cooling water system, noting it will be sized for "necessary water volumes". No actual volumes are provided nor are any or specific ranges provided. Further, insufficient information prevents comparison between 2009 EIS technologies and the BWRX-300 reactor cooling water system designs.[36] The result is a vague and opaque characterization of a crucial component of the BWRX-300 design and its interaction with local surface water and aquatic ecosystems.

Second, the use of evaluative and minimizing descriptive language also frustrates the public's ability to conduct technical reviews. This was briefly discussed in part one above where we qualified our use of the words "small" and "modular" to refer to the BWRX-300 reactor. Another example relates again to the cooling water system for the BWRX-300, where terms like "small-scale" to characterize the system is a concern in the context of missing data values.

Third, NTP has concerns about minimizing language relating to groundwater effects. Expected impacts to groundwater conditions at the site are regularly prefaced as being "temporary" and thus less ecologically significant. However, the 'temporary' construction period will likely last at least a decade – perhaps short according to the life-cycle of the reactor units, but in an EIS the reference point for time should be the surrounding ecology. Such a period in ecological terms may be long enough to permanently change species populations and habitat in the immediate vicinity of any new reactors.[37] When groundwater disturbances will result in a 63% decreased flowrate to on-site tributaries and wetlands to

[35] *Ibid.*
[36] *Ibid* at p 4.
[37] *Ibid* at p 5.

the east of the Darlington site, and 86%, 31%, and 21% decreased flows to Darlington Creek, Tree Frog Pond, and other wetlands respectively, the effects seem more potentially significant. Further, not all groundwater effects could be characterized as being temporary in nature: there may be permanent effects of BWRX-300 deep embedment, including the lowering of the local water table by 14m and change in groundwater flows at the Darlington site. There may also be complete groundwater loss to two wetland areas on the east of the site with the construction of all reactors.[38]

Finally, OPG often refers to the BWRX-300 reactor design as having a “smaller footprint”. However, it remains unclear how much land (and habitat) will be retained by the BWRX-300 construction site compared to what would have been removed by 2011 JRP-assessed reactor designs. For example, potential effects of the BWRX-300 reactors on breeding birds are impossible to discern. Yellow Warbler and Red-eyed Vireo, Barn Swallow, Eastern Wood Pewee, Wood Thrush, Bobolink, and Eastern Meadowlark are all present at and around the Darlington site. The EIS says “some” of their habitat which would have been removed for the 2011 JRP-assessed reactor, may be retained for the BWRX-330 design. There is no description of this retained habitat or its scale.[39] This is true for other species as well, discussed in more detail on pages 20-21 below.

As these examples illustrate, use of minimizing language to characterize the BWRX-300 design and its potential environmental effects can be misleading and should be approached with caution.

Information gaps in the evidentiary record

The discussion that follows canvasses identified information gaps in the evidentiary record for the BWRX-300 reactor design. These gaps are outlined to illustrate the challenges in determining whether the predictions of the original 2011 environmental assessment remain valid.

Underinclusive Valued Ecological Components

While the 2009 EIS for the DNNP had a clear table with VECs, it remains unclear how VECs were determined for the DNNP in more recent EIS revisions. Due to NTP’s past work on the recent relicensing hearing for the Darlington Waste Management Facility (DWMF), Dr. Fraz had become familiar with species included in Darlington’s most recent Environmental Risk Assessment (ERA) which provided some context for species present at the Darlington site and how they may be interacting with existing facilities and infrastructure there. The species list in the current EIS, however, is significantly more limited than that in the ERA: the revised EIS notes Deep water sculpin, Lake Sturgeon, Atlantic Salmon, and American Eel as fish species at risk, however, round goby, emerald shiner, alewife, white sucker, round whitefish, lake trout and any other salmonid sportfish – all named in the ERA – have not been included in this recent EIS. Red belly dace, a

[38] *Ibid* at p 5.
[39] *Ibid* at p 10.

benthic foraging species present on site in Coot's Pond is listed as a VEC in the ERA but not mentioned in revised DNNP documents.[40] Further, despite requiring an ecosystem approach for environmental impact statements, species on lower trophic levels appear to be wholly absent from listed VECs.

Species-specific assessments are similarly underdeveloped. For aquatic species: there are no details for DNNP-specific management plans for Atlantic Salmon or American Eels, and no information relating to Lake Sturgeon habitat or nursery areas. The only species-specific plan in the EA follow-up monitoring plan concerns round whitefish, for which a strategy had already been developed years ago. We have not found an evaluation or assessment of impingement or entrainment of any species other than round whitefish. Nor are any other species specifically noted in cumulative effects assessments or mitigation and management plans. Only thermal sensitivity of round whitefish is noted, no information is provided relating to thermal sensitivity of juvenile sturgeon or any other species: neither in Darlington-specific studies in the past or with reference to any published lab or field studies that may exist elsewhere.[41]

There is insufficient information relating to potential effects of the DNNP on six migrant songbird species: Olive-sided flycatcher, Common Nighthawk, Eastern Whip-Poor-Will, Canada Warbler, Rusty Blackbird and Least Bittern. The 2009 EIS reactor technologies had required a primary owl roost and 50% of suitable winter raptor foraging habitat to be removed. The updated BWRX-300 assessment is unclear about how much of this may be retained. The updated EIS and supporting documents do not contain clear information about noise levels during blasting activities and their potential effects on breeding birds either. Finally, there is no information about dust modelling and potential effects from dust for breeding birds. As such, there is no data by which the public can verify OPG's claims of "minor effects" in this regard.[42]

There is no information about specific mitigation strategies that involve the creation of artificial habitat for aerial forage species including chimney swift and purple martin. Further, there is no data about artificial habitat for bank swallows. On our site visit of the DNNP portion of the Darlington site, we learned about the program at Pickering Nuclear Generating Station to monitor uptake of artificial habitat for bank swallow. Apparently, OPG has three years' worth of data, none of it public, that shows some uptake in the most recent year. The most recent EIS notes that 2009 EIS assessments of effects to bank swallow are still applicable to the current project. However, as Dr. Fraz notes, the species' status has now become more precarious, classified as a threatened species in 2017, long after the 2011 JRP environmental assessment.[43] There is no assessment of the implications of this change in designation for the species by either OPG or CNSC staff, or any other

[40] *Ibid* at pp 8-9.
[41] *Ibid* at p 9.
[42] *Ibid* at pp 10-11.
[43] Government of Canada, "Bank Swallow (Riparia riparia): recovery strategy 2022", online: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/bank-swallow-2022.html. Dr. Fraz notes several other species present at the Darlington site that have also had their species status changed since the 2011 JRP environmental assessment. See her report for more details.

government agency. As such, the significance of the habitat disturbance on this species constitutes an information gap.[44]

For bats, several species use woodlands on and around the Darlington Nuclear site for roosting and foraging, including three endangered bat species: Little Brown Myotis, Northern Myotis and Tri-coloured Bat. Impacts of DNNP land clearing and construction remain unclear due to redactions in available documents. There is also some ambiguity in the revised EIS and supporting documents relating to exactly how much bat habitat will be retained for BWRX-300 reactors compared to 2009 EIS reactor technologies. Dust, noise, and light effects on bats also remain unclear with insufficient information or data to support assertions that potential effects will only be "minor".[45]

For insects, Treefrog Pond, Polliwog Pond, and Dragonfly Pond currently provide habitat for rare amber-winged spreadwing. Again, more information is required to determine whether this habitat can be retained and protected.[46]

Finally, and very significantly, the species at risk designations have changed for several species present at the site between the 2009 and 2020 EIS documents. Ultimately, a comprehensive list of VECs for the revised BWRX-300 EIS should be provided, alongside updated assessments for species, for public review in advance of any decision in this matter.

Insufficient data relating to groundwater conditions and potential impacts

In addition to the inability to compare groundwater modelling between 2011-assessed reactor technologies and the BWRX-300, Dr. Markelova has noted she has not had access to the results of a study commissioned by OPG in 2022 to determine how BWRX-300 construction and installation could affect a tritium plume at the Darlington Nuclear site. This plume is the result of a spill from an Injection Water Storage Tank in 2009.[47] NTP submits that public access to the results of this study should be afforded in advance of any decision in this matter.

Insufficient data relating to the once-through cooling water system

As noted already in these submissions, one of the most significant information gap relates to one of the most potentially significant source of environmental impacts: the once-through cooling water system. There is some confusion between different revisions of the most recent EIS document about the size of the discharge port of the diffuser.[48] No comprehensive characterization of potential effluent is provided, nor is its potential interaction with the receiving environment characterized with much detail, including any identified risks to ecological or human receptors.[49]

[44] Dr. Fraz expert report, Appendix B, at p 11.
[45] *Ibid*, at p 12.
[46] *Ibid*, at p 12.
[47] Dr. Markelova expert report, Appendix C, at p 12.
[48] Dr. Fraz expert report, Appendix B, at p 3.
[49] *Ibid* at p 7.

There are differences in the characterization of waste heat loads between EIS documents, some of which claim that thermal pollution for the BWRX-300 will be similar to 2011-assessed reactor technologies, and others that assert BWRX-300 thermal pollution will be less than 2011-assessed reactor designs. While the 2009 EIS technologies assumed a maximum of 9ºC water temperature rise at maximum generation capacity, BWRX-300 assessments only indicate the technology "is able to achieve" the same. As such, it remains unclear whether this is true of routine or maximum operations, and it is difficult to discern how probable exceedances may be. While there seems to be some degree of uncertainty around the thermal pollution associated with BWRX-300 operations, this uncertainty is not quantified or otherwise explained.[50] Further, virtually no information is provided to explain the exclusion of the need for cooling towers in the amended BWRX-300 design and the 100% reliance of lake water as a heat sink is not sufficiently justified.[51]

Inconsistent language is employed in the EIS and supporting documents relating to the requirement for a *Fisheries Act* authorization for in-water works to construct and install the intake and discharge structures in the lake bed.[52] Additionally, there is no information specific to how construction activities (which will take place in an inshore area with especially high concentrations of shrimp) may impact local food webs.[53] Further, the shoreline along the Darlington site is considered beneficial habitat for waterfowl, however there is no assessment of how they may be affected by areas of warm water that may increase along the shoreline due to the BWRX-300 output, including how nuisance algae may increase in, and impact, these areas.[54] Finally, there are no species-specific assessments of potential interactions by aquatic species with BWRX-300 thermal effluent.[55]

The cooling water system (condenser, condenser circulating water, and service water cooling systems) all require withdrawals of lake water and would in turn discharge warmed water back into the lake. These operations have the potential to alter lake flow dynamics, thermal regimes, and quality characteristics, however there is no comprehensive assessment of this. Further, there remains some uncertainty about routine flow rates in the once-trough cooling system. While a maximum inflow rate is provided ($68m^3$ per second for four reactors), no maximum discharge rate is. If it is the same (i.e. the flow through facilities consistent with intake), this would need to be specified. Further any operational changes in flow rats or ranges of possible flow rates should be provided.[56]

Assertions that a potential net increase in temperature of 2.9-3.4ºC would be protective of aquatic ecosystems beyond the mixing zones were considered "dubious" by Dr. Fraz who did not see any data or literature to support this claim.[57] Further, NTP as concerns about

[50] *Ibid* at pp 3-4.
[51] *Ibid* at p 4.
[52] *Ibid* at p 3.
[53] *Ibid* at p 4.
[54] *Ibid* at p 4.
[55] *Ibid* at p 4.
[56] *Ibid*, at p 4.
[57] *Ibid* at p 15.

potential conflicts of interest inherent in the CANDU owners group's standard of acceptable ambient water temperature increases (2.9-3.4ºC) referenced by CNSC staff in their CMD.[58]

All these matters require further elaboration and detailed assessment before any decision in this matter is rendered.

Further, Dr. Markelova has recommended that additional studies be provided to the public that assess: 1) "the risk of environmental cross-contamination (leak scenarios) in a common reactor coolant water and feedwater system, as compared to separate systems"; and 2) "the introduction of hydrogen gas into the cooling system of the BWRX-300 (including a risk assessment of malfunction of hydrogen gas injector, risk assessment of malfunction of the offgas system, risk of hypoxia in the lake caused by discharged coolant water, and alternative anti-corrosive methods, such as electromagnetic resonance, to replace the use of hydrogen gas).[59]

Insufficient information relating to stormwater management

In response to NTP's query about the lack of information relating to stormwater management, OPG noted that stormwater management plans were still being developed and could not be available for public comment by the November deadline for written submissions.[60] However, on our site visit, OPG indicated that there may not be routine stormwater monitoring for the construction area, and reliance instead on stormwater ditches to direct stormwater flows.[61]

Stormwater runoff can contain road salts, oils and greases, metals, nutrients, pesticides, and petroleum hydrocarbons that can affect soil, surface water, and groundwater quality. Stormwater flows can also make on-site contaminants more mobile. Dr. Fraz notes that a stormwater management description and plan is crucial for assessing: groundwater and stormwater interactions; impacts to natural features retained with the construction zone of BWRX-300 including ponds and wetlands; and any potential flooding, significant rains and snow melts, or changes in water levels due to climate change.[62] Dr. Markelova agrees and notes more modelling is also required to better understand a wider variety of scenarios and assumptions for how BWRX-300 construction (and soil stockpiles) may impact local wetlands: both from stormwater runoff and changes in groundwater flow.[63]

Insufficient information relating to hazardous substance releases

In addition to radionuclide releases, a BWRX-300 reactor would release non-radioactive hazardous substances. To date, we have not been able to locate a comprehensive

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[58] Canadian Nuclear Safety Commission staff, CMD 24-H2, at p 37, online: https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD24/CMD24-H2.pdf.
[59] The significance of each are discussed in more detail in Dr. Markelova's expert report, see: Appendix C, at pp 6-9.
[60] See Appendix D to these submissions.
[61] Darlington site visit, November 13, 2023.
[62] Dr. Fraz expert report, Appendix B, at p 8.
[63] Dr. Markelova expert report, Appendix C, at p 13.

statement of hazardous effluent quantity, concentration, or a comprehensive description of the point(s) of release. As such, it is impossible to get a sense of how their responsible management should look. In particular, Dr. Fraz as noted that there remains considerable uncertainty about hydrogen and noble metal releases from the BWRX-300 to the environment – these substances are proposed to be used to prevent corrosion.[64] Dr. Markelova voices similar concerns about potential accumulations spots in lake water if continuous hydrogen is discharged into these receiving waters in the case of malfunction of the OffGas system.[65] There will also be one-hour exceedances of NO2 and SO2 limits during project works, but no assessment is available that notes the frequency of these releases or their potential cumulative effects[66] More information relating to hazardous emissions should be provided to the public before a decision on this matter is rendered.

Insufficient information relating the management of solid wastes

For used fuel, it appears BWRX-300 reactors require a smaller used fuel bay and shorter interim fuel cooling before storage (3-5 years, compared to 10 years on average for 2011 JRP-assessed reactor technologies). Our understanding of more than this is difficult as specific information on the capacity of used fuel bays, the cooling period, and potential radionuclide or radioactivity releases from a used fuel accident scenario have been redacted from the reports we requested.[67]

Further, the documents NTP has accessed to date contain no detailed information about: the different management practices and plans BWR-300 waste may require; any proliferation-related concerns that may require specific management practices; or any differences in management generally between 2011-assessed wastes and BWRX-300 wastes (except for the larger waste drums, transport roads, and equipment noted above in part one). While this more logistical management information is appreciated, substantive waste categorization and a more detailed discussion of requisite substance-specific management practices would be in the public interest and enable a better understanding of environmental aspects of waste management for the BWRX-300 reactor. Dr. Fraz also notes that waste contents and their potential interaction with the environment should at least be canvassed on a high level in order to understand potential consequences of any failures in waste containment.[68] NTP submits this additional information should be provided for public review before any decision in this matter is rendered.

Insufficient information relating to cumulative effects

The assessment of cumulative effects is one of the most complex, but also most under-developed portions of the updated EIS and supporting documents. Cumulative effects identified in the 2009 EIS need to be verified and updated, taking into account current conditions in and around the Darlington Nuclear site. The EIS contains very broad qualitative evaluations, but do not contribute to meaningful sense of cumulative effects

[64] Dr. Fraz expert report, Appendix B, at p 16.
[65] Dr. Markelova expert report, Appendix C, at p 6.
[66] Dr. Fraz Report, Appendix B, at p 7.
[67] *Ibid* at p 8.
[68] *Ibid* at p 7.

associated with the DNNP project. Cumulative effects for thermal emissions from the once-trough cooling water system are absent, assessments of potential cumulative effects of the project on on-site soil, groundwater, and surface water – for both radiological and non-radiological chemical releases are also absent. There is no inclusion of any commitment to study potential cumulative effects of thermal pollution exposure for lake trout or emerald shiner.[69] As such, there is insufficient information and data to support OPG and CNSC assurances that there will be no significant residual adverse cumulative effects.

PART THREE:
Procedural concerns with the current review

The regulatory review process over the last year for the DNNP had some novel aspects that assisted intervenors' review of OPG's proposal. These included longer timeframes and an interactive workshop with CNSC staff. However, there were also aspects of this process that were confusing and frustrated intervenors' ongoing work reviewing the proposed DNNP project. NTP provides some insights and recommendations for future processes with the hope this is of interest to, and beneficial for, CNSC staff.

Unclear regulatory procedure

The regulatory review process for this revived DNNP has been a unique one. NTP deeply appreciates the opportunity to have prepared submissions for staff in advance of this hearing process. The earlier submission allowed us to become more familiar with the relevant materials. We could also submit our first information and documents at that time which helped to set us up better for the current hearing (as it often takes months to receive our requested information and exchange follow-up queries and responses). NTP has been consistently requesting longer intervention periods to assist with our work. Receiving a longer timeframe for this process was deeply appreciated and allowed us to more fully pursue our research and collaboration on this intervention.

At the same time, we also have some additional suggestions for procedural improvements. One suggestion is for CNSC staff to more fully explain all steps of a regulatory process to intervenors from the beginning. When the first call for participant funding went out for this matter, it would have been helpful to include a description of the whole process from the preliminary submission to CNSC staff at the start to the licence to construct hearing at the end, and every procedural step in between. This would allow intervenors to plan their interventions more strategically, ensuring they can properly prepare and ultimately provide appropriate analysis at each step of the process (should they wish to). As this current process was novel (with the preliminary submissions to CNSC staff and then a workshop with CNSC staff in advance of this hearing), it could at times be confusing. Communicating

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[69] *Ibid* at p 9.

the aims of each procedural step would also assist intervenors in their preparations so they can ensure their content is appropriate and helpful.

Finally, we would encourage CNSC staff to engage intervenors to see what they seek in intervention processes. This could assist CNSC staff interested in designing more responsive processes. The potential collaboration it could help ensure processes are more beneficial for both the CNSC and intervenors.

Confusing, inefficient, and opaque methods to access information

The most procedurally difficult aspect of the current hearing process has been information requests. While we are grateful to CNSC staff and OPG for being responsive to the regular requests we have been making since last winter, we are aware a proactive method of posting materials for the public to browse and download is the most efficient and user-friendly method for obtaining information for interventions.

While CNSC staff undertook to provide DNNP information in a single location on the Open Government Portal, this was actually an excel list with titles of selected technical reports by OPG, third party consultants retained by OPG and CNSC staff. No actual reports were posted as they did not have French translations. Further, we only learned of this list at the April workshop with CNSC staff which was held after we had submitted our first round of written comments in this matter. As such, NTP ultimately sought information and reports from OPG's website, the *CEAA* Registry, CNSC website, and CNSC staff and OPG directly. Ultimately, the reports we were able to obtain were more comprehensive than those contained in the list of reports posted to the Open Government portal.

That said, the lack of comprehensive posting of these reports in advance meant that we only learned of several key reports we required for our review when they were referenced in CNSC staff's CMD for this hearing. As a result, we only received a more fulsome evidentiary record with less than a month to review them before the final submission deadline. We are still reviewing several documents we received a week ago. Other documents, namely CNSC staff records of their information requests to OPG, were denied outright until they were completed. As such, we only received these sources quite recently and are still in the process of reviewing them as well. For greater transparency, we would encourage CNSC staff to consider making these tables available to the public even if they contain ongoing items of discussion with project proponents.

In the future, we would also propose that project proponents could more comprehensively and proactively post their technical reports to their websites in advance of hearing processes. If OPG had uploaded all its reports, redacted as needed, to its website along with its EIS, PPE, and CMD for this matter at the start of this process, it would have significantly assisted us in our intervention.

Comments relating to the April 2023 CNSC workshop

On April 4, 2023, a workshop was held for those who had received intervenor funding to provide comments to CNSC staff weeks earlier relating to the DNNP. This opportunity was appreciated, but the timing for this workshop was awkward: scheduled after intervenors' submission deadline, but before CNSC had a chance to read the interventions. This timing precluded intervenors from being able incorporate what they had learned from CNSC staff and other intervenors into their written submissions. For example, it was only during this meeting that NTP realized its confusion about the DNNP review process and the difficulties with certain ambiguities in the EIS and PPE documents were shared by several intervenors. Had we known this earlier, or had a chance to write our submissions after that workshop, we would have been able to make more pointed recommendations at that time relating to information disclosure in our submissions. Further, with the workshop being scheduled before CNSC staff had a chance to read any of our submissions, it precluded the possibility of deeper intervention-specific dialogue and understanding.

When we joined the online workshop, we learned we would be split up into four groups of intervenors: groups focusing on Environmental Effects and Risk Assessments; Waste Management and Decommissioning; Design & Analysis and Hazard Assessment; and Releases, Doses and Emergency Management. Ultimately, attendees resisted this, and the workshop proceeded without breakout sessions (thanks also to CNSC staff responsiveness and flexibility in the moment). The initial move to separate intervenors according to these issues evidenced several issues with how CNSC staff have been approaching public consultation around the DNNP. For the benefit of greater understanding in the future, NTP first submits that it (and several other intervenors) find many issues related to the DNNP to be interrelated, rather than siloed. Second, NTP submits that intervenors often welcome opportunities to learn from one another. NTP contributors recognize that regulatory processes can serve both decision-making as well as educative purposes – for CNSC staff, licensees, Commissioners, intervenors and members of the public. NTP hopes to contribute to these opportunities for collective and mutual learning through our interventions.

APPENDIX A: References

OPG report, NK054-REP-07730-00029 – *Environmental Impact Statement: New Nuclear – Darlington Environmental Assessment*, dated 30 September 2009.

OPG submission, *Darlington New Nuclear Project Report for the Review of the Environmental Impact Statement for Small Modular Reactor BWRX-300*, revision 0, NK054-REP-07730-00055, dated 05 October 2022.

OPG report, Darlington New Nuclear Project Environmental Impact Statement, Review Report for Small Modular Reactor BWRX-300, OPG CD# NK054-REP- 07730-00055, Revision 1, dated 28 June 2023.

OPG submission, Use of Plant Parameters Envelope to Encompass the Reactor Designs being Considered for the Darlington Site, N-REP-01200-10000, revision 5, dated 05 October 2022. OPG submission,

Use of Plant Parameters Envelope to Encompass the Reactors Designs being Considered for the Darlington Site, N-PRE-02100-10000, revision 6, dated July 2023.

OPG report, *Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300*, NK054-REP-07730-00058, revision 0, dated 31 December 2022.

OPG report, Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300, NK054-REP-07730-00058, revision 1, dated 19 July 2023.

OPG report, *Darlington New Nuclear Project Commitments Report*, OPG document number NK054-REP-01210-00078, revision 8, dated 31 August 2022.

OPG submission, *Environmental Monitoring and Environmental Assessment Follow-Up Plan for the Darlington New Nuclear Project*, NK054-PLAN-07730-00014, Revision 1, dated 28 October 2022.

OPG report, *Darlington New Nuclear Project – Site Evaluation Update Summary Report*, OPG document number NK054-REP-01210-00142, revision 0, dated 30 September 2022.

OPG report, *2020 Environmental Risk Assessment for The Darlington Nuclear Site,* OPG document number D-REP-07701-00001-R001, dated 21 September 2021.

OPG document, *Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project,* OPG document number NK054-REP-07730-00059-R000, dated 07 November 2022.

OPG document, *Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project,* OPG document number NK054-REP-07730-00059-R000, dated 07 November 2022.

Ontario Power Generation Inc. Dose from waste-waste volumes and activities. NK054-REP-07730-00068-R000, 2023-july-12

Ontario Power Generation Inc. Darlington New Nuclear Project BWRX-300 Preliminary Safety Analysis Report NEDO-33950, Revision 2, dated October 7, 2022

DNNP Construction Licence Application (CLA)

6911109: BWRX-300 Darlington New Nuclear Project (DNNP) GNF2 Fuel Design Description Qualification and BWR Fuel Licensing NK054-REP-01210-00140

6911109: BWRX-300 Darlington New Nuclear Project (DNNP) REGDOC-2.5.2 Compliance Matrix Report NK054-REP-01210-00172

6926242: OPG Confidential - DN Dose Calculations for Gap Analysis (NK054-REP-07730-00064-R000)

6926249: Geological and hydrogeological Environment Assessment of Environmental Effects Technical Support Document New Nuclear - Darlington Environmental Assessment (Vol 1) D_REP_NK054-REP-07730-00015_VOL+1

6926251: Geological and Hydrogeological Environment Assessment of Environmental Effects Technical Support Document New Nuclear - Darlington Environmental Assessment (Vol 2) D_REP_NK054-REP-07730-00015-VOL+2

6930023: CNSC Staff response to OPG DNNP Submission of Probabilistic Safety Assessment Methodology Hazards Analysis Methodology and DIQ Form

6946706: CNSC Staff review of OPG DNNP submission Package #1 Management Aspects Enclosures #4 and #5 Indigenous and Stakeholders Engagement

6911607: DNNP - CNSC Staff Completeness Review of the Application for the Licence to Construct a Reactor Facility

6989266: email - NK054-CORR-00531-10773 - Request for Extension for Submission of OPG's Response to CNSC Staff Comments on the Technical Sufficiency Review of the Application for the Licence to Construct a Reactor Facility

6965800: CNSC staff response to OPG DNNP Submission of the Updated Plant Parameters Envelope Report and EIS Review Report

6904000: DNNP Stakeholder Engagement Plan NK054-PLAN-01210-00019

6896067: Use of Plant Parameters Envelope (PPE) to Encompass the Reactor Designs being Considered for the Darlington Site N-REP-01200-10000

APPENDIX B

Nuclear Transparency Project

Public Review of the Darlington New Nuclear Project EIS for BWRX-300 Reactor Design

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Contents

OVERVIEW

This report is focussed to provide technical public review of the prediction, management, and monitoring of environmental impacts/effects of the DNNP. We are very thankful to OPG for responding to information requests in a timely manner and granting generous access to multiple requested documents (including the supporting documents provided on Nov 12, 2023). However, it is acknowledged that due to time constraints the documents shared on Nov 12, 2023 could not be reviewed for this report.

From our perspective, Lake Ontario is one of the environmental components that may experience the most significant and continued effects of the DNNP, during site preparation (building of the intake and the diffuser for the once through cooling system and decrease of groundwater flow to the lake) and operation phase through water and heat exchange. There could be both biotic and abiotic changes whose significance could be altered through interaction with climate change. A cumulative effect assessment of the DNNP with the already operational power plants would be of interest. These aspects of the project are comprehensively encompassed by JRP recommendations (#12, 26, 29, 32, 34,35, 36, 37, 40 and 61 in the CMD e-Doc 7120574), which highlight the importance of data monitoring and sharing on these aspects.

In addition, tables with list of VECs (valued ecosystem components) in different environmental components (aquatic, terrestrial) with a rationale of inclusion or exclusion like 2020 ERA for DNGS (D-REP-07701-00001-R001, Table 4-1, p. 4-5) were not available. Such Tables for each environmental components could have been useful to encompass the scale of the JRP recommendation (#22, CMD, e-Doc 7120574) which requires OPG by Govt. of Canada "to develop a follow-up program for insects, amphibians and reptiles, and mammal species and communities as appropriate, with focus on species at risk and the use of the program to verify the conclusions of the Ecological Risk Assessment".

Since there are multiple aspects of the project that could alter ground water level and or/flow i.e., dewatering for deeper foundation, utility trenches, hard water surfaces, stormwater management facilities and interception of groundwater by condenser circulating water system in the forebay channel (NK054-REP-07730-00058-R000, p.104, 108, 125) the need of ongoing sharing of information with public is significant especially in the context of climate change, when groundwater is becoming increasingly valuable. In lieu of JRP recommendations (# 19, CMD e-Doc 7120574, p.98) data of monitoring transitions in groundwater flows that may arise as a consequence of grade changes during the site preparation and construction phases of the DNNP should be made available to public.

The comprehensive information on the cumulative effects of the DNNP on soil, ground water and surface water quality (for radiological and non radiological chemicals release) could not be found in the EIS review document (NK054-REP-07730-00055 R000) or the

EIS review supporting document (NK054-REP-07730-00058-R000 and R001). This aspect is emphasized in JRP recommendations a covering all life cycle stages of the project (# 2, 11, 12, 13 and 14, CMD e-Doc 7120574). There is not much information on the hazardous substances related to BWRX-300 technology deployment. Since OPG is required to develop a comprehensive assessment of hazardous substance releases and the required management practices for hazardous chemicals on site for BWRX-300, and detailed assessment of predicted effluent releases from the Project (effluent quantity, concentration, points of release and conduct a comprehensive assessment of predicted effluent releases from DNNP including effluent quantity, concentration, points of release and a description of effluent treatment) ongoing public sharing on these integral aspects is needed.

Importantly, the EIS mainly relies on the subjective qualitative assessments which could have the highest uncertainty. Without a few examples with greater details of the framework/design of qualitative assessment used to determine impacts on the VECS, it is difficult to understand the technical background of the conclusion of "minor, negligible or no significant adverse effects" especially in relating a non-significant adverse effect to statistical and biological/ecological significance. Moreover, it is unclear how this methodology could be used for cumulative effect assessment considering various aspects of DNNP and/or other operational plants on site.

This report is divided into three main parts. The first part of the report addresses areas of interest, point towards ambiguities, and produces queries in a structured way, consistent with the organization of the EIS review of the BWRX-300. The second part is composed of the missing link perceptions that could have been avoided with provision of greater details of the matter (e.g., methodology, results, data of the background/supporting studies) and the third part consists of future recommendations for public access to information and/or data for transparency and better understanding.

I. Areas of Interest in the BWRX-300 EIS

1. Once Through Cooling System (Design and Working Details)

A few concerns or ambiguities are noted in the available information on the once through cooling water for the BWRX-300 design.

a) The Aquatic environment assessment (TSD, NK054-REP-07730-00013-R000) was conducted in 2009. Considering the global warming due to climate change would the assessment be still valid in terms of prediction of adverse effects of thermal pollution on Biota?

b) The context of the claim that "BWRX-300 will require a small scale once-through cooling system" need more detailed and clear elaboration. A few examples that are source of confusion are compiled here. First, the EIS review shows a possibility of reduction diameter of discharge port of the diffuser (NK054-REP-07730-00055 R000, p.62-65) whereas the revised EIS review supporting document mentions that the diameter of the discharge ports is increased by 40% (NK054-REP-07730-00058-R000, p.64). Second, the statements on the amount of waste heat load of the BWRX-300 and the 2009 EIS predictions are confusing. While the EIS supporting document (NK054-REP-07730-00058-R001, p.66) states that the likely effects on lake water temperature and waste heat load of the BWRX-300 design are expected to be similar to the EIS predictions; the CMD documents states that the waste heat load of the BWRX-300 design is expected to be less than the EIS predictions (CMD, e-Doc 7120574, p.37). Lastly, CMD states that construction of intake and discharge structures would require a *Fisheries Act authorisation* (CMD, e-Doc 7120574, p.26), while an expression of "may require" is used for authorization of the in-water work activities. (CMD, e-Doc 7120574, p.67).

c) At max power generation capacity, the 2009 EIS (NK054-REP-07730-00029, p.5-24) assumed a maximum 9^{o}C water temperature rise waste heat with a flow rate of 250m^3/s, the information of BWRX-300 on the this aspect gives a sense of possibility not certainty (can uncertainty be quantified for this estimate) in a statement: "The BWRX-300 deployment "can achieve" a cooling water temperature rise of 9ºC" (NK054-REP-07730-00055 R000, NK054-REP-07730-00055 R000, p.62). This statement gives a perception of retrospective environmental impact assessment. Also, it is unclear if any exceedances are predicted and what would be the frequency of the exceedances.

d) The operation of condenser, condenser circulating water and service water cooling systems all would withdraw water from the lake and return warm water to the lake with potential to alter the lake flow dynamics, thermal regime, and quality characteristics. It is indicated the BWRX "is expected" to have lower withdrawal and return rate (NK054-REP-07730-00055 R000, p.61). The statement gives a perception of retrospective environmental impact assessment. The revised EIS supporting document mentions that the maximum inflow rate is less than 68 m^3/s for 4 reactors, but the maximum discharge rate is not provided.

e) It is indicated that with considerable similarities to DNGS the once through cooling water design of BWRX-300 will be sized to "necessary water volumes" (NK054-REP-07730-00055 R000, p.65, 74, Table 5-2); this term needs a value to enable direct comparisons of the water volumes assessed in the 2009 EIS versus what the volumes required by the BWRX-300 design. Moreover, the use of term (small scale once-through cooling system) produces the desire to know the connection between the exclusion of need of cooling towers in the BWRX-300 design, 100% reliance of lake water as heat sink, and the necessary water volumes of the once through cooling system.

f) It is unclear whether the construction of intake and discharge structures in an inshore area of highest concentration of shrimp can have an indirect adverse effect on the food chain by affecting aquatic species that use shrimp as food (CMD, p.26, e-Doc 7120574).

g) With BWRX-300 deployment, areas of warm water may increase along the shoreline of Lake Ontario (NK054-REP-07730-00058-R000, p.103) which is considered beneficial for waterfowl, but it is unclear how this would affect the overall habitat quality of the area e.g., algal growth.

h) Periodic monitoring of data of cooling water, discharge temperature and plume characteristics in relation to fish habitat and susceptibility of VEC species, and evaluation of cumulative effects from already existing DNGS is a part of OPG commitments (D-P.12.4, NK054-PLAN-07730-00014, p.21). It would be integral to have access to this data to see the whole picture.

i) In summary, it is not possible to get a clear context of the EIS conclusion of "negligible adverse effects" with discharge water temperature of 9^{o}C without access to the (TSD, NK054-REP-07730-00013-R000 and DNNP Supporting Environment Studies-NK054-REP-01210–0001) and details of the design of the cooling water system of the BWRX-300 system verifying lower thermal impact.

2. Impact on Ground Water

a) The EIS review reports that BWRX-300 would cause "Temporary decrease in water flow to Lake Ontario (NK054-REP-07730-00055 R000, p.31). However, Groundwater Modelling report (NK054-REP-07730-00059-R000, Table on p.45) shows a decrease in groundwater inflow of 17-37% (min-max) between the years 2028-2034 of the construction phase of the project, which is expected to return close to the pre- construction levels in the next 10 years (2034-2044). The clarification of the context of the term "temporary" is missing. It is acknowledged that there is uncertainty in these predictions, which further highlights the importance of defining the context of the term temporary (NK054-REP-07730-00059-R000, pp.11).

b) For the Wetlands/Tributaries to the East a 63% decrease is shown between the years 2028- 2033. For Darlington Creek to the Northeast, Tree Frog Pond, and Other Wetlands (86, 31 and 29% decrease in groundwater flows respectively), are shown between the yrs. 2028- 2034). Similarly, between the yrs. 2028-2032, a 21% decrease relative to the pre-construction period in ground water inflow to Bank swallow protected area is indicated. This is considered a "temporary effect " based on predictions of the inflows to return to nearly the pre-construction time by the year 2044. Twelve years (starting from construction of unit 4 (2032-2044) is a considerably long time to be called "temporary". It is unclear if the term was used in the context of the complete life cycle of the BWRX-300 reactor.

c) It is stated that dewatering for deeper foundations of BWRX-300 design would lower the water table by approximately 14 m and would "permanently" change ground water flow on the DN site (NK054-REP-07730-00058-R000, p.125). The connection between the use of terms temporary and permanent is unclear.

d) The groundwater modelling report (NK054-REP-07730-00059-R000, Table on p. 45) shows complete loss of groundwater to two wetland areas: Wetlands to the South, Wetlands to the Southeast (100% decrease in groundwater flows), either by the construction of one reactor or 4 over a period of 7 yrs. since these wetlands were assumed to be completely removed in the 2009 EIS during construction phase. However, for the BWRX-300 design, a possibility to retain sensitive areas of wetlands (Treefrog Pond, Polliwog Pond and Dragonfly Pond, South and Southeast Wetlands) that were to be removed for the bounding scenario reactors in the EIS is indicated. Although this possibility has already been examined by further studies, (NK054-REP-07730-00058-R000, p.82) NTP does not have access to these results. Transparency could only be ensured by sharing these results with the public.

e) In summary, as there are multiple aspects of the project that could alter ground water level and or/flow i.e., dewatering for deeper foundation, utility trenches, hard water surfaces, stormwater management facilities and interception of groundwater by condenser circulating water system in the forebay channel (NK054-REP-07730-00058-R000, p.104, 108, 125) the need of ongoing sharing of information with public is significant.

3. Airborne and Waterborne Releases of RN

a) The air borne emission of BWRX-300 was found to be different in the following aspects (Noted in both NK054-REP-07730-00055 R000 and NK054-REP-07730-00058-R000) . Tables 4.1 and 4.2 (N-REP-01200-10000, R005, R006) showing data of airborne source term show that 35 isotopes are exclusively released by BWRX-300 reactors. These include Kr-83m, Kr-89, Xe-137, I-132, I-134, I-135, Na-24, P-32, Mn-56, Fe-55, Ni-63, Cu-64, Zn-65, Rb-89, Y-90, Sr-91, Sr-92, Y-91, Y-92, Y-93, Mo-99, Tc-99m, Rh-103m, Rh-106, Ag-110m, Sb-124, Te-129m, Te-131m, Te-132, Cs-138, La-140, Ce-144, Pr-144, W-187, Np-239. And the BWRX-300 design is associated with the release of the largest amounts of 3 radioisotopes (Bq/y) which include Iodines (I-132. I-134, I-135, and Fe-59).

b) While it could be understandable that the cumulative radioactive dose to humans or biota/year might not change due to change in proportion of radionuclides; concerns are that varying proportion of radionuclides in the atmospheric emissions can change certain characteristics of the mixture. Since different radionuclides vary in their radioactive half-lives and chemical, biological, and environmental properties the chemistry of the specific concentration of a RN in the mixture could change, as well as the chemical and physical properties of mixture and the toxicity dose response relationship of the mixture. The situation could be more complex because the radionuclides could be expected to be released as a mixture of non-radioactive chemicals like noble metals used to control corrosion, and other process chemicals (not named in NK054-REP-07730-00058-R000). Therefore, effluent characterization is necessary which is also highlighted in JRP recommendations (CMD, p.90, e-Doc 7120574).

c) Estimated airborne release of C14 and Radioiodines for BWRX-300 are higher (1.25 and 1.01 times respectively) than predictions of the 2009 EIS (CMD, p.20, e-Doc 7120574). It is unclear whether the effects of these radionuclides on terrestrial and soil biota are being evaluated with consideration of dry and wet deposition. Moreover, it is unclear if the smaller normal operation minimum release height above finished grade for BWRX-300 (35 vs 48.8m) versus other technologies assessed in the 2009 EIS can make any difference to the dry and wet deposition of contaminants (both radioactive and nonradioactive chemicals) from the DNNP.

d) It is also mentioned that the solid waste activity would have the same principal radionuclides but different proportions (NK054-REP-07730-00058-R000, p.50), which would not impact the EIS predictions. However, Tables 4.5 and 4.6 (N-REP-01200-10000, R006) showing data of solid waste radioactivity show that 36 isotopes are exclusively released by BWRX-300 designs. These include Am-241, Am-242m, Am-243, Cm242, Cm243, Cm244, Cm245, Cm246, Cs-136, Cu-64, I-129, I-132, I-134, I-135, Mn-56, Mo-99, Np-237, Np-239, P-32, Pu-238, Pu-239, Pu-242, Rh-103m, Sr-89, Sr-91, Sr-92, Tc-99m, Te-129m, Te-131m, Te-132, W-187, Y-90, Y-91, Y-92, Y-93 and Zn-65. It could be anticipated that the presence of these RNs in the solid waste may require consideration in accidental release scenario like flooding during onsite storage before waste treatment.

e) Discharge of radioactive effluent to the environment is expected in the event where the liquid waste management inventory would not allow for recycling of the water and removal of radioactivity (CMD, p.27-28, e-Doc 7120574). It is surprising to find that this scenario was not discussed in the radioactivity release scenarios in the CMD along with predicted details of the composition of the effluent.

4. Air Quality

a) Air quality is a project-environment interaction applicable to all life cycle stages of the DNNP project (Table 5.1-1, 2009 EIS, NK054-REP-07730-00029). With predictions of the increase in the number of receptors exposed to short-term (1 hour) concentration exceedances of NO2 during site preparation (exceedances of both the 2020 and 2025 1-hour NO2 CAAQS and 1-hour SO2 CAAQS, CMD e-Doc 7120574, p.21-22); it is logical to raise question on the frequencies of exceedances and assessment of probable cumulative hazardous effects on human health of these short-term exposures. (Important to note is the fact that annual NO2 exposure at all receptor locations are predicted to exceed the 2025 CAAQS).

b) With an acknowledgement that Benzo(a)pyrene is the most restrictive (almost prohibited) contaminant for PAHs and the most restrictive air contaminant overall (i.e., all VOCs and PAHs combined), it is surprising to find Benzo(a)pyrene missing from Table 5 of the CMD (CMD, e-Doc 7120574, p.23).

5. Storm Water Management

It appears that a separate Storm Water Management Plan for the BWRX-300 is being prepared or in the process; that will describe the control and management of natural water from sources like winter snow melt, serious rain events, and ground water from deep excavations (NK054-REP-07730-00058-R000, p.83). This document would also be important as the design would contribute to additional baseflow into Darlington Creek and surface water ponds possibly be retained by the BWRX-300 design and reduce the extent of the groundwater drawdown area and would have details of management in worst case like flooding and climate change. Sharing of this document would be needed for public transparency since stormwater runoff can contain road salts, oils and greases, metals, nutrients, pesticides, and petroleum hydrocarbons to affect soil, surface water and groundwater quality.

6. Storage of Used Fuel

a) The BWRX-300 has a smaller used fuel pool bay for used fuel interim storage to let it cool and decay. 2009 EIS reactors required cooling "typically over a period of 10 years", before being transferred into dry-storage containers and stored on site. BWRX-300 would require movement of used fuel earlier (between 3-5 years) to the waste management facility, under the assumption that "fuel storage facilities will be available when needed" (NK054-rep-07730-00058-R000, p.38). This aspect is difficult to visualize because specific information on the capacity of used fuel bay, the cooling period and RA release from used fuel accident have been redacted (Table 5-26, NK054-rep-07730-00058-R000, R001).

b) Moving the spent fuel earlier and storage in the interim DRY storage facilities for longer than what was assessed in the EIS is an aspect where transparency would require greater details of how the management system would work to prevent emission into environment (including predictions of worst case scenarios, malfunctions and accidents and associated adverse effects on human and environmental, which are important considering that the used fuel would be moved to dry storage facilities on site almost 2-3 times earlier than typical practice).

7. Fish VECs

a) It is unclear if there are differences in the selection of VECs for the DNGS site and for the EIS of the DNNP. The 2020 ERA for DNGS (D-REP-07701-00001-R001, Table 4-1, p. 4-5) has a list of VEC indicator fish species. The DNNP EIS review document (NK054-REP-07730-00055 R000, p.43) identifies Deep water sculpin, Lake Sturgeon, Atlantic Salmon, and American Eel as fish species at risk, but many fish species like round goby, emerald shiner, alewife, white sucker, round whitefish, lake trout and salmonid sportfish are not mentioned/discussed. Similarly, Alewife, and Lake trout are present on site, are exposed to waterborne effluent and thermal stressor through surface water and consumption of food and included as VECs in the 2020 ERA for DNGS (D-REP-07701-00001-R001, Table 4-1, p.4-6), but not included in the EIS relevant to BWRX-300. Northern Redbelly Dace is a benthic foraging species present on site (Coot's Pond) and was a VEC species in 2020 ERA for DNGS, with no mention in the EIS documents applicable to BWRX-300 specifically.

b) While it is noted that Lake sturgeon and American Eel will be included as VECs in the permit process after initiation of water works of the DNNP. Near shore nursery and foraging habitats are reported to be present for Lake sturgeon (D-REP-07701-00001-R001, p. 238). It would be interesting to get the details of the environmental management program for conservation of these species.

c) Unfortunately, not many details could be found on Atlantic Salmon (a SAR species) in the EIS review document (NK054-REP-07730-00055 R000).

d) There is a list of commitments for round white fish effect assessment, and proposal of a round whitefish action plan for prediction of adverse effects, but commitments specific to any other fish species could not be found in the Environmental Monitoring and Environmental Assessment Follow-Up Plan (NK054-PLAN-07730-00014), which could be expected for Lake sturgeon because of the use of near shore as nursery and foraging habitats. Moreover, unlike round whitefish, commitments of assessments of permanent aquatic effects (impingement, entrainment, climate change) and a plan for their incorporation into cumulative effect assessment was not given for any other fish species. Commitments of cumulative assessment including thermal effects for Lake trout and Emerald shiner (species exposed to thermal effluent, (D-REP-07701-00001-R001, p. 4-5) be could not be found in the Environmental Monitoring and Environmental Assessment Follow-Up plan.

e) Thermal sensitivity was noted only for round white fish (D-REP-07701-00001-R001, p. 4-5), that could be related to use of the near shore area as spawning habitat and thermal sensitivity of early life stages. It is unclear if studies for thermal sensitivity of juvenile Sturgeon or other fish species present at site were conducted or thermal criteria from published lab or field studies are used.

8. Amphibian and Reptiles VECs

One turtle species that uses DNNP site for breeding became listed as a SAR (species at risk) since the EIS (NK054-REP-07730-00058-R000, p.43). As the name of the species was not provided in NK054-REP-07730-00058-R000, it is assumed to be either Midland Painted Turtle or Snapping Turtle.

9. Bird VECs

9.1 Breeding Birds

a) From available information (accessible before Nov 12, 2023), it is difficult to clearly get the overall scale of BWRX-300 deployment on breeding birds (Yellow Warbler and Red-eyed Vireo, Barn Swallow, Eastern Wood Pewee, Wood Thrush, Bobolink, and Eastern Meadowlark). The EIS review supporting document mentions that BWRX-300 deployment would retain "some" breeding bird habitat that was assumed to be lost in the 2009 EIS. In the light that recent surveys have gathered information on these species, a relevant question could be that is it not possible to get an estimated percentage of the habitat that could be saved (probably with an appraisal of uncertainty), instead of the use of the word "some" because a detailed site layout plan is assumed to be available at this stage.

b) A complete list of breeding birds VECs was not available in the BWRX-300 EIS review supporting document

9.2 Migrant Songbirds and their Habitat

The impact of project on the six migrant bird species (new SAR species since EIS) Olive-sided flycatcher, Common Nighthawk, Eastern Whip-Poor-Will, Canada Warbler, Rusty Blackbird and Least Bittern is not discussed in sufficient detail.

9.3 Winter Raptor Feeding and Roosting Areas

a) It is unclear if the loss of the one primary owl roost, and approximately 50% of the suitable winter raptor foraging habitat is still considered an effect associated with BWRX-300 design deployment (NK054-REP-07730-00058-R001, p.89). A relevant question could be that is it not possible to get an estimated percentage of the habitat that could be saved (probably with an appraisal of uncertainty), since a detailed site layout plan is assumed to be available at this stage.

b) Ongoing sharing of data of the success of specific mitigative measure that involves development of artificial habitat for aerial forage species (e.g., Chimney Swift and Purple Martin) in potentially suitable locations on the DNNP site was also expected in the EIS review but was not present.

9.4 Bank Swallow Habitat

With the map of Bank swallow habitat being redacted from NK054-REP-07730-00058-R000 (p.67, 68), it is hard to visualize the term “smaller footprint” on bank swallow. Since the last EIS was done in 2009 which was before the recognition of the Bank Swallow as the “threatened” on the federal *Species at Risk Act*, it seems a bit concerning when the EIS supporting documents repeatedly acknowledges the loss of Bank swallow habitat for the 4-reactor scenario due to shoreline protection and/or hydrogeological changes (e.g., p.68,76) and considers this impact to be consistent with EIS. Development of artificial nesting habitat for bank swallow is a mitigative measure whose effectivity and success could only be evaluated after the measure is implemented for a few years post site preparation and construction phase. The adverse effects of shoreline works can be minimized “depending on the timing of the installation of the shoreline protection works” (NK054-REP-07730-00058-R001, p.92). This is an encouraging possibility, and the shoreline works are anticipated to be scheduled around to avail this possibility”.

9.5 Bats

Several species of bats are using the woodlands on the DNNP site for roosting and foraging activities, which represents a baseline condition that was not previously considered in the 2009 EIS. Out of many, three bat species are considered endangered species Little Brown Myotis, Northern Myotis and Tri-coloured Bat. Ambiguities exist on the EIS of these VECs due to a couple of reasons. Redaction of information of the removal of vegetation communities with BWRX-300 deployment (NK054-REP-07730-00058-R000, p.81), indication of a possibility of preservation of “some” woodland ecosystem/ breeding mammal habitat, and if BWRX-300 deployment would require removal of the woodland on the Northeast side of the DN site (roosting habitat of Little Brown Myotis) and the treed foraging habitats for multiple species of bats on the eastern portion of the site (NK054-REP-07730-00058-R000, p.94).

10. Insect VECs

If the BWRX-300 design “does not/may not require” the removal of Treefrog Pond, Polliwog Pond and Dragonfly Ponds (NK054-REP-07730-00058-R000, p.71), the only habitats for the rare insect species (the Amber-winged Spreadwing) and Monarch butterfly would be retained. Also, dust modelling has confirmed that the effects would be “minor”. It would have been useful to have results of insect monitoring surveys and comparisons with modelling predictions of habitat preservation available to public.

11. Cumulative Effects

a) Cumulative thermal effects of once through cooling system on the aquatic environment (including biota) were not available in section 5.8.1 of the EIS review.

b) Likewise, the cumulative effects of the project on soil, ground water and surface water quality (for example radiological and non radiological chemicals release like processing chemicals) via all transport pathways could not be found.

c) It appears that OPG has done an updated assessment of cumulative effects on VECs within the aquatic and the terrestrial environment (CMD p.66, e-Doc 7120574). Only comprehensive details could offer the opportunity to understand the background of the conclusions of "no residual significant adverse cumulative effects" associated with the proposed deployment of BWRX-300.

d) It was not possible to find a cumulative impact assessment of various aspects of project development on terrestrial VECs e.g., a cumulative impact of dust, noise, light and vibration on bats, or a cumulative assessment of change in ground water flow and blasting on bank swallow habitat etc.

II. Missing Links Perceptions

1. The EIS review document (NK054-REP-07730-00055 R000) emphasises the term **"**smaller footprint" for BWRX-300 design, a term which is supported by numbers, at most of the places but not necessarily all places. In connection a term "footprint would be smaller" is used often to make EIS conclusions of the BWRX-300 design. Smaller is a comparable term which is hard to visualize without having a numerical estimate.

2. It has been iterated in the EIS review document (NK054-REP-07730-00055 R000) that the BWRX-300 deployment will retain "some" terrestrial habitats on the DNNP site. And additional studies are on going to determine this aspect. The availability of these studies results (data with number estimates) would be important to support the claim of "smaller footprint".

3. The methodology of EIS states that qualitative comparisons of BWRX-300 with the conclusions of 2009 EIS will be done. But comparative terms like "smaller, slightly higher and smaller" etc. are not comprehensible without quantitative context. A few examples are noted. The BWRX-300 will require "less" land area for administration and physical support facilities than described in the EIS. The land area required for used fuel dry storage of the BWRX-300 is "smaller" than what was assessed in the EIS. BWRX-300 deployment will retain "some" terrestrial habitats on the DNNP site. "Some" shoreline development is required for BWRX-300 design. The methodology of EIS also describes a framework of quantitative comparisons of BWRX-300 in case a qualitative comparison is not possible. This involves additional studies to collect data, that are analyzed to see if conclusions of 2009 EIS are met or not. If the results of additional studies are not consistent with the EIS, residual effects are identified after considering mitigation measures and the significance of the residual effects is determined. Following this, need for necessary additional studies and/or mitigation options is identified if required. Without having access to "data of the additional studies, details of mitigative

measures with data supporting their effectiveness and data showing the statistically nonsignificant residual effects this practice appears to be technically less convincing.

4. These comments are especially relevant to both existing and New Project-Environment Interactions:

   i) For better understanding a few detailed examples of the qualitative impact assessments would have been useful considering this methodology was applied in the Tier-1 of the assessment which may have the highest uncertainty.

   ii) At present is not possible to understand the allocation of significance level of adverse effects at Tier 1 of the impact assessment methodology, especially with statements like: For the Step 1 of the EIS, "the assessment criteria were based on the size and extent of the effect, and thresholds were established such that any residual adverse effect that was rated as low for any one of the criteria used in Step 1 would necessarily be a residual adverse effect that was so minimal that it could not be significant, no matter how high the ratings that were achieved for the other criteria at Step 1" (2009 EIS, p.9-6). Since the "significance" to an impact is assigned on ratings, it is not possible to understand how one can relate these ratings to statistical and biological/ecological significance at the first step of the strategy.

   iii) It is unclear how an effect with small size and extent, but considerably prolonged duration (e.g., thermal impacts on aquatic environment through the operational life of plant) assessed?

   iv) How can this strategy be used for cumulative effect assessment considering various aspects of DNNP and/or other operational plants on site?

5. Without greater details of the framework/design of qualitive assessment that was used to determine impacts on the new VECs not included in the 2009 EIS like Bats (Table 5-11), and Bank swallow Table 5-9), it is difficult to understand the technical background of the conclusion of "minor or no adverse effects". While it could be noted that hydrogeological and vibration studies were quantitative, the use of results of these studies for qualitative assessments is unclear as well.

6. The rationale behind qualitative impact assessment of BWRX-300 with respect to a few VECs like cultural meadow and thicket ecosystem and habitat of Insects – Migrant butterfly stopover areas are unclear (NK054-REP-07730-00058-R000, Table 5-20), especially when the EIS provides a numerical estimate of the likely residual adverse effect (loss of 50 ha of cultural meadow ecosystem and loss of approximately 24 to 34 ha loss of butterfly habitat). The claim of "smaller environmental footprint" of BWRX-

300 could have been better supported with quantitative estimates presumably with the use of already completed quantitative dust modelling study, and the detailed site layout and activities plans.

7. The use of terms like "minor, negligible, minimal" and "non-significant" to describe likely residual/adverse effects is incomplete without describing the details of the qualitative or quantitative criteria of these terms, which could help in clear discrimination.

8. Need of further/additional studies has been identified at multiple places in the document (NK054-REP-07730-00055 R000) for the following VECs. These studies were needed to assess the new pathways for effects of noise, dust, and light, in addition to surface and ground water on the VECs.

   - Bats
   - Wetland and Woodland Ecosystems, Rare Plant Species, Amphibians and Reptiles, Insects – Dragonflies and Damselflies, Mammal communities and species
   - Breeding Mammals, Migrant Butterfly Stopover Area, Breeding Birds, including Winter Raptor Feeding and Roosting Area, and Migrant Songbirds and their Habitat.
   - Bank swallows

   A concern is that it is not clearly mentioned anywhere if the approval of permit for site preparation/construction of DNNP be awaiting until these studies results become available (in the light of note "review in progress", NK054-REP-07730-00055 R000, p.209)..

9. Likely effects of BWRX-300 on Lake water temperature are hard to visualize and compare with the EIS without sufficient details of intake and diffuser structure and "in-design" mitigation measures of the water intake and discharge structures, thermal plume modelling and thermal effects assessments.

10. NTP appreciates the sharing of most recent ERA of the DN site (D-REP-07701-00001-R001). While this document has details of the process of selection of ecological VECs and a Table with list of all VECs (Table 4-1, p. 4-5), such a table was missing from the EIS review supporting document (NK054-REP-07730-00058-R000). Availability of such a Table would have been useful in getting a full picture of environmental monitoring programs for protection of VECs (see bullet point 1a).

11. Near shore nursery and foraging habitats are reported to be present for Lake sturgeon (D-REP-07701-00001-R001, p. 238). In contrast to this, the CMD states that the nearshore area does not contain a critical habitat for these species (CMD, e-Doc 7120574, p.28). The two statements produce confusion.

12. The statement that "a net increase of 2.9-3°C above ambient temperatures beyond the mixing zone are protective of the aquatic environment" (CMD, e-Doc 7120574, p.37) is dubious without support of data to arrive at this conclusion.

13. A list of commitments related to the on-site ponds are shown (NK054-REP-07730-00058-R000, p.84) to be either scaled down or considered no longer relevant to the BWRX-300 deployment. These include maintenance of biodiversity of Coot's Pond, creation of new fish-free wetland ponds with riparian plantings, salvage and relocation of aquatic plants and biota, replantation of Cultural Meadow and Cultural Thicket with native shrub plantings and wood land dominated by Sugar Maple. A clear quantitative description of the scale down is missing. Northern Redbelly Dace has become established and has historically been abundant in the Coot's Pond, but adaptive management measures are not shown (CMD, e-Doc 7120574, p.48).

14. In the hazardous waste management section (decommissioning), it is stated that "the BWRX-300 may not have the same three designated substances (mercury, lead, asbestos) listed in the EIS" (NK054-REP-07730-00058-R000, p.202). However, details of composition of hazardous waste of BWX-300 are not provided. Notably, the JRP recommendation (#26, CMD, e-Doc 7120574) accepted by Govt. of Canada also requires a comprehensive assessment of hazardous substance and/ chemicals releases and the required management practices on site.

15. It is unclear what chemicals would be used and released to environment with the BWRX-300 deployment. While Hydrogen and noble metals would be used to prevent corrosion, the specific information on their release to environment (normal operation and accidental scenario) could not be found (NK054-REP-07730-00058-R000, p.165 and NK054-REP-07730-00058-R001).

16. The JRP panel (#14, CMD, e-Doc 7120574) recommended detailed assessment of predicted effluent releases from the Project (quantity, composition, point of release and a description of effluent treatment. No data on this aspect not available in the EIS review.

17. The JRP panel (#2, CMD, e-Doc 7120574)) recommended a comprehensive soils characterization program before site preparation phase. It is unclear in the EIS review if this program is underway.

III. Recommendations/Future Requests

1. Availability of main studies as well as ALL supporting studies used and cited including TSDs and methodology documents for example (summarized in Table 15 of the CMD, e-Doc 7120574, p.119-121) to support the major claims of an EIS document. In addition, the most interesting aspect of the project would be cumulative effects assessment of various components like cumulative effects of DNNP on aquatic, and terrestrial biota and habitat, during site preparation, and construction phases; and cumulative effects in the

operational phase considering power plants already operational. These could provide a better picture of the quantity of terrestrial, and habitat retained by the DNNP and support the “smaller footprint”.

2. For transparency, details of adaptive management program and compensation plans (for fish and/or other VECs) to address changes to aquatic ecosystems with details of the mitigative measures would be appreciated. In addition, results of the i) follow-up program for soil quality during all stages of the DNNP, ii) the water and sediment quality monitoring program required before start of in-water works, iii) enhanced groundwater and contaminant transport modelling including wet and dry deposition of all contaminants of potential concern, iv) monitoring of transitions in groundwater flows that may arise as a consequence of grade changes during the site preparation and construction phases, v) results of follow up and management program on species at risk to verify the ERA predictions, vi) the details of round whitefish action plan should shared for transparency.

3. For transparency, details of adaptive/follow up management program of air contaminants (especially Acrolein and Benzo(a)pyrene, SO2 and NO2, SPM, PM2.5 and PM10) with details of the mitigative measures would be appreciated.

4. Data/outcome of further, additional, ongoing studies pertinent to assessment of baseline conditions or prediction of future impacts related to any environmental component (human/biota/physical) should be shared on ongoing basis for public transparency.

5. Results of monitoring studies, mitigative measures or risk assessment during site preparation, operation, construction, and operation phase committed in the OPG commitments should be made available to public. For example, surface water risk assessment during operation phase (OPG commitment D-P.12.3). This would be necessary to see the implementation of the JRP recommendations and OPG commitments.

6. Of the environmental effects on VECs that were considered for determination of further significance after mitigation measures, (NK054-REP-07730-00058-R000, Table 5-30) because likely residual adverse effects were identified in the EIS; conclusions of “Opportunity area not considered in the EIS – Residual Adverse Effects anticipated to be minor” highlight an area of ongoing data collection (during the LCA of the BWRX-300 design) and a possibility of consistent information/data sharing.

7. While the EMP reports (N-REP-03443-10027, N-REP-03443-10026, N-REP-03443-10023) have major focus of human health and radionuclides, it is not known if documents with similar details of the monitoring of non-radionuclides and/or conventional contaminants on ecosystem health including thermal effects monitoring on the aquatic ecosystem exist (having data tables with

measured levels of a contaminant in environmental components like undiluted effluent, surface water, ground water and soil for all receptor location like the EMP).

8. The details of the toxicity testing criteria, the test methodologies and test frequencies that would be used to confirm that stormwater discharges from DNNP complies with the *Fisheries Act* as required by JRP would be of special interest to NTP.

References

OPG report, NK054-REP-07730-00029 – *Environmental Impact Statement: New Nuclear – Darlington Environmental Assessment*, dated 30 September 2009.

OPG submission, *Darlington New Nuclear Project Report for the Review of the Environmental Impact Statement for Small Modular Reactor BWRX-300*, revision 0, NK054-REP-07730-00055, dated 05 October 2022.

OPG report, Darlington New Nuclear Project Environmental Impact Statement, Review Report for Small Modular Reactor BWRX-300, OPG CD# NK054-REP- 07730-00055, Revision 1, dated 28 June 2023.

OPG submission, Use of Plant Parameters Envelope to Encompass the Reactor Designs being Considered for the Darlington Site, N-REP-01200-10000, revision 5, dated 05 October 2022. OPG submission,

Use of Plant Parameters Envelope to Encompass the Reactors Designs being Considered for the Darlington Site, N-PRE-02100-10000, revision 6, dated July 2023.

OPG report, *Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300*, NK054-REP-07730-00058, revision 0, dated 31 December 2022.

OPG report, Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300, NK054-REP-07730-00058, revision 1, dated 19 July 2023.

OPG report, *Darlington New Nuclear Project Commitments Report*, OPG document number NK054-REP-01210-00078, revision 8, dated 31 August 2022.

OPG submission, *Environmental Monitoring and Environmental Assessment Follow-Up Plan for the Darlington New Nuclear Project*, NK054-PLAN-07730-00014, Revision 1, dated 28 October 2022.

OPG report, *Darlington New Nuclear Project – Site Evaluation Update Summary Report*, OPG document number NK054-REP-01210-00142, revision 0, dated 30 September 2022.

OPG report, *2020 Environmental Risk Assessment for The Darlington Nuclear Site,* OPG document number D-REP-07701-00001-R001, dated 21 September 2021.

OPG document, *Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project,* OPG document number NK054-REP-07730-00059-R000, dated 07 November 2022.

OPG document, *Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project,* OPG document number NK054-REP-07730-00059-R000, dated 07 November 2022.

APPENDIX C

Public Review of Darlington New Nuclear Project with respect to water use and environmental impact

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November 20, 2023

BACKGROUND OF DARLINGTON NEW NUCLEAR PROJECT

The Darlington New Nuclear Project (DNNP) is situated at the existing Darlington Nuclear site which is located on the north shore of Lake Ontario in the Municipality of Clarington.

In 2009, Joint Review Panel (JRP) was be established to review the environmental assessment with the conclusion that "the DNNP is not likely to cause significant adverse environmental effects, provided the mitigation measures proposed and commitments made by OPG during the review, and the JRP's recommendations are implemented." However, at the time the Environmental Impact Statement (EIS) was conducted, no specific reactor technology was selected; rather, the EIS considered a Bounding Scenario as the basis for the environmental assessment.

In December 2021, OPG selected the BWRX-300 for deployment at the DNNP site and started working with the vendor, GE Hitachi Nuclear Energy, to progress the design of the BWRX-300 and develop the required documents in support of the Licence to Construct (LTC) Application. In July 2023, a supporting document (Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300) was released to cover the deployment of four BWRX-300 reactors and consider all phases of the DNNP from site preparation, construction, operation, and decommissioning. It provides "the analysis whether the BWRX-300 deployment would result in any significant residual adverse effects as well as any opportunities for improvements".

GOAL OF THIS REVIEW

This review should specifically evaluate the relevance and validity of the findings from the 2009 Environmental Impact Statement (EIS) and its supporting documents in the context of deploying the BWRX-300 reactor technology at the Darlington New Nuclear Project (DNNP) with respect to water use and environmental impact.

1 COMPARISON OF BWRX-300 SMR WITH OTHER REACTORS

1.1 Previously considered PWR and PHWR reactors

Previously considered reactors (PPE, Table B.1.2, page 48):

1) Evolutionary Power Reactor (EPR)
2) Advanced Passive Reactor (AP1000)
3) Advanced CANDU Reactor (ACR-1000)
4) Enhanced CANDU 6 Reactor (EC6)

These types of reactors belong to Pressurized Water Reactors (PWR) and Pressurized Heavy Water Reactor (PHWR).

PWR and PHWR reactors have some **similarities** in terms of their design and operation:

a) Both reactor cores are contained in a pressurized vessel, hereby the name of the reactors.

b) Both use water as a coolant: PWR and PHWR both use water as a coolant to remove heat generated by the nuclear reactions. However, water type is different. In PWR, ordinary water is used as a coolant while in PHWR, heavy water is used as a coolant.

c) Both require a neutron moderator: Both reactors require a neutron moderator to slow down the neutrons released by the nuclear reactions to maintain the chain reaction. In PWR, the coolant water itself is used as a neutron moderator. In PHWR, heavy water is used as both a coolant and a neutron moderator.

Despite these similarities, PWR and PHWR reactors have some notable differences in terms of their fuel type, fuel cycle, and other operational characteristics. For example, PWR uses enriched uranium fuel, while PHWR can use natural uranium fuel. PWR typically requires more complex and expensive fuel cycle management, while PHWR has a simpler fuel cycle.

1.2 A new BWRX-300 reactor

A new reactor proposed is the BWRX-300, which is a small modular nuclear reactor design developed by GE Hitachi Nuclear Energy. This reactor belongs to another type of reactors, such as Boiling Water Reactor (BWRs). Despite some differences in design and operation, BWRX-300 share several similarities with PWR and PHWR reactors.

1.2.1 Similarities

Similarities between BWRX-300 and previously considered reactors (PWR and PHWR) include:

a) Fuel type: All three reactor types use uranium as their fuel source. The fuel is formed into ceramic pellets, which are then placed into fuel rods that are arranged into fuel assemblies. The radioactivity of fuel is different as described below.

b) Heat transfer by water: In all three reactor types, heat is generated by nuclear reactions in the fuel and is transferred to water that flows through the reactor core. The heated water is then used to generate steam, which drives a turbine to produce electricity. The type of water is different as described below.

1.2.2 Differences

While BWRX-300, PWR, and PHWR reactors share several similarities, they also have some important differences in their design and operation:

a) Reactor Type: PWRs and PHWRs are pressurized water reactors and heavy water reactors, respectively. Both types of reactors operate under a pressurized system, where the water coolant is kept at a high pressure to prevent it from boiling. In turn, the BWRX-300 is a boiling water reactor. It means that it has a simpler design where the reactor core is immersed directly in water, rather than is contained in a pressurized vessel.

b) Neutron Moderation: The neutron moderation system is different for these reactor types. BWRX-300 and PWRs use ordinary water as both the coolant and the neutron moderator, while PHWRs use heavy water as the moderator and coolant.

c) Embedment of the building: the BWRX-300 has deeper (38 m below grade) foundation embedment, as compared to other reactors (13.5 m). This difference alters groundwater flow in a different manner, as discussed below. With respect to safety, by placing the reactor deep underground, it provides an additional layer of protection against potential external threats such as natural disasters, extreme weather events, and human-induced accidents or attacks. The deep embedment also helps to reduce the risk of radiation exposure to the surrounding environment and people in case of an accident. At the same time, building below the water table presents unique challenges, such as dealing with potential groundwater infiltration and ensuring that the structure remains stable in wet conditions.

d) Fuel assembly design: The fuel assembly design also differs between the reactor types. The BWRX-300 has a simpler fuel assembly design with a single-channel core, while PWRs and PHWRs have more complex fuel assembly designs.

e) Discharging water: The once-through cooling system used in the BWRX-300 is designed to directly withdraw water from Lake Ontario and use it to cool the reactor. The water will then be discharged back into the water source at a higher temperature than it was initially taken. Discharged water from a BWR is expected to achieve a cooling water temperature rise of 9 ºC (NK054-REP-07730-00055 R000, p.62). While, discharged water from PWRs and PHWRs reactors can be as high as 40-50°C above the inlet temperature. The chemical composition of discharging water from BWRX-300 is not clarified, while assumed that it may contain hydrogen gas. There is a lack of environmental impact assessment of the discharging water quality to the surface water of Lake Ontario as discussed below.

f) Cooling System: The cooling system used in these reactor types is drastically different. The BWRX-300 uses a natural-circulation cooling system through the core directly, while PWRs and PHWRs use forced-circulation cooling systems through a separate heat exchanger. The BWRX-300 uses a once-through cooling system that eliminates the need for cooling towers, which are typically used in large thermal power plants to transfer waste heat to the atmosphere. The BWRX-300 has a very high thermal efficiency, which means that it produces less waste heat per unit of electricity generated compared to traditional nuclear power plants. This allows it to operate with a smaller cooling system, which further reduces the need for cooling towers. Despite of these benefits in the cooling system, there is a lack of supporting information on its drawbacks discussed in the following chapter.

2 COOLING SYSTEM

The important discrepancy in the design of BWRX-300 with bound scenarios is in the cooling system. According to 2022 EIS document (Table 3, pp.19, 20, 22): "In the BWRX-300, the reactor coolant water and the feedwater are the same" while "In the EIS (Environmental Impact Statement), the reactor coolant water and the feedwater do not mix".

This discrepancy implies not only the system operation and quantity of water used for cooling, but also the quality of water to be discharged into the lake. Up to date limited information is spread though the documents and there is no comprehensive analysis of the cooling systems and their environmental assessments available for review. The OPG commented during the follow-ups with NTP that "the design of the once through cooling system will be finalized" later, potentially, by 2026. Nevertheless, it has already been concluded that "the EIS conclusions regarding the effects on the site drainage and water quality, lake circulation and water temperature, and shoreline processes remain valid for the BWRX-300 deployment" (2023 Supporting Document, p. 71).

From spread information available in the EIS Supporting Document (Table 5-21, p. 167) and follow-ups, the cooling system of BWRX-300 is different from bound scenarios in the following ways:

WATER QUANTITY:

- No use of cooling towers, rather simplified cooling system with natural circulation and a common reactor coolant water and feedwater system.

WATER QUALITY:

- No use of hydrazine chemical, rather the use of hydrogen gas (H2) and noble metals in cooling water.

These changes are considered beneficial by OPG with respect to environmental impact assessment as the decrease of water quantity withdrawn from the lake in the absence of cooling towers and better water quality due to the replacement of toxic hydrazine by hydrogen gas and noble metals, which "have low toxicity." as stated in Table 5-21 (p. 167). Moreover, the accident scenario of "The leak or release of chemicals from the blowdown ponds for cooling towers" becomes irrelevant, since "the BWRX-300 deployment will not include cooling towers nor blowdown ponds" (p. 164).

Having considered the above-mentioned statements with regard to the goal of the EIS Supporting Document 2023 ("to cover the deployment of four BWRX-300 reactors and consider all phases of the DNNP from site preparation, construction, **operation**, and decommissioning"), this review highlights the lack of risk assessment with regard to the differences in cooling systems. In particular, the use of hydrogen gas in cooling systems implies safety concerns with its storage and application, as well as changes in the redox chemistry of surface water quality. **In order to verify that the EIS conclusions remain valid for the BWRX-300 deployment, the following assessment studies have to be performed and demonstrated to the reviewers:**

a. The risk of environmental cross-contamination (leak scenarios) in a common reactor coolant water and feedwater system, as compared to separate systems.

b. The introduction of hydrogen gas into the cooling system of the BWRX-300:
   1) Risk assessment of malfunction of hydrogen gas injector
   2) Risk assessment of malfunction the Offgas System
   3) Risk of hypoxia in the lake caused by discharged liquid effluent
   4) Alternative anti-corrosive methods to replace the use of hydrogen gas

2.1 Common reactor coolant water and feedwater system

It is probable that a common cooling system, while more efficient for resource usage for construction and operation, poses a greater risk of environmental contamination, compared to separate systems. Therefore, the environmental impact assessment has to include **the risk of cross-contamination in a common reactor coolant water and feedwater system**.

- **Contamination risk:** Higher risk of cross-contamination. A leak in the coolant system could more readily lead to contamination of the feedwater system.
- **Single point of failure:** The common system could present a single point of failure, where a problem in one part affects the entire system.
- **Leak scenario:** In a separated system, a coolant leak might be contained within the coolant system, minimizing environmental impact. In a common system, the same leak could contaminate the feedwater, leading to broader environmental consequences.

2.2 Hydrogen gas in the cooling system

It is explained in the EIS Supporting Document 2023, that the introduction of hydrogen gas (H2) into the cooling system of the BWRX-300 is considered beneficial as it is less toxic than hydrazine. However, the main concern about hydrogen gas is not in its chemical toxicity, rather in its explosive potential towards reactor's safety and changes in redox chemistry of lake water upon the discharge. The use of hydrogen in cooling systems may pose safety and environmental risks, which requires a comprehensive risk management approach, encompassing system design, operational protocols, and emergency response strategies.

2.2.1 Risk assessment of hydrogen gas storage

Hydrogen gas is extremely flammable, and its mixtures with air can be explosive. Hydrogen is often stored under high pressure. Due to its small molecular size, hydrogen can leak from even small openings. Advanced leak detection systems and robust tanks capable of withstanding the pressure without leaking or rupturing are crucial. These parameters have been extensively considered in the Preliminary Safety Analysis Report (PSAR).

This document could be requested for further evaluation:

- Detailed information shall be available in EPRI NP-5283-SR, "Guidelines for Permanent BWR Hydrogen Water Chemistry Installations," Electric Power Research Institute.

2.2.2 Risk of malfunction of hydrogen gas injector

The malfunction in the automatic hydrogen injection system has to be assessed with respect to higher concentrations of hydrogen in the cooling water. Any breach or leak in the cooling system can introduce air, creating a potential hydrogen-air mix which is flammable. An explosion or fire within the cooling system could cause significant damage to reactor components. Damage to the reactor's cooling system can lead to radiological hazards if radioactive materials are released.

Alternatively, discharging water with high hydrogen content into surface water of Lake Ontario may pose the risk of water ignition on the surface, especially near the discharge point. Upon discharge, the hydrogen in water could come into contact with air, creating potential flammable zones. Sudden ignition or fire could harm local aquatic and terrestrial ecosystems.

Therefore, **"Malfunction scenario of hydrogen gas injector"** with respect to the reactor's safety and surface water impact must be analysed. Mitigation strategies have to be considered and assessed:

- Implement advanced leak detection systems in the cooling circuit.
- Continuous monitoring of hydrogen concentration with automatic shutdown or adjustment features.

Without this risk assessment, the conclusion that "No additional conventional malfunctions and accidents were identified for the BWRX-300 deployment." (2023 Supporting Document, Table 5-21, p. 164) is not fully valid.

2.2.3 Hydrogen gas concentration in a passive cooling system

The once through cooling water design of the BWRX-300 raises specific considerations regarding dissolved oxygen levels and the associated fire hazards due to hydrogen gas used for anti-corrosion.

According to the Preliminary Safety Analysis Report (PSAR), *"in order to reduce the risk of IGSCC in reactor vessel internals, the BWRX-300 plant chemistry regime includes Hydrogen Water Chemistry System and On-Line NobleChemTM (OLNC). Control of reactor water oxygen during startup/hot standby is accomplished by utilizing the deaeration capabilities of the condenser."* (p. 819)

In a common cooling system, due to natural circulation, there's a hypothetical possibility that dissolved oxygen levels might be higher compared to separated systems. Natural circulation could facilitate more oxygen dissolution from the atmosphere or from other sources into the water. Elevated oxygen levels can exacerbate corrosion issues, potentially necessitating increased use of hydrogen gas as an anti-corrosion agent. Whereas, the use of hydrogen gas in areas with higher oxygen levels can create an environment conducive to fire hazards.

These parameters have been included into the Preliminary Safety Analysis Report (PSAR) (p. 819): *"The BWRX-300 water chemistry sampling and monitoring program is designed to analyze and monitor system chemistry for trending with alarm notification so actions can be taken to stay within operating specifications. The water chemistry control parameters, recommended operating limits, and recommended monitoring frequencies are developed to minimize the potential for IGSCC (Intergranular Stress Corrosion Cracking) by controlling both ionic impurity and oxidizing radiolysis product concentrations in the reactor water."*

2.3 Alternative corrosion control methods

One of the goals of the EIS 2023 Supporting Document is "the analysis whether the BWRX-300 deployment would result in any significant residual adverse effects as well as **any opportunities for improvements"**. Considering that the use of hydrogen gas in the cooling systems contributes to the additional risk implications, the mitigation measures may include the application of alternative anti-corrosive methods.

Hydrogen Water Chemistry is an established technique for mitigating and reducing the growth rates of IGSCC (Intergranular Stress Corrosion Cracking) in reactor vessel internals. However, the exploration of non-chemical corrosion control methods, such as electromagnetic resonance, could be also beneficial. It has been shown that **electromagnetic fields (EMF) could effectively control scaling and reduce corrosion without the need for hydrogen gas**. The application of EMF for anti-scaling and anti-corrosion has been demonstrated over the last 20 years and the technology is available by industrial water treatment companies (e.g., Nanoresonance Industries: www.nanoresonance.org). Therefore, it is suggested to consider alternative corrosion control methods within the **Chemistry Control Program**.

Electromagnetic treatments are reported to induce bulk precipitation of crystals rather than adhesion to surfaces, which is beneficial in preventing corrosion and scaling on reactor walls, pipes, and vessels. This mechanism, primarily driven by Lorentz forces, changes the orientation of proton spin, affecting hydration effects and crystallization nuclei formation. Further research and development in this field, particularly focused on applying these techniques in the specific environment of nuclear reactors, could lead to safer, more efficient, and environmentally friendly cooling systems.

Reference:

Lin, L., Jiang, W., Xu, X. *et al.* A critical review of the application of electromagnetic fields for scaling control in water systems: mechanisms, characterization, and operation. *npj Clean Water* **3**, 25 (2020). https://doi.org/10.1038/s41545-020-0071-9

3 GROUNDWATER

3.1 Depth of construction and impermeable walls

The construction design of the BWRX-300 is drastically different from the design of other reactors assessed within the EIS 2009 with respect to groundwater impact:

1. The deeper foundation embedment of the BWRX-300 by 25 m: the depth of the BWRX-300 is 38 m, while the depth of other reactors is 13.5 m.

2. The installation of low permeability cut-off wall through the overburden around the excavations for the BWRX-300, while no such constructions are applicable to other reactors.

The potential environmental effects from a deeper (38 m below grade) foundation embedment of the BWRX-300, as compared to other reactors (13.5 m), was assessed within the 2020 EIS EIS 2009. The conclusion by OPG was that for the BWRX-300 the effects of the dewatering operations on the groundwater flow during construction would be **temporary**, which is considered better than **permanent dewatering by other reactors** (EIS NK054-REP-07730-00029, p.31).

In order to test the validity of this statement, a 3D groundwater flow model was developed by Golder Associates Ltd. in 2022 to calculate changes in groundwater flow patterns and in groundwater discharge to surface water features (NK054-REP-07730-00059-R000, p.14).

Modelling results:

1. The modeling exercise for the BWRX-300 confirms that *"the magnitude of the groundwater drawdown will be greater during construction (due to the deeper excavation)"* (NK054-REP-07730-00059-R000, p.17).
2. The assumption behind the model for the BWRX-300 is that *"reactor foundation is completed as a "waterproof" structure, such that dewatering activities are only associated with the construction period (i.e., post construction dewatering activities are discontinued, and groundwater elevations allowed to recover)".* So that the key comparative statement about the temporal changes to groundwater flow is based on the mitigation measures that have to be implemented.
3. Less groundwater recharge (from 4 to 21%, depending on the construction scenario) is expected into the bluff, which may cause negative impact on Bank Swallow habitat.
4. The model for the lower depth of excavations for the reactors considered in 2009 EA at the same conditions is available from CH2M HILL Canada Limited and Kinectrics Inc. (CH2M HILL and Kinectrics). 2009. Geological and Hydrogeological Environment Existing Environmental Conditions Technical Support Document New Nuclear – Darlington Environmental Assessment. Report No. NK054-REP-07730-00005-R000. In order to be able to compare the results between the different reactor types, the comparative models shall be developed with and without impermeable walls, contain the list of human-made assumptions plus reasonings between the two models.

Comments:

The model calibration for the BWRX-300 refers to the results of these studies from 2009:

- CH2M HILL Canada Limited and Kinectrics Inc. (CH2M HILL and Kinectrics). 2009. Geological and Hydrogeological Environment Existing Environmental Conditions Technical Support Document New Nuclear – Darlington Environmental Assessment. Report No. NK054-REP-07730-00005-R000.
- CH2M Hill Canada Ltd. 2009. Geological and Hydrogeological Environment Environmental Assessment of Environmental Effects Technical Support Document New

Nuclear – Darlington Environmental Assessment, NK054-REP-07730-00015 Rev 000. Submitted to Ontario Power Generation (OPG) Inc.

Conclusions:

The results of the modeling are used in all supporting documents highlighting the comparison to the results of the 2009 EA. For example, the conclusion of the DNPP Environmental Impact Statement Review Report from 2023 is "***In contrast to the EIS****, which considered permanent dewatering resulting in permanent changes to groundwater flow conditions, the study confirmed that for the BWRX-300 the effects of the dewatering operations on the groundwater flow during construction would be temporary. After the construction period, the dewatering operations would cease, and the effect of the deeper embedment on groundwater flow would be negligible."* (NK054-REP- 07730-00055, p.32).

In order to use comparative statements, models for different reactors need to be developed with the same assumptions and modelling parameters: *"in the 2009 EA* ***it was assumed*** *that dewatering to the base of the excavation would be permanent (i.e., occurs both during construction and operation of the facility)."* (NK054-REP-07730-00059-R000, p.17).

All statements comparing the temporal vs permanent effects to groundwater flows between different types of reactors are based on the assumptions, rather than on the comparison of two different models. Therefore, by November 2023, the lack of described studies highlight that **the conclusions of the EIS and its supporting documents are not fully applicable for the BWRX-300 deployment** in terms of:

- *"Given that the BWRX-300 deployment will involve dewatering only during construction, and changes following construction are negligible, the deployment of four BWRX-300 reactors* ***can be expected to have less anticipated effect on the hydrogeological environment than what was assessed in the EIS****."* (NK054-REP-07730-00058, p.112)

A new EIS is recommended specifically for the BWRX-300 design to avoid comparative subjective statements with regard to other types of reactors.

3.2 Groundwater pollution

The 2009 EA results are based on the groundwater quality before the IWST (Injection Water Storage Tank) spill that happened in 2009, which caused an increase in localized concentrations of tritium in groundwater within the DNGS protected area (NK054-REP-01210-00142, p. 376). The highest concentration reported within the plume was 7.18×10^4 Bq/L during 2012. From 2009, there is a general decline in tritium contamination, however, *"slight increases in tritium concentrations were observed at some locations within the protected area"* (NK054-REP-01210-00142, p. 376). These increases are explained by OPG with regard to the changes in the groundwater levels following the dewatering activities at the site.

Comments:

According to the report (NK054-REP-07730-00059-R000, p.14), one of the goals of the groundwater modelling for Darlington New Nuclear Project by Golder Associates Ltd. in 2022 was to calculate "*groundwater seepage pathways from areas of elevated tritium concentrations*". However, these results are not available nor summarized in the report. Therefore, there are no results available to assess the potential changes to groundwater quality by the BWRX-300 construction and operation.

Conclusions:

Given the fact that the 2009 IWST spill happened after the 2009 EA conclusions, it is required to assess how the dewatering activities related to the construction of the BWRX-300 may impact the the groundwater quality in the DNGS protected area. Otherwise, **the conclusions of the EIS and its supporting documents are not fully applicable for the BWRX-300 deployment** in terms of:

- *"The DNNP's effects on groundwater quality were assessed in the review of EIS. The BWRX-300 deployment was found to be consistent with the information in EIS Section 5.6.6. Therefore, the information on the effects on physical well-being as they relate to **groundwater quality applies to the BWRX-300 deployment**.* (NK054-REP- 07730-00055, p. 137)

4 SURFACE WATER AND STORMWATER

4.1 Dewatering activities and local wetlands

Site activities related to the BWRX-300 will involve excavation and stockpiling soil, construction laydown areas, foundation dewatering, and construction of permanent facilities. The corresponding impacts on surface water (ponds, wetlands, and tributaries) were examined and available in the report "Hydrology Memo To Assess Water Balance Of Surface Water Features For The Darlington New Nuclear Project nk054-rep-07730-00060-r000, 2022-11-08".

Modeling results:

1. Relatively small changes in flows and hydroperiod in three Pond catchments and the Darlington 'D' tributary.
2. Significant (greater than 500%) increases in monthly flows through summer to the **Southeast Wetland** and the **Darlington 'E' Tributary** (p. 19).
3. Mitigation measures include promoting re-vegetation of the spoils piles, construction of shallow infiltration trenches, and stormwater management controls to control peak flows (Page 19).

Comments:

The modelling exercise demonstrates that the construction of the BWRX-300 may have a significant impact on some of the local wetlands. Since the model is based on human-made assumptions, it is important to build more models considering various scenarios and assumptions in assessing groundwater impacts. The mitigation measures to address potential changes in groundwater discharge and flow patterns will largely depend on the stormwater management program.

4.2 Stormwater management

According to the 2009 EA, "*The general approach to stormwater management during site preparation, construction, and operation, as described in the EIS, is applicable to the BWRX-300 deployment.*" (EIS, page 40). However, by November 2023, there is no a complete stormwater management program.

According to OPG follow-ups, the stormwater management program is being conducted in phases:

- **Flood Hazard assessment of the BWRX-300 site:** The results of this assessment are summarized in Chapter 2, Section 2.5 Hydrology in the Preliminary Safety Analysis Report (PSAR). It has been concluded that *"Although the flooding hazards are expected to be similar for DNNP and DNGS sites, **more details on the hazards** are to be provided at a later stage of BWRX-300 design.*" (p. 124).
- **Site preparation phase:** The stormwater design for the early works phase has been approved by MECP and the ECA permit has been received by OPG.
- **Construction and operation phases:** The stormwater design is in progress and will not be complete by the November 20, 2023.

Additional documents could be requested for further evaluation:

- NK054-REP-01210-00012-R01, "Site Evaluation of the OPG New Nuclear at Darlington - Part 5: Flood Hazard Assessment," Ontario Power Generation.

4.3 Hydrogen in cooling system and Lake Ontario

Hydrogen gas being injected into the water of cooling system may potentially be discharged to Lake Ontario. Hydrogen gas is an active electron donor in various redox reactions in water biogeochemistry. As a result, the introduction of hydrogen gas into the cooling system can increase the chemical oxygen demand of the water upon discharge to the lake. Other organic or inorganic substances in the water can react with hydrogen, leading to a series of reactions that ultimately consume dissolved oxygen.

Implications of hydrogen gas discharge to surface water may include:

- Decrease of dissolved oxygen.
- Oxygen depletion (anoxia) can be detrimental to aerobic aquatic organisms, including fish and beneficial aerobic bacteria, leading to stress or death.
- Anoxic conditions can lead to the dominance of anaerobic organisms, altering the ecological balance of the lake.
- Anoxia can lead to the release of harmful substances like hydrogen sulfide (H2S), which is toxic to many forms of aquatic life.
- Nutrients like phosphorus can be released from sediments under anoxic conditions, potentially leading to eutrophication.
- Anoxia can disrupt the natural nutrient cycles in the lake, affecting the overall health and productivity of the ecosystem.

While hydrogen gas is likely to dissipate quickly in an open environment, continuous reactor operation may lead to accumulation spots that could pose risks. Therefore, the discharge of hydrogen-containing water into a lake can have significant adverse effects on the lake's ecosystem, including the development of hypoxic conditions, eutrophication, and harm to aquatic life.

These concerns have been effectively addressed by the Preliminary Safety Analysis Report (PSAR), *"to compensate for any excess hydrogen which may travel downstream and be removed from the main condenser by the Offgas System, a corresponding amount of oxygen, as a constituent of injected air provided by the Service Air System, is injected into the Offgas System prior to Offgas Recombiner"* (p. 1330).

It is desirable to perform the risk assessment of hypoxia in the surface water under malfunction conditions of Offgass System. The analysis of hydrogen concentration and its effect on surface water quality in the lake during routine reactor operation, as well as in the malfunction scenarios, is necessary. Without **the risk assessment of malfunction of the Offgas System**, the conclusion that *"Water quality, lake circulation and water temperature, and shoreline processes remain valid for the BWRX-300 deployment"* (2023 Supporting Document, p. 71) is not fully valid.

5 WASTE

The waste from the BWRX-300 is different from other types of reactors by composition and higher radioactivity. In particular,

1. Gaseous releases of iodine are greater for the BWRX-300 than other reactor designs assessed in the 2009 EIS (NK054-REP-07730-00058p. 26). Even though the overall dose from iodine is calculated to be lower per year, its **net emissions are still higher**.

Radionuclides	Dose [Sv/a]	Contribution to the total dose
TOTAL dose from airborne emissions	5.41e-08	100%
C-14	2.93E-08	54.2%
H-3	7.75E-09	14.3%
Iodines (I-131, I-132, I-133, I-134, I-135)	7.62E-09	14.1%
Xe (tot)	6.64E-09	12.3%
Kr (tot)	2.63E-09	4.8%
Other 27 elements	1.29E-10	0.2%

2. The total radionuclide activity of the BWRX-300 (LLW+ILW) is also higher. From Table 2-25, it appears that the waste from BWRX-300 is expected to emit 1.78e+12 Bq/m3, which is **2.75 times higher in the EIS scenarios** (4.89e+12 Bq/m3). (p. 184 Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300).
3. With respect to the Spent Fuel, there is no information available for the radioactivity per reactor volume or energy produced GWe (m3/year). The only information is given in Table 3 (NK054-REP-07730-00068-R000, p. 11) indicates that the overall dose in the accidental scenarios of BWRX-300, as compared to the EIS scenarios, is:
   - 13% higher to the public (371 uSv)
   - 22% higher to the workers (45 mSv)

It has to be noted, that the dose to the workers in the case of accident is 45 mSv, which is 90% of the regulatory dose limit. This is significant because it means the workers are exposed to almost the highest permissible level of radiation in a single incident. This is much closer to the regulatory limit compared to the 33.9 mSv dose from other reactors.

The cause of the higher radioactivity from spent fuel of BWRX-300 is explained by OPG as higher activity of Kr-80 released during accident scenario (NK054-REP-07730-00068-R000, p. 12). **Radioactivity data for the spent fuel of BWRX-300**, rather than its dose and comparative results to EIS scenarios is required to assess whether the findings from the 2009 Environmental Impact Statement (EIS) and its supporting documents remain valid in the context of deploying the BWRX-300.

4. Data from the IAEA (Table 2, TD-1591) shows that BWR reactors produce twice as much solid waste volume (m3/year) per GWe than PWR reactors, and **5 times more solid waste** beta-gamma activity (Bq/year) per GWe than PWR.

Comments:

The waste characteristics of the BWRX-300, as highlighted, present notable differences from other reactor designs. The higher emission of gaseous iodine from the BWRX-300, despite a lower overall yearly dose, raises environmental and health safety concerns. The BWRX-300 produces significantly more solid waste volume and beta-gamma activity per GWe than other PWR reactors, that underscores a substantial increase in waste management requirements.

The absence of detailed information about the spent fuel activity and behavior contributes to uncertainty in managing its environmental impact. Given the heightened environmental concerns, transparency in communicating about waste characteristics, risks, and management plans is essential to maintain public trust. Regulating waste that is different in composition and higher in radioactivity than that from other reactors may require a new **Environmental Impact Assessment** with respect to the waste management from the BWRX-300.

6 CONCLUSIONS ON THE RELEVANCE OF EA 2009

The new EIS would be required if either of both parameters are changed since the last Environmental Impact Assessment of 2009. These parameters include:

1. Change in local environmental conditions.
2. Change in the design, operation, and waste management of a new proposed reactor BWRX-300, as compared to other reactors assessed earlier.

With respect to the changes in reactor environmental safety, although there are many similarities between BWRX-300, PWR, and PHWR reactors, there are also important differences in their design and operation. The detailed list of additional risk and environmental impact assessments is provided in this report as recommendations for a potentially **new Environmental Impact Assessment** specific for all phases of the DNNP from site preparation, construction, operation, and decommissioning of the BWRX-300 reactors.

7 REFERENCES

Ontario Power Generation Inc. Dose from waste-waste volumes and activities. NK054-REP-07730-00068-R000, 2023-july-12

Ontario Power Generation Inc. Darlington New Nuclear Project BWRX-300 Preliminary Safety Analysis Report NEDO-33950, Revision 2, dated October 7, 2022

OPG report, NK054-REP-07730-00029 – Environmental Impact Statement: New Nuclear – Darlington Environmental Assessment, dated 30 September 2009.

OPG submission, Darlington New Nuclear Project Report for the Review of the Environmental Impact Statement for Small Modular Reactor BWRX-300, revision 0, NK054-REP-07730-00055, dated 05 October 2022.

OPG report, Darlington New Nuclear Project Environmental Impact Statement, Review Report for Small Modular Reactor BWRX-300, OPG CD# NK054-REP- 07730-00055, Revision 1, dated 28 June 2023.

OPG submission, Use of Plant Parameters Envelope to Encompass the Reactor Designs being Considered for the Darlington Site, N-REP-01200-10000, revision 5, dated 05 October 2022. OPG submission.

Use of Plant Parameters Envelope to Encompass the Reactors Designs being Considered for the Darlington Site, N-PRE-02100-10000, revision 6, dated July 2023.

OPG report, Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300, NK054-REP-07730-00058, revision 0, dated 31 December 2022.

OPG report, Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300, NK054-REP-07730-00058, revision 1, dated 19 July 2023.

OPG report, Darlington New Nuclear Project Commitments Report, OPG document number NK054-REP-01210-00078, revision 8, dated 31 August 2022.

OPG submission, Environmental Monitoring and Environmental Assessment Follow-Up Plan for the Darlington New Nuclear Project, NK054-PLAN-07730-00014, Revision 1, dated 28 October 2022.

OPG report, Darlington New Nuclear Project – Site Evaluation Update Summary Report, OPG document number NK054-REP-01210-00142, revision 0, dated 30 September 2022.

OPG report, 2020 Environmental Risk Assessment for The Darlington Nuclear Site, OPG document number D-REP-07701-00001-R001, dated 21 September 2021.

OPG document, Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project, OPG document number NK054-REP-07730-00059-R000, dated 07 November 2022.

OPG document, Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project, OPG document number NK054-REP-07730-00059-R000, dated 07 November 2022.

Use of Plant Parameters Envelope to Encompass the Reactor Designs being considered for the Darlington Site, N-REP-01200-10000 (PPE)

DNNP Construction Licence Application (CLA)

Follow Up Information requests from Nuclear Transparency Project (NTP) specific to the Darlington New Nuclear Project

Thank you for providing the documents we requested in our last round of information requests. We would also like to request the following document, if it can be shared with us:

Dose from Waste - Waste volumes and activities NK054-REP-07730–00068 R00, July 12, 2023	The requested document is attached.
NK054-REP-07730-00064-R001	The requested document is attached.

We also have a few follow up questions relating to the 2nd category of information requests we sent. They are below (in a new column in blue) in the table you provided in your last responses to us. Below this table are our final set of six information requests, generated by our technical experts Dr. Shamaila Fraz and Dr. Ekaterina Markelova as they reviewed the additional materials you provided to assist us to understand the EIS and PPE.

CATEGORY 2 – Additional information

There are six broad areas in which we require more information than is contained in either the 2022 EIS or PPE documents. These have been summarized in the enumerated list below. Some of this information may be contained in the reports we requested above. If this is the case, please let us know. If the requested information below is contained in reports we have not yet requested, please provide those additional reports for our reference.

OPG's General Comments: Please note that since the first submission of the EIS review, (NK054-REP-07730-00055) OPG has updated and submitted to the CNSC Revision 001 of the EIS Review for the BWRX-300 at the DNNP to reflect the following:

1. the concept of zero radiological liquid release during normal operations: OPG intends to operate the BWRX-300 without radioactive releases to the lake during normal operation. As a result, the public dose would be further reduced.
2. the results of additional studies on opportunities to retain habitat features on the DNNP site: Studies confirm no significant residual effects on retained habitat.
3. better representative estimates of solid waste activity and volume during the normal operation of a BWRX-300: Solid waste volume and total activity are lower than those considered in the EIS.

1. Constituents of Potential Concern specific to the BWRX-300 modular reactor design:	OPG Response	NTP Follow-up Query (Oct. 2, 2023)	OPG Response (Oct. 19, 2023)
a. Descriptions and analysis of the specific content and types of radionuclides in gaseous effluents, liquid effluents, and solid wastes from the proposed BWRX-300 modular reactor design. We are interested in descriptions that include analysis of applicable radionuclides that include their respective half-lives and chemical, biological, and environmental properties and pharmacokinetic profiles. Further, an explanation of exactly how they may vary from the radionuclides released by the reactor designs specified in the 2009 EIS would also be of special interest;	This information is provided in the following: • A discussion of gaseous airborne releases (Section 20.13 of the PSAR and Table 20.13). • A discussion of liquid effluent releases (Section 20.14 of the PSAR and Table 20.14-1). • A comparison of airborne releases, and liquid releases between the BWRX-300 and the bounding scenario reactors assessed in the EIS (Section 5.5.7 of the EIS Review Supporting Document.) • A similar comparison for solid radioactive waste (Table 5-25 of the EIS Review Supporting Document). • The effects of radioactive releases to the atmosphere and surface water (Section 5.5.7 of the EIS Review Supporting Document).	Thank you. NTP had reviewed these portions of the EIS and was hoping for further information to be provided. While the EIS assures that all releases will be below regulatory limits, the way this has been calculated for each substance released (in keeping with each substance's multiple characteristics) remains unclear. Especially when the principal radionuclides released to air and water by BWRX-300 are the same as those assessed for other technologies but vary in their proportions. Can OPG provide more information (than what is already included in the EIS) showing their data and calculations involved in their evaluations of radionuclide releases to air and water from a BWRX-300 reactor? Again, we're looking for more detail relating to OPG's argument of "no impacts to EIS conclusions". Table 5-25 (p 184) of the EIS Review Supporting Document notes the radioactivity values (Bq/m^3) of low-level radioactive waste (LLW) is greater than the corresponding values in the EIS. Can OPG explain and clarify? Further, no data is available on	As mentioned in the OPG general comments above, the EIS review report "NK054-REP-07730-00055" was recently updated. Supporting documents such as the EIS Review supporting document "NK054-REP-07730-00058" and certain additional studies were also updated. Revision 1 of the EIS review report "NK054-REP-07730-00055" and the EIS Review supporting document "NK054-REP-07730-00058" are available on the OPG website and links were provided in the covering email to this document. The BWRX-300 is designed for zero radiological liquid releases during the normal operation, as such radiological releases from the DNNP plant during normal operation are from only airborne emissions. Similar to the EIS, the impact of radiological emissions from the BWRX-300 was assessed based on the resulting public dose which was conducted in a separate study "Dose Calculations for Human and Non-Human Biota to Support Gap Analysis for Darlington New Nuclear Project", NK054-REP-07730-00064-R001. The results from this study show that the dose to the public is approximately 1.2 μSv/year for four BWRX-300 reactors at the DNNP site. This dose is well within the 1000 μSv/year regulatory limit, as well as the dose of 4 μSv/year calculated in the EIS. A copy of the study is provided for your reference. Please note that redacted information in this document is related to GEH proprietary information. As indicated in the rationales for the revision 1 of the EIS Review in OPG's general comments, instead of nominally deriving the solid waste activities from IAEA (International Atomic Energy Agency) information from the existing BWR plants that was used in the revision 0 of the EIS review, GEH has provided better

		the radionuclide composition of the solid waste activity for BWRX-300 reactors in Table 4.5 and 4.6 of the PPE document (p.107, 108- N-REP-01200-10000-R005). Can such data be provided?	representative estimates of solid waste activities and volume that would be expected during the normal operation of a BWRX-300. Solid waste volume and total activity are lower than those considered in the EIS. The list of radionuclides of the BWRX-300 solid radioactive wastes is similar to that of the previously assessed technologies, but the radionuclides are present in different proportions. Solid radionuclide composition is available in the updated PPE N-REP-01200-10000-R006, available on OPG's website and provided in the covering email to this document.
b. Descriptions and analysis of non-radiological substances in gaseous effluents, liquid effluents, and solid wastes from the proposed BWRX-300 modular reactor design. An explanation of exactly how they may vary from the non-radiological substances released by the reactor designs specified in the 2009 EIS would also be of special interest (other than or in addition to the chemicals from blowdown ponds for cooling or hydrazine which the 2022 EIS notes are not applicable for BWRX-300 modular reactors);	Information on non-radiological releases from the deployment of the BWRX-300 are provided in Section 20.8.4 and Table 2.4-1 of the PSAR. The effects of non-radiological releases to air and water on non-human biota is provided in Section 5.5.14.4 of the EIS Review Supporting Document.	No NTP follow-up. Thank you for this response.	
c. Any cumulative analysis of radiological and non-radiological atmospheric or liquid effluent releases from a BWRX-	Chapter 5.8 of the EIS Review Supporting Document describes the assessment of cumulative environmental effects. Sections 5.8.1 to 5.8.5 summarize the	Redactions from technical documents relating to BWRX-300 once-through cooling and thermal pollution are frustrating NTP experts' ability to assess potential	Please see Section 5.8 of the EIS Review supporting document "NK054-REP-07730-00058" which contains fewer redactions and more information on the once-through cooling system.

300 modular reactor to the local environment.	cumulative effects of BWRX-300 deployment in comparison with those assessed in the 2009 EIS.	BWRX-300 thermal pollution. To follow up more specifically: if the total power generation of BWRX-300 design is less than EPR, is it still predicted to lead to a waste thermal loading of 9ºC? While the EIS 2009 provides an assumed flow rate of cooling water for EPR, the flow rate for BWRX-300 is redacted in the EIS review supporting documents. OPG asserts the BWRX-300 flow rate is less, and thus would not impinge or entrain as many fish. However, the exact flow rate value is redacted, thus making it impossible to understand its significance. Further, information relating to the once-through cooling system design (EIS supporting document p.79) is redacted. Is there anywhere else where NTP experts could find more details relating to OPG's calculations to ensure the BWRX-300 will meet applicable regulations concerning thermal loading of its once-through cooling water system as well as impingement/entrainment? Would these include any aquatic species-specific analysis?	The EIS Review Supporting document notes in Section 5.5.4.5 that the BWRX-300 once through cooling system intake velocity to be lower than that in the EIS. Species specific impingement and entrainment analysis will be complete as part of the once through cooling detailed design.

2. Comparisons of wastes and waste management practices between BWXR-300 modular reactors and those for Darlington's current reactors and reactor technologies contained in the 2009 EIS:	**OPG Response**	**NTP Follow-up Query**	**OPG Response**

a. Analysis comparing the classification of wastes (e.g. ILW or HLW) from BWRX-300 modular reactors and the current CANDU reactors operating at the Darlington site	The waste classification for the BWRX-300 will follow CSA N292.0, which is the same as the CANDU reactor at the Darlington site.	Does OPG have any materials outlining how it will interpret and implement the requirements in this CSA document? If not, we will just consult the document itself.	The current OPG Nuclear Waste Program is compliant with CSA N292.0 and implements its requirements. A similar program will be developed for the DNNP based on the requirements of CSA N292.0 and the OPEX contained from the current Nuclear Waste Program.
b. A comprehensive comparison between waste management activities required for the BWRX-300 modular reactors compared with those currently employed at the Darlington site for its existing CANDU reactors.	The BWRX-300 used fuel will follow the same basic waste management activities as are employed at the existing Darlington site: following a period of wet storage in the used fuel pool, the used fuel is transferred to dry storage containers and placed in appropriate storage facilities. The L&ILW will be processed on-site and stored or otherwise managed in appropriate facilities either on-site or shipped to OPG licensed off-site facilities. OPG's Nuclear Sustainability Services – Western Waste Management Facility currently receives and manages such waste from existing OPG nuclear generating station.	Can OPG provide a more comprehensive comparison of similarities and potential differences between how the wastes would be managed? e.g. 1: the BWRX-300 used fuel pool appears to be smaller than those assessed in the EA, which might require moving used fuel earlier to the waste management facility. If so, this would mean longer dry storage periods than those assessed in the EIS. Is there any further information OPG could provide relating to this issue and how it was assessed? e.g. 2: solid waste volumetric activity (Bq/m^3) generated by BWRX-300 is greater than what was assessed in the EA (p 41 NK054-REP-07730-00058-R000). However, in contrast to this, it is stated that the solid waste generated by the operation of the BWRX-300 (Bq/m3/year) has less radioactivity annually (p.50-NK054-REP-07730-00058-R000). How can these findings be reconciled/what are they speaking to?	The BWRX-300 used fuel pool can accommodate used fuel from operation for the same amount of time (nine years) as the technologies considered in the EIS. Fuel remains on site in dry storage until it is transferred to NWMO for eventual placement in the deep geological repository. This approach is also consistent with the EIS. As mentioned in OPG's general comments, the EIS review report "NK054-REP-07730-00055" was updated and supporting documents such as the EIS Review supporting document "NK054-REP-07730-00058" and certain additional studies were also updated. As indicated in the rationales for the revision 1 of the EIS Review in the OPG's general comments, instead of nominally deriving the solid waste activities from IAEA (International Atomic Energy Agency) information from the existing BWR plants that was used in revision 0 of the EIS review, GEH has provided better representative estimates of solid waste activities and volume that would be expected during the normal operation of a BWRX-300. Solid waste volume and total activity are lower than those considered in the EIS. The list of radionuclides of the BWRX-300 solid radioactive wastes is similar to

		e.g. 3: again, similar to what Is being asked about above in 1(a), if wastes for the BWRX-300 are the same as the EA but present in different proportions (p.50-NK054-REP-07730-00058-R000), what calculations and data are available to support OPG's assessments and arguments that the differing proportions are not significant?	that of the previously assessed technologies, but the radionuclides are present in different proportions. The effects of the change in waste composition of BWRX-300 were assessed based on the resulting dose to members of the public and to the workers from the radiological malfunctions and accidents involving solid radioactive waste against the accident criteria of the regulatory dose limits of 1 mSv and 50 mSv for members of the public and for the worker respectively. The assessment was conducted using the same criteria and accident scenarios as those examined in the EIS as described in Section 5.7.2 of the revision 001 of EIS Review and in more details in Section 5.7.3.1 of the revision 001 of EIS Review Supporting document. The BWRX-300 resulting public and worker doses for the accident were estimated to be 371 μSv and 45 mSv respectively. These values are below regulatory dose limit mentioned above. Hence, the effects from BWRX-300 solid waste is consistent with the EIS determination of the absence of significant residual adverse effects. The above assessment was documented in a separated study "Dose from Waste - Waste Volumes and Activities", NK054-REP-07730-00068-R000. A copy of the study is provided for your reference. Please note that redacted information in this document is related to GEH proprietary information.
c. A description of any differences in requirements for long-term waste storage between BWRX-300	The general requirements for used fuel storage of BWRX-300 and CANDU are the same. Due to differences between the	Can clarification be provided relating to two potentially competing claims in the EIS Supporting Document: 1) "The alpha and beta-	As mentioned in the OPG general comments, the EIS review report "NK054-REP-07730-00055" was updated. Hence its supporting documents such as the EIS Review supporting document "NK054-REP-07730-00058" and certain additional studies were

used fuel and used fuel from existing CANDU reactors at the Darlington site and reactors considered in the 2009 EIS;	fuel of the BWRX-300 and the fuel from the existing CANDU reactors, different dry storage containers will be needed for the BWRX-300 fuel. These canisters will have the same function as the existing CANDU dry storage containers to safely contain the fuel and will be chosen from the various dry storage containers for boiling water reactor fuel used worldwide. For long-term storage, the BWRX-300 fuel can be stored consistent with what is described in the 2009 EIS (i.e., in waste storage buildings or outdoors on concrete pads). OPG is working with NWMO to ensure the plans for a DGR incorporate the design of the GNF2 fuel from the BWRX-300.	gamma activity per reactor volume (Bq/m3) in solid waste for the BWRX-300 is assumed to be 2.5 times higher than what had been assessed in the EIS" (EIS Supporting document, p 184). and: 2) "When compared to the assessment from the EIS, the solid waste generated by the operation of the BWRX-300 has less radioactivity annually (Bq/year) (EIS Supporting Document, p 50). These claims are based on statements in the EIS review Supporting Document (NK054-REP-07730-00058-R000 p.40) that the activity of beta-gamma emitters in the solid waste is higher than the bounding activity of beta-gamma emitters in the EIS. However, when the activity of H-3 and C-14 in L& ILW is included in the EIS bounding values, the total activity of the BWRX-300 L& ILW is lower. As such, our question is: out of the two approaches what is the acceptable/standard method to assess this? An explanation of the 2nd approach (inclusion of H-3 and C14) would be especially appreciated.	also updated. As indicated in the rationale for revision 1 of the EIS Review in OPG's general comments, instead of nominally deriving the solid waste activities from IAEA (International Atomic Energy Agency) information from the existing BWR plants that was used in the revision 0 of the EIS review, GEH has provided better representative estimates of solid waste activities and volume that would be expected during the normal operation of a BWRX-300. Please refer to Section 5.7.2 of the revision 001 of EIS Review and Section 5.7.3.1 of the revision 001 of EIS Review Supporting document for the updated comparison of BWRX-300 solid waste to those used in the EIS.
d. Safety analysis of the potential impacts to human and	When compared to the assessment from the 2009 EIS, the solid waste generated by	The Kr-85 and H-3 activities released during an accidental scenario of BWRX-300 design are	As mentioned in OPG's general comments, the EIS review report "NK054-REP-07730-00055" was updated. Hence its supporting documents such as the

environmental health of the higher level of activity in BWRX-300 wastes, including potential impacts relating to BWRX-300 wastes being moved from fuel bays earlier (in time) than would be the case for other reactor technologies considered in the 2009 EIS;	the operation of the BWRX-300 has less radioactivity annually (Bq/year), the same principal radionuclides, and less annual volume. Section 5.7.3 of the EIS Review Supporting Document provides a discussion on postulated radiological and transportation malfunctions and accidents involving solid waste. The effect of the activity in BWRX-300 wastes is assessed in Section 5.7.3.1 of the EIS Review Supporting Document, and supports the conclusion there are no significant adverse effects. For used fuel, the dose consequences due to higher activity will be managed through appropriate cask selection and shielding design.	redacted from Tabel 5-26 (EIS Supplemental Document, p 186), so it hard to see the context of the term “slightly higher than EIS” used for the value of Kr-85. Can any further information be provided?	EIS Review supporting document “NK054-REP-07730-00058” and certain additional studies were also updated. Please note that in Revision 1 of the EIS Review supporting document, Table 5-26 that you are referring to now becomes table 5-25. The Kr-85 and H-3 activities released during an accidental scenario of BWRX-300 design are redacted as they are GEH proprietary information. As mentioned in our response to questions in e.g. 2 and e.g.3 of 2(b) above, the BWRX-300 resulting estimated public and worker doses for the accident were below regulatory dose limit for accident. Hence, the effects from BWRX-300 solid waste is consistent with the EIS determination of the absence of significant residual adverse effects.
e. An assessment of potential effects on groundwater or soil biota in routine waste management operations for BWRX-300 modular reactors. Further, any analysis of potential impacts on groundwater or soil biota in case of any natural accidents relating to waste management activities.	As stated in the 2009 EIS construction-related waste will be sent to appropriately licensed off site waste management facilities for disposal or recycling (section 2.5.11, 2009 EIS). The generation of non-radioactive (i.e., conventional) wastes will be minimized to the extent practicable through re-use and recycling programs. All residual waste (i.e., that remaining after diversion programs) will be collected regularly by licensed contractors and transferred to appropriately licensed off-site disposal facilities and no waste disposal facilities will be	No NTP follow-up. Thank you for this response.	

	established on the DN site (section 2.6.13, 2009 EIS). The management of construction waste and conventional waste is not predicted to interact with the ground water environment or non-human biota. Nuclear waste and used fuel transportation, processing and storage postulated accidents are discussed in section 5.7.3.1 of the EIS Review Supporting Document.		

3. Construction of BWRX-300 embedded foundations:	**OPG Response**	**NTP Follow-up Query**	**OPG response**
a. Analysis of potential environmental impacts of required mining, excavating, grading, and/or blasting activities for the 38m embedment of BWRX-300 modular reactors. A comparison of groundwater impacts of the installation of BWRX-300 modular reactors with the installation of the other reactor designs specified in the 2009 EIS is of particular interest;	The requested analysis is provided in Section 5.5.6 of the EIS Review Supporting Document.	The EIS and supporting documents do not provide much detail in their assessment of impacts to surrounding habitat. Where could we find more data relating to how much and which on-site aquatic habitats could be retained due to the decreased above-ground surface area of the BWRX-300 compared with previously proposed reactor designs in 2009?	The Project site plan with respect to the construction and operation of four units is currently under development. At this time, the extent of on-site aquatic habitat that can be retained has not yet been finalized. However, for assessment purposes as part of the EIS Review, it is assumed that aquatic habitat, such as the three on-site ponds, are retained.

b. A comprehensive description of the composition, handling/treatment, and disposal of liquid effluent during BWRX 300 construction and installation; and	Refer to Section 5.3 Surface Water Environment of the EIS (NK-054-REP-07730-00029). Management of conventional releases in liquid effluent during construction will be addressed through compliance with applicable regulatory requirements and a Ministry of Environment, Conservation and Parks (MECP) Environment Compliance Approval, as applicable. The project will be in compliance with testing, monitoring, and discharge limits as well as volume.	No NTP follow-up. Thank you for this response.	
c. Implications for stormwater management during BWRX-300 construction and installation.	Refer to Section 2.5.9 Management of Stormwater in the EIS (NK-054-REP-07730-00029) for this information. Management of storm water will be in compliance with applicable regulatory requirements and a Ministry of Environment, Conservation and Parks (MECP) Environment Compliance Approval, as applicable.	No NTP follow-up. Thank you for this response.	

4. Comparisons of cooling water designs between BWRX-300 modular reactors and those for Darlington's current reactors and	**OPG Response**	**NTP Follow-up Query**	**OPG Response**

reactor technologies contained in the 2009 EIS:			
a. Analysis comparing the pros and cons of having completely separated reactor coolant water and feedwater versus common reactor coolant water and feedwater, including probable environmental impacts of each design.	The EIS Review Report (NK054-REP-07730-00055, has confirmed the environmental impacts of the BWRX-300 are bounded by the approved EIS. The boiling water reactor design has a single coolant loop for the reactor and turbine. This simplification eliminates the need for a steam generator, results in less components to maintain, and generally results in higher thermal efficiency. With primary coolant entering the turbine, shielding and associated radiological monitoring and controls are required in the turbine area of the facility when the unit is operating. Turbine maintenance during outages also requires radiological considerations. The probable environmental impacts of the BWRX-300 design are outlined in the EIS Review Report, and as mentioned above, bounded by the approved EIS.	Has OPG developed radiological monitoring plans and controls for BWRX-300 operation and any specific considerations or plans for maintenance and outages? If so, can they be shared with NTP?	OPG understands this follow-up question is in relation to the original intent on the monitoring of environmental impact. With respect to radiological environmental monitoring, OPG has an Environmental Monitoring Program for the DN site. This program includes sampling and modeling to determine the annual estimated dose to offsite members of the public from the operating facilities and these annual reports are posted on OPG's website. This program will be reviewed to encompass DNNP operations, and any necessary changes will be implemented prior to DNNP operations.

5. Environmental monitoring plans for the Darlington Nuclear site and potential BWRX-300 modular reactors:	**OPG Response**	**NTP Follow-up Query**	**OPG Response**

a. A description (with a map) of how many new groundwater wells will be installed and each well's location around any constructed modular BWRX-30 reactors. This should include a discussion and supporting analysis of whether the BWRX-300 units will have their own groundwater monitoring program, or whether (and how) they will be integrated with the existing groundwater monitoring plan for the Darlington site;	The DNNP Environmental Monitoring and Environmental Assessment Follow up (EMEAF) Program includes a groundwater monitoring component. The EMEAF details the monitoring or assessment activities to be undertaken to confirm the predictions of environmental effects identified in the environmental assessment and to determine the effectiveness of mitigation measures. The follow-up groundwater monitoring program applies to the groundwater monitoring wells network within the DNNP site boundary and remains compliant with CSA N288.7.	No NTP follow-up. Thank you for this response.	
b. A description (with a map) of the stormwater infrastructure that will be constructed around (or be restructured to accommodate) any installation of the modular BWRX-300 reactors. This should include how stormwater runoff from the BWRX-300 site would be monitored and collected and channeled into drainage systems of retention ponds. It should also explain how stormwater whether any treatment	The stormwater infrastructure design is in progress. Stormwater management will be addressed through compliance with applicable regulatory requirements and a Ministry of Environment, Conservation and Parks (MECP) Environment Compliance Approval, as applicable. OPG has conducted a Flood Hazard assessment of the BWRX-300 site. The results of this assessment are summarized in Chapter 2 Section 2.5 Hydrology in the Preliminary Safety Analysis Report (PSAR).	Will maps or diagrams of stormwater infrastructure for the BWRX-300 be available in advance of our written submission filing deadline of Nov. 20?	As noted, the stormwater infrastructure design is in progress and being conducted in phases. The stormwater design for the early works site preparation phase has been reviewed and approved by MECP and the ECA permit has been received by OPG. The ECA can be publicly accessed via the MECP's website. The stormwater design for the construction and operation phase remains in progress and will not be complete by the November 20 date.

methods would be applied, and if so what these methods would be.			
c. A more fulsome description of potential surface water impacts by modular BWRX-300 reactors and exactly how these effects will be monitored and mitigated. This description should go beyond the assessment of water temperature already included in EIS materials. i. This should also include references to studies mentioned in the EIS which were undertaken to assess impacts of changes in hydrology or surface water to specific terrestrial elements such as amphibians and reptiles, and their habitat (e.g. EIS section 5.3.4). We also request electronic copies of these studies	Potential surface water impacts resulting from the BWRX-300 deployment are detailed in Section 5.5.3 of the EIS Supporting Document. Potential effects to the terrestrial environment resulting from hydrological changes are detailed in Section 5.5.5 of the EIS Supporting Document. OPG has an Environmental Monitoring and Environmental Assessment Follow up (EMEAF) Program that details the monitoring or assessment activities to be undertaken to confirm the predictions of environmental effects.	Information on shoreline activities and the map illustrating the shoreline has been redacted. Can OPG explain why this redaction is necessary and point us to any other information relating to shoreline management around any potential BWRX-300 reactor? During construction/installation and operation? The recent EIS documents rely on the 2009 EA's assessment of impacts to bank swallow habitat, however the Bank Swallow was not listed as endangered back when the 2009 assessment was conducted. Was this recent change in the species' status subject to specific analysis in more recent OPG environmental surveys/reports? If so, can this information be provided? Can any more information be provided on potential artificial nesting habitat that may be developed for the species, and how a follow-up monitoring plan would assess its use by the species/efficacy?	Text and map illustrating the shoreline in section 5.5.3.8 of the EIS Review Supporting document were conservatively redacted and has been updated in revision 001 of the EIS Review supporting document "NK054-REP-07730-00058". Additional studies were completed as detailed in Section 5.5.5.6 of the EIS Supporting Document. The potential for disturbances or impacts from Project-Environment interactions related to dust, noise, hydrogeology, vibrations from blasting, and/or shoreline protection on the Bank Swallows and their habitat were assessed for one-unit deployment. The results of this assessment indicated that the adverse effects on Bank Swallows following the implementation of mitigation are anticipated to be minor. Additionally, OPG constructed a pilot artificial bank swallow nesting structure on the Pickering site in 2021 for the purpose of testing its efficacy. The 2023 preliminary observations have been positive, with the habitat being used by bank swallows. Monitoring of the artificial nesting structure will continue through to 2027 under the Safe Harbour Stewardship agreement issued by the MECP. If successful, DNNP can use a similar design as a compensation measure for impacts to bank swallow nesting habitat, if required.

themselves;			
d. A description of how other existing environmental monitoring plans for both radionuclides and non-radionuclides in liquid effluent, gaseous releases to air, and aquatic and terrestrial species would be integrated with measures specific to monitoring impacts of the modular BWRX-300 reactors. i. Note: It appears as though gaseous releases of iodine are greater for the BWRX-300 than other reactor technologies assessed in the 2009 EIS. How is this specific issue being addressed (e.g. mitigated) in OPG's plans for a BWXR-300 modular reactor?	OPG has an Environmental Monitoring and Environmental Assessment Follow up (EMEAF) Program that details the monitoring or assessment activities to be undertaken to confirm the predictions of environmental effects. The total emissions to the atmosphere from the BWRX-300 are lower than reactor technologies considered in the EIS. Although the assessment of atmospheric emissions of iodine are slightly higher in the report, the dose from iodine is low. It should also be noted that the Iodine values were calculated using Industry Standards (NEDO-10871) that assume a conservative number of fuel failures in the reactor.	Thank you for this response. Some additional follow up queries based on the additional reports you shared are in the new queries below this chart.	

6. OPG measures to mitigate fish impingement and entrainment	OPG Response	NTP Follow-up Query	OPG Response
6. What measures would be undertaken to mitigate fish impingement and entrainment in BWRX-300 intakes? EIS Table 7 (p68) notes a "Once-through-cooling porous veneer intake has been designed specifically for reducing entrainment and impingement of fish. The intake incorporates design features based on fish behavioural principles and is also located offshore at depths which are less productive than inshore locations. The expected losses will be low relative to Lake Ontario populations". Is this true for the BWRX 300 design as well, and where could we find BWRX-300-specific evaluations of the potential for fish impingement and entrainment? If this information is available in studies, we request electronic copies of them. Further:	The requirements for the once-through cooling system and its ability to mitigate fish impingement and entrainment is independent of the reactor technology. OPG has updated the impingement and entrainment analysis for the BWRX-300 and has confirmed it is within the conclusions of the approved EIS as described in the EIS Review Report (NK054-REP-07730-00055).	Can further information be provided relating to the DFO assessments and requirements for addressing potential impingement and entrainment of fish in BWRX-300 cooling water intakes? Are assessments of cumulative effects required and being undertaken? If any reports or written correspondences have occurred relating to these points, can NTP have copies?	Project commitments related to the study of cumulative effects are captured in the DNNP Commitments Report NK054-REP-01210-00078, commitment D-P-12.4. The assessment of cumulative effects is ongoing.

a. To what extent, to date, has the Department of Fisheries and Oceans and possibly Environment and Climate Change Canada assessed the BWRX-300 design for compliance (including via permit) with the Fisheries Act?	The design of the once through cooling system is in progress. Applicable regulatory requirements will be complied with and addressed through applicable permits, including engagement with Fisheries and Oceans Canada and Environment and Climate Change Canada.	Will this design be completed and shared for public comment in advance of our Nov. 20 deadline for written submissions?	Additional design information for the once through cooling system is in progress and will not be available by November 20th.
b. EIS Table 7 (p67) notes mitigative efforts in the Fish Habitat Compensation Plan to ensure a minor residual adverse effect. Where could more information be found on these measures, and can we access an electronic copy of this plan?	The Fish Habitat Compensation Plan is dependent on the once through cooling system design and shoreline protection. When the design is finalized the compensation plan will be developed to support the Fisheries Act Authorization application to the Department of Fisheries and Oceans (DFO).	Can this be provided in advance of our Nov. 20 deadline for written submissions?	This information will not be available by the November 20th deadline for written submissions. The Fish Habitat Compensation Plan for construction activities of the once through cooling system will be available prior to in-water construction activities.

7. Valued Ecosystem Components	**OPG Response**	**NTP Follow-up Query**	**OPG Response**
7. The EIS asserts impacts on terrestrial and aquatic VECs posed by the BWRX-300 modular reactor design would be less significant than those posed by reactor designs considered in the 2009 EIS. Can you provide specific information or data used to support these claims (either from a	Detailed descriptions of the potential impacts on terrestrial and aquatic VECS are found in Sections 5.5.5, 5.5.5 and 5.9 of the EIS Supporting Document. Terrestrial and aquatic VECs are included in the DNNP Environmental Monitoring and Environmental Assessment Follow up (EMEAF) plan to confirm the	Thank you. Yes, we have already reviewed these portions of the EIS. Is there any more specific information available that could be shared with NTP such as any data that supports the predictions of environmental effects identified and the sufficiency of proposed mitigation measures? Without this data we are	The purpose of the DNNP Environmental Monitoring and Environmental Assessment Follow up (EMEAF) program is to provide the necessary data and information to determine the effectiveness of mitigation measures taken and to facilitate the verification of EIS predictions of environmental effects from the DNNP. As concluded from the EIS review for the BWRX-300 reactor technology, the EA follow up monitoring remains suitable for the deployment of BWRX-300 and activities will be carried out though the DNNP project phases. Should unanticipated adverse environmental effects be

more detailed EIS support document, data collected from mitigative measures, or proposed or in-place monitoring plans that assess effects on VECs)?	predictions of environmental effects identified in the environmental assessment and to determine the effectiveness of mitigation measures.	unable to fully understand the predictions of environmental effects identified in the environmental assessment or determine the effectiveness of mitigation measures	identified as the project progresses, they will be addressed through adaptive management measures.

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CATEGORY 3 – Clarifying 2022 EIS and PPE reports

We request additional clarity on the following portions of the 2022 EIS document:	OPG Response	NTP Follow-up Query	OPG Response
8. Table 3 "Comparison of how energy is produced" (pp19, 20, 22): according to what criteria were BWRX-300 and 2009 EIS reactors designated to be "similar" in design despite the fact that "In the BWRX-300, the reactor coolant water and the feedwater are the same" while "In the EIS (Environmental Impact Statement), the reactor coolant water and the feedwater do not mix".	The single or separate cooling loop does not impact any EIS conclusions. Furthermore, as shown in Section 4.0 of the EIS Review, the vast majority of BWRX-300 design parameters are within the original PPE values. The effects of those BWRX-300 parameters that fall outside of their respective PPE values were assessed and their effects remain consistent with the conclusions of the EIS.	No NTP follow-up. Thank you for this response.	
9. Table 4 "Project works and activities" (p24): "mobilization and preparatory works" appear to be defined as largely "clearing, grubbing, services and utilities, and on-site roads and related infrastructure". On this basis, the 19 ha area on which the BWRX 300 would be built was considered to constitute a "smaller footprint" than other reactor technologies considered in the 2009 EIS. Why was the deeper foundation embedment and related preparatory activities below ground,	The footprint refers to the surface area of the facility. The deeper foundation embedment has been assessed separately in Section 4.1.2 of the EIS Review.	In OPG's assessments does the "footprint" of the reactors relate to the volume of soil produced during excavation or the above-ground surface area required for the installation of a BWRX-300 reactor? Can further OPG analysis be provided relating to the following note in the EIS Supplemental Document: "Dewatering will result in drawdown (by approximately 14 m to an elevation of approximately 76 masl) of the water table and the Interglacial Deposits in the overburden; groundwater flow on the DN Site will be permanently changed" (p 125). And can	In this context, "footprint" is referring to the above ground surface area required for the BWRX-300. The quoted material from the EIS Supporting Document is referring to the effects associated with the reactor technologies assessed in the EIS. The last paragraph of the same section provides a comparison to the BWRX-300 and notes that for the BWRX-300 "...there will be no permanent impact to the groundwater flow during the operational phase as the groundwater will be allowed to recharge to natural levels after excavation and construction."

not included in the analysis of the construction footprint of the BWRX-300 in this table?		further information be provide relating to specific mitigation of this effect?	
10. Table 6 “Summary of residual adverse effects and relevant VECs”: certain cells in this table are highlighted in pink with a note that “pink shades indicate that there is potential for a Residual Adverse Effect from BWRX-300 deployment that is different than that described in the EIS OR was not considered in the EIS”. However, all the columns in the shade of pink then conclude: “Residual adverse effect not considered in the EIS”. Can OPG provide more clarity on the rationale behind these decisions? a. Use of the qualifying words “potential” and “some” relating to environmental effects are imprecise and indicate some uncertainty. Will further clarity and verification happen in a future follow-up monitoring program, or	The reactors considered in the EIS required a much larger footprint, hence the removal of all terrestrial habitats on the DNNP site were assumed in the EIS and their residual adverse effect did not need to be considered at that time. The BWRX-300 requires a smaller footprint, as such opportunities to preserve some terrestrial habitats exist but need to be explored to confirm the feasibilities of such reservation and the potential residual adverse effect. Where it was noted that further study was required to assess effects to habitats that may be retained due to the smaller scale of the DNNP, these studies have been completed since the completion of the EIS review report and are reflected in the EIS Review Supporting Document NK054-REP-07730-00058.	Thank you. Could the studies you’ve referenced in your response be made available to NTP?	The previous answer is referring to the EIS supporting document NK054-REP-07730-00058 which has been provided.

before then? b. Relating to potential effects on habitat and species conservation associated with the deployment of modular BWRX-300 reactors, could you provide some clarity around which effects were anticipated to be less significant and which were not considered in the EIS?			
11. Section 5.3.14 (p64) notes a decline in bank swallow burrows since 2008. How would future monitoring differentiate between this ongoing decline and impacts specific to the installation of BWRX 300 modular reactors? a. Further, if the loss of nesting habitat exceeds the 1000 burrow threshold, how could the potential contribution of BWRX-300 reactor operations to this trend be defined? b. What plans have been developed to mitigate decreasing groundwater flow to the bluffs that would disrupt bank swallow habitat?	As noted in the question, the decline of bank swallow burrows is well documented. Natural forces, such as groundwater and erosion, constantly erode the face of shoreline embankments and effect habitat contained within them. (EIS section 8.4.3 (NK054-REP 07730-00029). The DNNP environmental monitoring and EA follow-up program details the monitoring to verify predictions of the environmental effects identified in the environmental assessment, and to determine the effectiveness of mitigation measures. This includes monitoring for effects on bank swallows. This EIS Review concluded that the EA follow-up and monitoring programs remain suitable for BWRX-300 deployment. OPG continues to monitor the Bank Swallow colonies on an annual basis at both the Bank Swallow Evaluation Area which includes the Darlington site, as well as a reference location at Bond Head	No NTP Follow-up. Thank you for this response.	

	bluffs. As bank Swallows and their habitat are protected under the provincial Endangered Species Act, measures to mitigate impacts to Bank Swallows from the Project will be addressed through an Endangered Species Act (ESA) permit issued by the Ministry of Environment, Conservation, and Parks, as applicable. Any effect on groundwater during the construction is expected to be temporary.		
12. EIS Table 7 (p81) notes "Five (5) residual adverse effects have been identified that require additional studies. These residual adverse effects were not considered in the EIS and are anticipated to be not significant. 1. On-site Aquatic Habitat (ponds, intermittent tributaries to Darlington Creek and to Lake Ontario, Darlington Creek, 2. VECs in the Cultural Meadow and Thicket Ecosystem,3. Wetland and Woodland Ecosystems, Rare Plant Species, Amphibians and Reptiles, Insects – Dragonflies and Damselflies, Mammal communities and species, 4. Bank swallows, 5. Bats". Since these conditions were not considered in the EIS, what is the status of the	Additional studies on groundwater, hydrology, noise, dust, and vibration (from blasting) were completed following the submission of the EIS Review Report. The results of the studies are provided in the EIS Review Supporting Document and confirm that any residual effects do not alter the conclusion of the EIS.	No NTP Follow-up. Thank you for this response.	

assessments? Are these studies a part of the environmental assessment follow up monitoring program and will these assessments be completed before any BWRX-300 licensing hearing before the CNSC?			
13. EIS Table 4 (p25) notes, "For BWRX-300, the water intake and the discharge pipes will be sized for four reactors. The discharge pipe includes a series of diffusers from which the water is discharged to promote rapid thermal mixing in the lake". This statement raises the question of heat rejection to lake water, but a more detailed discussion of this aspect is not in the EIS. If the reliance of BWRX 300 on once-through cooling water for both primary and secondary cooling alter the overall need of water from lake, what could the impacts of rapid thermal mixing of discharge water be, and what are the advantages of choosing a design that would not use atmosphere as the ultimate heat sink? Further what will the actual size of BWRX-300 discharge pipes be? We understand they have	The EIS considered both atmosphere (cooling tower) and lake water (once through cooling) as a heat sink. OPG has completed commitment D-C-1.1 to conduct a Best Available Technology Economically Achievable (BATEA) assessment for once through cooling and mechanical draft cooling towers, which concluded a once through cooling system was the BATEA technology. The CNSC accepted that this assessment addressed the Joint Review Panel action and closed the commitment. OPG has updated the thermal plume analysis for the BWRX-300 and has confirmed it is bounded by the approved EIS as mentioned in the EIS Review Report (NK054-REP 07730-00055). The current design of the discharge tunnel is approximately 6m in diameter. The diffusers are approximately 60cm in diameter.	It seems the EA follow-up monitoring plan notes, "If the once-through cooling system is chosen for the DNNP, a comprehensive surface water risk assessment will be conducted to include the surface combined thermal and contaminant plume" (p 81) Can OPG comment on the status or progress of this assessment? Would it be available to NTP in advance of our Nov. 20 deadline for written submissions?	The risk assessment will be conducted once the design of the once through cooling system is finalized and will be submitted as part of the licence to operate application in 2026.

been designed with the capacity to function for 4 modular reactors at the Darlington site.			

Additional Questions from NTP:

Question	**OPG Response**
There is no mention of specific conservation of bat habitat in the EA Follow-up Monitoring Plan or related OPG commitments. Are there any additional sources of information whereby NTP can get a sense of what will happen to roosting and foraging habitat for bats during the construction when the replanting of shrubs would not yet have occurred and when such replanting is a possible but not confirmed solution for impacts to bat habitat? How will this continue to be addressed during any future operation of BWRX-300 reactors?	Habitat for species at risk bats is regulated under the provincial Endangered Species Act and/or the federal Species at Risk Act and any adverse effects of the DNNP will be subject to permitting/approval requirements under the relevant legislation. For example, ESA permitting would require appropriate beneficial actions to address any impact to species at risk.
When would the results of the comprehensive surface water risk assessment be available to NTP? (Including the surface combined thermal and contaminant plume; and the physical displacement effect of altered lake currents as a hazardous pulse exposure to fish species whose larvae passively drift through the area such as lake herring, lake whitefish, emerald shiner and yellow perch, reference in EA Follow-up Monitoring Plan, p 81)	The surface water risk assessment will be conducted once the design of the once through cooling system is finalized and will be submitted as part of the licence to operate application in 2026.
Almost all the EA follow up objectives for the terrestrial and the aquatic environments are to a) provide additional baseline data for comparison against future follow-up monitoring results, b) confirm the effectiveness of the mitigation measures and plans for VECs, c) Verify EIS predictions of a minor (not significant) or no residual adverse effect and d) provide information to support planning and design of restoration plans. Monitoring studies of aquatic and terrestrial VECs span all stages of the project, baseline, site preparation, construction and operation phases. Does OPG have a plan for how it would share the data in these assessments on an ongoing basis with members of the public?	The EA follow up monitoring results will be reported in the DNNP Annual Report and submitted to the CNSC as part of our licence conditions. The report will be made available to members of the public.
Page 26 of the Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300 asserts “Iodines make a small contribution to the dose, so overall the BWRX-300 results in lower doses than the bounding scenario	The airborne emissions from radioiodines as well as carbon-14 are slightly higher for the BWRX-300 as compared to emissions of these radionuclides assumed in the EIS. However, the atmospheric emissions

reactors". However, our calculations show iodines' contributions to airborne emissions are ~14%: Table 1. Calculations of iodines' contribution to the overall dose from airborne emissions based on data from Table 2-5, Dose calculations for human and non-human biota to support gap analysis for Darlington New Nuclear Project nk054-rep-07730-00064-r000, 2022-11-16 (by Dr. Markelova) In light of this data, can OPG clarify the significance of iodine's contribution to airborne emissions from a BWRX-300 reactor?	for tritium, particulates, and noble gases are significantly lower than those assumed in the EIS. The values are provided in Tables 5-16 and 5-17 of the revised EIS Review Supporting Document. The intent of the quoted sentence was to explain how a slight increase in the emission of iodines is outweighed by the significant decrease in other emissions such that the resulting overall dose is lower than what was estimated in the EIS.

Radionuclides	Dose [Sv/a]	Contribution to the total dose
TOTAL dose from airborne emissions	5.41e-08	100%
C-14	2.93E-08	54.2%
H-3	7.75E-09	14.3%
Iodines (I-131, I-132, I-133, I-134, I-135)	7.62E-09	14.1%
Xe (tot)	6.64E-09	12.3%
Kr (tot)	2.63E-09	4.8%
Other 27 elements	1.29E-10	0.2%

Using data from Table 2-25, it appears that the total radionuclide activity (LLW+ILW) in the BWRX-300 scenarios (1.78e+12 Bq/m3) is 2.75 times higher in the EIS scenarios (4.89e+12 Bq/m3). This may be inconsistent with other statements in OPG materials excerpted below. Could OPG clarify their characterizations of solid waste from the BWRX-300 compared with previously assessed reactor models?	Please refer to responses provided in question 2(b, c and d) of Category 2 above.
For the BWRX-300, the radiological waste contains different proportions of radionuclides than the waste that was assessed in EIS. In addition, the mass of fuel placed in the used fuel transfer cask is different than what had been assessed in the EIS." (p 187 Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300)	Please refer to responses provided in question 2(b, c and d) of Category 2 above
Data from the IAEA (Table 2, TD-1591 [57]) shows that BWR reactors produce twice as much solid waste volume (m3/year) per GWe than PWR	Please refer to responses provided in question 2(b, c and d) of Category 2 above

reactors, and 5 times more solid waste beta-gamma activity (Bq/year) per GWe than PWR. The waste volume and activity for Pressurized Heavy Water Reactors (CANDU) are similar, but slightly less conservative, therefore the PWR values were retained. (p 184 Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300)	
"Therefore, as shown in Table 5-25, the alpha and beta-gamma activity per reactor volume (Bq/m3) in solid waste for the BWRX-300 is assumed to be 2.5 times higher than what had been assessed in the EIS (Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300). (p 184 Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300)	Please refer to responses provided in question 2(b, c and d) of Category 2 above
Generally, we are missing more detailed characterizations of solid wastes. If OPG could provide the Calian Nuclear "Dose from Waste" report requested on page 1 above, it would help us understand expected wastes to be generated by BWRX-300 reactors.	Please refer to responses provided in question 2(b, c and d) of Category 2 above
Table 5-25 is the only source of information on the radionuclides content available for review. However, it appears that it is not original data, but rather values that are meant to indicate activities "adjusted to the ratios". The derived ratios are mentioned for C-14 (0.77%) and H-3 (2.1E-04). Other ratios are unclear. Please provide more details on the estimation of these ratios. Please provide original source of data and dose calculations. These may be contained in the Calian report, but if not, could the requested data be provided in addition to this report?	Please refer to responses provided in question 2(b, c and d) of Category 2 above

Table 5-25: Solid L&ILW radioactive waste activity (Bq/m^3) [59]

Radionuclide	EIS LLW (Bq/m^3)	EIS ILW (Bq/m^3)	BWRX-300 LLW (Bq/m^3)	BWRX-300 ILW (Bq/m^3)
Am-241	9.93E+05	2.80E+07	2.48E+06	7.00E+07
C-14	3.05E+08	2.70E+12	2.94E+06	2.08E+10
Cm-244	2.46E+05	4.80E+06	6.17E+05	1.20E+07
Co-60	7.56E+08	5.10E+10	1.89E+09	1.28E+11
Cs-137	3.63E+08	5.30E+10	9.05E+08	1.33E+11
Gd-153	1.45E+07	5.80E+11	3.64E+07	1.45E+12
H-3	2.83E+11	1.20E+12	5.86E+07	2.48E+08
Pu-238	2.33E+05	6.90E+06	5.80E+05	1.73E+07
Pu-239	5.01E+05	1.50E+07	1.25E+06	3.75E+07
Pu-240	7.25E+05	2.20E+07	1.81E+06	5.50E+07
Pu-241	9.98E+07	3.80E+09	2.49E+08	9.50E+09
Ru-106	5.95E+07	1.30E+10	1.49E+08	3.25E+10

Note: Additional radionuclides identified in [56] that are not in this table make a negligible contribution to the dose.

nuclear transparency project

Website: www.nucleartransparency.ca
Email: info@nucleartransparency.ca

Submitted by email

March 20, 2023

To President Velshi and Members of the Canadian Nuclear Safety Commission,

Re: Comments relating to Ontario Power Generation's 2022 Environmental Impact Statement and Plant Parameters Envelope documents for the Darlington New Nuclear Project

We would like to begin by thanking the Commission for this opportunity to provide comments on the Environmental Impact Statement Review Report (EIS) and Updated Plant Parameter Envelope Report (PPE) for Ontario Power Generation's (OPG) Darlington New Nuclear Project (DNNP) proposal. We would also like to recognize the efforts of Canadian Nuclear Safety Commission (CNSC) staff, multiple Canadian civil society organizations, members of the public, and Indigenous Nations for their informative publicly available materials and submissions on this matter. Finally, we thank Ontario Power Generation (OPG) for their time in preparing preliminary responses to several of our information requests to date.

These comments have been made possible by CNSC funding through its Participant Funding Program (PFP). These submissions were drafted by NTP founder and coordinator Pippa Feinstein. Hydrogeologist Dr. Ekaterina Markelova and environmental toxicologist Dr. Shamaila Fraz are also in the process of reviewing OPG materials for this intervention.

Our submissions have been divided into five parts on the following pages:

About NTP

The Nuclear Transparency Project (NTP) is a Canadian-registered not-for-profit organization dedicated to supporting open, informed, and equitable public discourse on nuclear technologies. NTP advocates for robust public access to data and other types of information and helps to produce accessible analysis of publicly available information, all with a view to supporting greater transparency in the Canadian nuclear sector.

NTP engages with a multi-disciplinary group of experts to address economic, ecological, and social facets of the Canadian nuclear sector, producing public reports, academic articles, and other publicly accessible resources as well as intervening in regulatory decision-making processes. The organization seeks to support youth and early career scholars, especially those from underrepresented communities and groups. NTP also recognizes a responsibility to model the transparency and accountability practices for which it advocates. It is committed to interdisciplinary, cross-sectoral, and equitable collaborations and dialogue between regulators, industry, civil society, members of host and potential host communities, as well as academics and professionals from Science, Technology, Engineering, and Mathematics (STEM) fields, the social sciences, and humanities.

About the current opportunity for public comments

The Ontario provincial government directed OPG to propose new nuclear reactors to be built at the Darlington site in 2006. OPG proceeded to prepare an EIS for three potential reactor models: AECL's ACR-1000, Areva's US_EPR, and Westinghouse's AP-1000. Once the process began, OPG was requested to add another type of reactor to their assessment: the EC6. An environmental assessment (EA) of OPG's EIS was conducted by a Joint Review Panel (JRP) under the *Canadian Environmental Assessment Act, 1992.* The JRP issued a report recommending that the project proceed, provided a series of 67 recommendations were implemented mitigating potential adverse effects of any new build project at Darlington.

OPG and the JRP sought to evaluate all four models in the same process by using what they called a 'bounding approach' in which the general characterizations of the potential adverse environmental impacts associated with all four reactors were identified and assessed together. This bounded approach resulted in a fairly broad EIS and EA, with many particulars (including those relating to environmental emissions, waste management, and other issues) being left to determine in more detail once a reactor model for the Darlington site was chosen at a later date. The JRP noted in their final report, however, that if a 'fundamentally different' reactor design was selected for the Darlington new build project, it would require a new EA.

In early October, 2022, OPG submitted an updated EIS and PPE for the DNNP. In these documents, OPG introduced its chosen technology for its new build project: the BWRX-300 modular reactor, a reactor technology that was not considered in the initial EIS for new reactors at the Darlington site. OPG argues that the potential environmental impacts of this new BWRX-300 modular reactor technology are mostly within the parameters of the 'bounding approach" used in the original EIS in 2006. As such, it argues no new EA is required under the current *Impact Assessment Act* for the construction of up to four new modular BWRX-300 reactors at the Darlington site.

The CNSC scoped the current public comment opportunity narrowly, asking for submissions relating to whether the proposed BWRX-300 modular reactor should be considered a "fundamentally different" reactor to the four others reactor types studied between 2006 and 2011. In preparing submissions, the CNSC directed members of the public to only consult two documents: the 2022 EIS and PPE prepared by OPG.[1]

No definition of "fundamental difference" has been developed. The main criteria provided to help members of the public comment on whether this threshold for a new EA has been met are the 198 plant parameters used to 'bound' the assessment of the initial four reactor designs. By OPG's own estimate: 60 of the 198 parameters are not applicable to the BWRX-300 design; nine BWRX-300 features are outside the 198 parameters; the remaining 129 parameters capture predicted BWRX-300 impacts.[2]

Concerns over the current focus on the "fundamental difference" threshold

After reviewing the EIS and PPE, it became apparent that there was not enough information in either document to get a comprehensive sense of the potential adverse environmental impacts of the BWRX-300 modular reactor. There was also insufficient information to develop a clear understanding of how the BWRX-300 modular reactors would interact more generally with the local environment. For example, neither the EIS nor the PPE contain detailed information or data relating to:

- The source, volumes, or discharge points for all identified contaminants to air, surface water, groundwater, and stormwater;
- Exact treatment or mitigative efforts to address potential contaminants in liquid effluent, contaminant releases to air, groundwater or in stormwater; or
- Additional environmental monitoring that will be required, should the BWRX-300 modular reactor be approved, to ensure against any significant adverse environmental effects.

In fact, many of the potential environmental effects identified by OPG are still being examined and modeled to determine their significance and necessary mitigation measures: approximately 30% of the potential residual effects of the BWRX-300 reactor are still being studied,[3] approximately 15% of the studies to determine the significance of residual adverse effects of the BWRX-300 are still being studied.[4]

[1] Canadian Nuclear Safety Commission, "Darlington New Nuclear Project (DNNP) pre-licensing consultation", online: https://www.letstalknuclearsafety.ca/dnnp-pre-licensing-consultation
[2] Ontario Power Generation, "Environmental Impact Statement Review Report – DNNP", online: https://www.letstalknuclearsafety.ca/33710/widgets/138079/documents/95811, pp 29-30.
[3] Ontario Power Generation, "Environmental Impact Statement Review Report – DNNP", Table 6.
[4] Ontario Power Generation, "Environmental Impact Statement Review Report – DNNP", Table 7.

Further, there are several times in the EIS where OPG predicts that the BWRX-300 impacts on the local environment will be less that those identified in the original EIS due to a relatively "smaller environmental footprint" of the BWRX-300 design. For example:

- OPG asserts the aquatic environment will be more protected by BWRX-300 than the other reactors in the initial EIS because it's flow rate is relatively smaller.[5] However, no assessment is provided to characterize the BWRX-300 flow rate and its impact on aquatic biota in more detail;
- OPG asserts terrestrial effects of the BWRX-300 reactors will similarly be less than those identified for other reactors in the initial EIS since the surface area taken up by the reactors will be less for the BWRX-300 (19 hectares per reactor compared with the average 35 hectares for other reactors examined in the original EIS).[6] The relative differences in disruption during construction of the BWRX-300 reactors versus other EIS reactors is under examined, and there is no evaluation of the likelihood that any saved surface area from smaller reactors would constitute significant gains in species habitat;
- Further, arguments relating to the "smaller footprint" for the BWRX-300 ignore the deeper foundations required for the BWRX-300 (38m compared to all other reactors in the initial EIS that had a foundation depth of around 13.5m deep).[7] The excavation work required for the BWRX-300 will alter the water table at the site, though the ways in which it may do so, and for exactly how long, are not discussed sufficiently in the 2022 EIS report;
- OPG asserts BWRX-300 will generate smaller volumes of waste than the reactor models examined in the initial EIS, and argues this factor indicates a smaller environmental impact.[8] However, these wastes have higher radioactivity levels, than other CANDU wastes at the Darlington site. It is unclear from the 2022 EIS and PPE how this higher activity is taken into consideration when evaluating impacts and management requirements for spent fuel from the BWRX-300 reactors.

We are in the process of reviewing OPG supporting documents to get a better sense of the predicted environmental effects of the BWRX-300 and their potential significance. We were not able to make a confident determination from information in the 2022 EIS and PPE alone as to whether BWRX-300 reactors are fundamentally different from the other reactors assessed in the original EIS. We argue it would be irresponsible to say with any authority or confidence that the BWRX-300 fits reasonably within the original plant parameter envelope, with reference to the 2022 EIS and PPE alone.

<u>Concerns relating to transparency in public communications</u>

Transparency is a crucial precondition for accountability. It is required of regulators and companies in different ways, and for different purposes. In the nuclear sector,

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[5] Ontario Power Generation, "Environmental Impact Statement Review Report – DNNP", p 90.

[6] Ontario Power Generation, "Environmental Impact Statement Review Report – DNNP", p 91.

[7] Ontario Power Generation, "Environmental Impact Statement Review Report – DNNP", p 10.

[8] Ontario Power Generation, "Environmental Impact Statement Review Report – DNNP", p 25 and 27.

transparency is demonstrated by an accessible regulator that ensures its work and the reasoning behind its decisions are clearly communicated to the public. It is also demonstrated by licensees who share information about the real and potential impacts their facilities can have on the environment, human health, the economy, and society more broadly. Regulators have an important role in ensuring licensees provide this information. Regulators are also responsible for ensuring they and the public have the necessary information on which to make informed decisions about what real and potential impacts are reasonable or acceptable, and which are not.

In this intervention, NTP identified two main areas in which transparency can be better safeguarded by both the CNSC as regulators, as well as OPG as a licensee. The first relates to need for clearer communications of the DNNP's context and the current EIS and PPE documents prepared in 2022. The second relates to ongoing information gaps that prevent NTP from being able to provide fulsome analysis of the BWRX-300 modular reactor. OPG is proposing to continue the EIS process initiated in 2006, however little note is made to the existing record on which OPG hopes to continue to build.

Each of these two areas will be discussed below in more detail in turn.

1) Public communications relating to project context

Since the original EIS was prepared, it was considered in an Environmental Assessment that resulted in a series of additional information requests of OPG, and a final EA report in 2011 that specified the project could only proceed if the following studies were undertaken and resulted in findings that any identified environmental impacts could be mitigated to ensure against them becoming 'significant'. These studies included:

- A comprehensive soil characterization program (EA recommendation 2);
- A follow-up and adaptive management program for air contaminants including Acrolein, NO_2, SO_2, SPM, PM_2, and PM_{12} (EA recommendation 8);
- A detailed acoustic assessment, noise monitoring, and a noise complaint mechanism (EA recommendation 9);
- A detailed geotechnical investigation prior to site preparation activities (including site-wide information on soil physical properties, determining mechanical and dynamic properties of overburden material, mapping geological structures to deepen understanding of "site geological structure model", and other measures, EA recommendation 10);
- Collecting water and sediment quality data for future embayment area produced as a result of shoreline modifications close to the outlet of Darlington Creek (EA recommendation 12);
- Collecting and assessing water quality data for shoreline and off-shoreline locations in the study area in advance of any in-water works (EA recommendation 13);
- Evaluating site layout opportunities to minimize effects on terrestrial and aquatic environments (EA recommendation 20);

- Developing a follow-up program for insects, amphibians and reptiles, mammal species and communities to verify the effectiveness of mitigation efforts (EA recommendation 22);
- Sampling to confirm the presence of Least Bittern before site preparation activities begin (EA recommendation 25);
- The geotechnical and seismic hazard elements of a geotechnical investigation be performed (with varying activities required before site preparation, construction, and operation phases of a new build project, EA recommendation 38);
- Expanding the scope of groundwater monitoring for flows that may arise as a consequence of grading changes during site preparation and construction phases (EA recommendation 19);
- Determining the compensation for any loss of ponds and for preventing runoff of sediment and other contaminants into Coot's Pond during site preparation and construction (EA recommendation 21);
- A detailed assessment of predicted effluent releases from the project including effluent quantity, concentration, points of release and a description of effluent treatment, demonstrating how the chosen technology will achieve best available treatment techniques economically achievable, and determine whether further mitigation is necessary (EA recommendation 14);
- Establishing toxicity testing criteria and methodologies (including testing frequency) for confirming that stormwater discharges will comply with the *Fisheries Act* (EA recommendation 16);
- Assessments of ingress and transport of contaminants in groundwater at all project phases (taking into account effects of any future dewatering and expansion activities at nearby St. Mary's Cement Quarry, EA recommendation 17);
- A comprehensive assessment of the management of hazardous substance releases and required management practices for hazardous chemicals on site (EA recommendation 26);
- A surface water risk assessment, once a reactor technology is chosen, characterizing the surface combined thermal and contaminant plume, and the physical displacement effects of altered lake currents as a "hazardous pulse exposure" to fish whose larvae drift through area (EA recommendation 35);
- Conducting a hazard algae assessment (EA recommendation 40);
- Making provisions for on-site storage of all used fuel and low and intermediate-level wastes for the duration of the project, should permanent storage elsewhere not be found or approved (EA recommendations 52 and 53);
- Conducting additional fish impingement and entrainment monitoring and looking into cost-effective mitigation such as live return systems and acoustic deterrents (EA recommendations 30 and 32); and
- Ensuring advanced thermal plume modelling is conducted that takes climate change impacts into account (EA recommendation 34).[9]

[9] For acceptance by Governor in Council, see: "Government of Canada's Response to the Joint Review Panel Report for the Proposed Darlington New Nuclear Power Plant Project in Clarington Ontario, online: https://www.ceaa.gc.ca/archives/evaluations/29525/document-html-eng_did=55542.html.

Neither the 2022 EIS nor PPE systematically address any of these studies or their progress. As such, it remains unclear to what extent this ongoing work has been conducted. It remains unclear whether the studies themselves have been included in the supporting documents referred to in the EIS. We are still in the process of verifying the extent to which they are referenced in the supporting materials OPG shared with us over the last week.

The 2011 EA report was judicially reviewed by the Federal Court upon an application by several participants in that EA process. Justice Russell for the court found there to be insufficient information on the public record relating to hazardous substance emissions from a future new build, radioactive waste management practices, and the effects of a severe common cause accident.[10] To date in our review, we have assessed the first two issues in the 2022 EIS and PPE and similarly find significant information gaps.

This Federal Court decision was then appealed by OPG, the CNSC, and Attorney General. The Federal Court decision was ultimately overturned by the Federal Court of Appeal's majority, however, the dissenting judgment of Rennie JA agreed with the initial decision by Russell J that there was not enough information on the EA public record relating to hazardous emissions from the proposed new nuclear project.[11]

These cases show that the extent and sufficiency of the evidentiary record in this case has been long-contested. The comprehensiveness of the evidentiary record should be the top priority in any evaluation of the proposed BWRX-300 modular reactors.

2) Lack of access to data and detailed information to support EIS and PPE

As discussed above, both the EIS and PPE are highly context-dependant documents, part of a process initiated in 2009 that was subject to two court rulings (though ultimately affirmed). This full context and the supporting documents referenced in OPG's EIS and PPE should have been made available alongside the 2022 EIS and PPE documents themselves – both on the CNSC consultation website as well as OPG's own website.

The follow-up studies required by the EA report of the JRP should also have been explicitly discussed by OPG in their application and shared online with the public along with the current EIS and PPE documents. This is still something that can be done now, as intervenors like ourselves continue to study this proposal and prepare for any further environmental review or application by OPG for a licence to construct new reactors at the Darlington site.

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[10] *Ontario Power Generation Inc. v. Greenpeace Canada,* 2014 FC 463, online: https://www.canlii.org/en/ca/fct/doc/2014/2014fc463/2014fc463.pdf, para 228.

[11] *Ontario Power Generation Inc. v. Greenpeace Canada,* 2015 FCA 186, online: https://www.canlii.org/en/ca/fca/doc/2015/2015fca186/2015fca186.html?searchUrlHash=AAAAAQAmZmVkZXJhbCBjb3VydCBvZiBhcHBlbCBjbnNjIGdyZWVucGVhY2UAAAAAAQ&resultIndex=2, paras 49-51.

Finally, projects like these underscore the importance of proactive routine environmental performance disclosures, so that members of the public can ground their reviews of the proposed project in larger understandings of the Darlington site and how existing nuclear facilities engage with the local ecosystem in which they are embedded.

<u>Concerns with the current CNSC review process</u>

1) Indigenous jurisdiction and the CNSC's regulatory context

NTP recognizes the sovereignty and jurisdiction of the Indigenous Nations on whose land the Darlington site sits. We support their interventions in this matter and recognize them as relevant decision-makers when determining allowable activities by nuclear industry in their territories. NTP also recognizes the applicability of Indigenous laws as part of these Nations' governance systems of their homelands on which any approved new modular nuclear reactors would operate.

OPG's claimed ownership of this site does not extinguish Indigenous jurisdiction, nor does it prove the paramountcy of Canadian law and regulation of the site. A formalized process by which Indigenous Peoples' authority and jurisdiction is observed is necessary to determine a just outcome of these matters and should be defined by these rights holders.

2) Excluding other factors in determinations about EAs

In addition to the question of the BWRX-300's "fundamental difference" to other reactor technologies, or not, there are other public interest arguments for a new EA. Since the completion of the EA for the DNNP, federal environmental assessment legislation has changed twice. New species at risk have been listed and are present in the vicinity of the Darlington site. Further, the underlying need for these projects, and changes in energy demand forecasts and energy mixes since 2006 have been significant – as have public decision-making processes in the province relating to these types of determinations. EIS revisions (between 2010 and 2022) were dormant for 12 years, and the initial EIS is now 14-17 years old.

Were a new EA required, it would not necessarily require all new assessments, and as such would not unnecessarily duplicate work that has already been done. Rather, it would provide for a consolidated record of all past studies, and ensure they are supplemented with additional work required by the current federal standards demanded of significant industrial project proposals.

APPENDIX A: NTP information requests and responses to date

<u>Information request timelines</u>

March 2, 2023: NTP information requests sent to OPG – Environment, Health, and Safety

March 13, 2023: Response received from OPG – Environment, Health, and Safety indicating no updates yet available relating to outstanding DWMF information requests

March 13, 2023: Response received from OPG – New Nuclear Growth with four of the requested reports

March 17, 2023: Response received from OPG – New Nuclear Growth with further two of the requested reports as well as preliminary responses to the second category of NTP's information requests

March 20, 2023: Response received from OPG – New Nuclear Growth with final requested report

March 20, 2023: NTP sent confirmation of reports and responses received, requested rationales for redacted portions of three of the reports

nuclear
transparency
project

Website: www.nucleartransparency.ca
Email: info@nucleartransparency.ca

Submitted by email

March 2, 2023

To Mr. McCalla,

Re: Information requests to assist the Nuclear Transparency Project's intervention in the Canadian Nuclear Safety Commission review of OPG's Darlington New Nuclear Project

The Nuclear Transparency Project (NTP) has been funded by the Canadian Nuclear Safety Commission (CNSC) to prepare an intervention in the upcoming hearing to consider Ontario Power Generation's (OPG) proposed Darlington New Nuclear Project (DNNP). NTP is submitting the following information requests in order to better understand OPG's licensing application and supporting documents (namely the Environmental Impact Statement (EIS) and Plant Parameters Envelope (PPE) from October 2022).

Our information requests are divided into three categories: the first contains a list of requested studies; the second requests information that is not included in the 2022 EIS or PPE documents (though we recognize this information may be in the additional documents we are requesting); and the final category seeks clarification on specific portions of the 2022 EIS and PPE documents. We have also attached as an appendix to this document a table with outstanding information requests from December 6, 2022 which we sent as part of our intervention in the Darlington Waste Management Facility relicensing process. We still hope to receive responses to those questions as they will assist with our preparations for this current intervention.

Our deadline for providing written comments to the CNSC on the EIS and PPE is March 20, 2023. As such, we request a preliminary response to our queries from OPG by March 13, 2023. We hope by that time you will be able to provide: 1) access to the requested reports (the first category of requests below); and 2) a timeline by which OPG expects to provide responses to the information requests in this document (including its appendix).

With appreciation for your time and assistance,

Pippa Feinstein, JD LLM
Coordinator, NTP

Information requests specific to the Darlington New Nuclear Project

CATEGORY 1 – NTP's list of requested supplementary documents

In order to better understand OPG's EIS and PPE documents, we request electronic copies of the reports listed below. We understand there are several versions of some of these reports, some of which appear available online. For these reports, we have included links to the copies we have been able to find and request confirmation that these are the most recent versions and/or the versions of these reports being relied on for OPG's licensing application.

- Calian Nuclear, "Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300";
- WSP Golder, "Hydrology Memo to Assess Water Balance of Surface Water Features for the Darlington New Nuclear Project";
- WSP Golder, "Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project";
- OPG, "Darlington New Nuclear Project Commitments Report"
    - (is this the most recent version and/or the version of this report being relied on for OPG's licensing application: https://archive.opg.com/pdf_archive/Nuclear%20Licencing%20Documents/Darlington%20New%20Nuclear/Commitments_Report.pdf);
- OPG, "DNNP Site Evaluation Update Summary Report";
- OPG, "BWRX-300 Darlington New Nuclear Project Preliminary Safety Analysis Report"
    - (is this the most recent version and/or the version of this report being relied on for OPG's licensing application: https://www.opg.com/documents/dnnp-bwrx-300-preliminary-safety-analysis-report-pdf/; and
- Any draft environmental assessment follow-up monitoring program for BWRX-300 modular reactors, should they be approved for construction at the Darlington Nuclear site.

CATEGORY 2 – Additional information

There are six broad areas in which we require more information than is contained in either the 2022 EIS or PPE documents. These have been summarized in the enumerated list below. Some of this information may be contained in the reports we requested above. If this is the case, please let us know. If the requested information below is contained in reports we have not yet requested, please provide those additional reports for our reference.

1. Constituents of Potential Concern specific to the BWRX-300 modular reactor design:
    a. Descriptions and analysis of the specific content and types of radionuclides in gaseous effluents, liquid effluents, and solid wastes from the proposed

BWRX-300 modular reactor design. We are interested in descriptions that include analysis of applicable radionuclides that include their respective half-lives and chemical, biological, and environmental properties and pharmacokinetic profiles. Further, an explanation of exactly how they may vary from the radionuclides released by the reactor designs specified in the 2009 EIS would also be of special interest;

   b. Descriptions and analysis of non-radiological substances in gaseous effluents, liquid effluents, and solid wastes from the proposed BWRX-300 modular reactor design. An explanation of exactly how they may vary from the non-radiological substances released by the reactor designs specified in the 2009 EIS would also be of special interest (other than or in addition to the chemicals from blowdown ponds for cooling or hydrazine which the 2022 EIS notes are not applicable for BWRX-300 modular reactors);
   c. Any cumulative analysis of radiological and non-radiological atmospheric or liquid effluent releases from a BWRX-300 modular reactor to the local environment.

2. Comparisons of wastes and waste management practices between BWXR-300 modular reactors and those for Darlington's current reactors and reactor technologies contained in the 2009 EIS:
   a. Analysis comparing the classification of wastes (e.g. ILW or HLW) from BWRX-300 modular reactors and the current CANDU reactors operating at the Darlington site
   b. A comprehensive comparison between waste management activities required for the BWRX-300 modular reactors compared with those currently employed at the Darlington site for its existing CANDU reactors.
   c. A description of any differences in requirements for long-term waste storage between BWRX-300 used fuel and used fuel from existing CANDU reactors at the Darlington site and reactors considered in the 2009 EIS;
   d. Safety analysis of the potential impacts to human and environmental health of the higher level of activity in BWRX-300 wastes, including potential impacts relating to BWRX-300 wastes being moved from fuel bays earlier (in time) than would be the case for other reactor technologies considered in the 2009 EIS;
   e. An assessment of potential effects on groundwater or soil biota in routine waste management operations for BWRX-300 modular reactors. Further, any analysis of potential impacts on groundwater or soil biota in case of any natural accidents relating to waste management activities.

3. Construction of BWRX-300 embedded foundations:
   a. Analysis of potential environmental impacts of required mining, excavating, grading, and/or blasting activities for the 38m embedment of BWRX-300 modular reactors. A comparison of groundwater impacts of the installation of BWRX-300 modular reactors with the installation of the other reactor designs specified in the 2009 EIS is of particular interest;

   b. A comprehensive description of the composition, handling/treatment, and disposal of liquid effluent during BWRX-300 construction and installation; and
   c. Implications for stormwater management during BWRX-300 construction and installation.

4. Comparisons of cooling water designs between BWRX-300 modular reactors and those for Darlington's current reactors and reactor technologies contained in the 2009 EIS:
   a. Analysis comparing the pros and cons of having completely separated reactor coolant water and feedwater versus common reactor coolant water and feedwater, including probable environmental impacts of each design.

5. Environmental monitoring plans for the Darlington Nuclear site and potential BWRX-300 modular reactors:
   a. A description (with a map) of how many new groundwater wells will be installed and each well's location around any constructed modular BWRX-30 reactors. This should include a discussion and supporting analysis of whether the BWRX-300 units will have their own groundwater monitoring program, or whether (and how) they will be integrated with the existing groundwater monitoring plan for the Darlington site;
   b. A description (with a map) of the stormwater infrastructure that will be constructed around (or be restructured to accommodate) any installation of the modular BWRX-300 reactors. This should include how stormwater runoff from the BWRX-300 site would be monitored, and collected and channeled into drainage systems of retention ponds. It should also explain how stormwater whether any treatment methods would be applied, and if so what these methods would be.
   c. A more fulsome description of potential surface water impacts by modular BWRX-300 reactors and exactly how these effects will be monitored and mitigated. This description should go beyond the assessment of water temperature already included in EIS materials.
      i. This should also include references to studies mentioned in the EIS which were undertaken to assess impacts of changes in hydrology or surface water to specific terrestrial elements such as amphibians and reptiles, and their habitat (e.g. EIS section 5.3.4). We also request electronic copies of these studies themselves;
   d. A description of how other existing environmental monitoring plans for both radionuclides and non-radionuclides in liquid effluent, gaseous releases to air, and aquatic and terrestrial species would be integrated with measures specific to monitoring impacts of the modular BWRX-300 reactors.
      i. Note: It appears as though gaseous releases of iodine are greater for the BWRX-300 than other reactor technologies assessed in the 2009 EIS. How is this specific issue being addressed (e.g. mitigated) in OPG's plans for a BWXR-300 modular reactor?

6. What measures would be undertaken to mitigate fish impingement and entrainment in BWRX-300 intakes? EIS Table 7 (p68) notes a “Once-through-cooling porous veneer intake has been designed specifically for reducing entrainment and impingement of fish. The intake incorporates design features based on fish behavioural principles and is also located offshore at depths which are less productive than inshore locations. The expected losses will be low relative to Lake Ontario populations”. Is this true for the BWRX-300 design as well, and where could we find BWRX-300-specific evaluations of the potential for fish impingement and entrainment? If this information is available in studies, we request electronic copies of them. Further:
   a. To what extent, to date, has the Department of Fisheries and Oceans and possibly Environment and Climate Change Canada assessed the BWRX-300 design for compliance (including via permit) with the *Fisheries Act*?
   b. EIS Table 7 (p67) notes mitigative efforts in the Fish Habitat Compensation Plan to ensure a minor residual adverse effect. Where could more information be found on these measures, and can we access an electronic copy of this plan?

7. The EIS asserts impacts on terrestrial and aquatic VECs posed by the BWRX-300 modular reactor design would be less significant than those posed by reactor designs considered in the 2009 EIS. Can you provide specific information or data used to support these claims (either from a more detailed EIS support document, data collected from mitigative measures, or proposed or in-place monitoring plans that assess effects on VECs)?

CATEGORY 3 – Clarifying 2022 EIS and PPE reports

We request additional clarity on the following portions of the 2022 EIS document:

8. Table 3 “Comparison of how energy is produced” (pp19, 20, 22): according to what criteria were BWRX-300 and 2009 EIS reactors designated to be “similar” in design despite the fact that “In the BWRX-300, the reactor coolant water and the feedwater are the same” while “In the EIS (Environmental Impact Statement), the reactor coolant water and the feedwater do not mix”.

9. Table 4 “Project works and activities” (p24): “mobilization and preparatory works” appear to be defined as largely “clearing, grubbing, services and utilities, and on-site roads and related infrastructure”. On this basis, the 19 ha area on which the BWRX-300 would be built was considered to constitute a “smaller footprint” than other reactor technologies considered in the 2009 EIS. Why was the deeper foundation embedment and related preparatory activities below ground, not included in the analysis of the construction footprint of the BWRX-300 in this table?

10. Table 6 “Summary of residual adverse effects and relevant VECs”: certain cells in this table are highlighted in pink with a note that “pink shades indicate that there is

potential for a Residual Adverse Effect from BWRX-300 deployment that is different than that described in the EIS OR was not considered in the EIS". However, all the columns in the shade of pink then conclude: "Residual adverse effect not considered in the EIS". Can OPG provide more clarity on the rationale behind these decisions?

a. Use of the qualifying words "potential" and "some" relating to environmental effects are imprecise and indicate some uncertainty. Will further clarity and verification happen in a future follow-up monitoring program, or before then?
b. Relating to potential effects on habitat and species conservation associated with the deployment of modular BWRX-300 reactors, could you provide some clarity around which effects were anticipated to be less significant and which were not considered in the EIS?

11. Section 5.3.14 (p64) notes a decline in bank swallow burrows since 2008. How would future monitoring differentiate between this ongoing decline and impacts specific to the installation of BWRX-300 modular reactors?
    a. Further, if the loss of nesting habitat exceeds the 1000 burrow threshold, how could the potential contribution of BWRX-300 reactor operations to this trend be defined?
    b. What plans have been developed to mitigate decreasing groundwater flow to the bluffs that would disrupt bank swallow habitat?

12. EIS Table 7 (p81) notes "Five (5) residual adverse effects have been identified that require additional studies. These residual adverse effects were not considered in the EIS and are anticipated to be not significant. 1. On-site Aquatic Habitat (ponds, intermittent tributaries to Darlington Creek and to Lake Ontario, Darlington Creek, 2. VECs in the Cultural Meadow and Thicket Ecosystem,3. Wetland and Woodland Ecosystems, Rare Plant Species, Amphibians and Reptiles, Insects – Dragonflies and Damselflies, Mammal communities and species, 4. Bank swallows, 5. Bats". Since these conditions were not considered in the EIS, what is the status of the assessments? Are these studies a part of the environmental assessment follow up monitoring program and will these assessments be completed before any BWRX-300 licensing hearing before the CNSC?

13. EIS Table 4 (p25) notes, "For BWRX-300, the water intake and the discharge pipes will be sized for four reactors. The discharge pipe includes a series of diffusers from which the water is discharged to promote rapid thermal mixing in the lake". This statement raises the question of heat rejection to lake water, but a more detailed discussion of this aspect is not in the EIS. If the reliance of BWRX-300 on once-through cooling water for both primary and secondary cooling alter the overall need of water from lake, what could the impacts of rapid thermal mixing of discharge water be, and what are the advantages of choosing a design that would not use atmosphere as the ultimate heat sink? Further what will the actual size of BWRX-300 discharge pipes be? We understand they have been designed with the capacity to function for 4 modular reactors at the Darlington site.

We request additional clarity on the following portions of the 2022 PPE document:

14. B1.1, Table 1 points 1.2.1 and 1.4.1: what climate change model (if any) is being used to predict probable maximum precipitation (PMP)? What are the worst-case scenarios being used and how will the PMP accommodate heavy rainfall or potential flash flood events?

15. B1.3, Table 3, points 1.2.2: Can more analysis be provided to support how valid and conservative anticipated maximum estimates of snow and ice loads are for the root of the building housing the BWRX-300 modular reactor(s)?

16. B1.3, Table 3, points 1.4.1 and 1.4.2: Can OPG clarify what is meant by the comment, “This is a design assumption, rather than a site characteristic” relating to maximum groundwater and maximum flood descriptions?

17. B1.3, Table 3, points 4.1., 14.1.1, and 14.1.3: it is noted at these points that wet bulb (WB) temperature is not a limiting temperature. Is this explained by the phrase elsewhere that “Wet bulb temperature values are not normally collected as part of standard meteorological monitoring at the Darlington station and thus do not exist specifically for the Darlington site”? If so, why is this explanation not included in points 4.1., 14.1.1, and 14.1.3?

18. B1.4, Table 4: for all PPE parameters for which the “where used” column notes either the N/A or “not used in EIS or Site Evaluation Studies”, can OPG explain the rationale for this designation? How is the exclusion of these PPE parameters justified, e.g. on the basis of redundancy, non-requirement by the CNSC or other technical reasons like prorated values? Further, how are these exclusions consistent with the criteria described in section B3.2 “Limiting factors to environmental impact”?
    a. For this same table, there are a few places in column 2 where it notes that values of PPE parameters are prorated (Y), but in column 4 exactly the same values are provided for both the single unit and the prorated value (e.g., see points 7.3.1, 9.3.2, 12.3.3). How can these same values be explained?
    b. In column 5 of the same table “where used”, can you clarify if the prorated values of the PPE parameters were used for EIS and SES wherever applicable (e.g., see points 2.4.15, 2.5.15, 2.6.2, 9.5.1, 9.5.3, 10.3.1, 10.3.2, 13.4, 16.1.1 and more).
    c. Several places (e.g., see points 9.3.1, 9.3.2, 11.2.3, 12.4.3, 16.1.3, 16.1.4 and 18.4) note in the last column that “this PPE value was considered but not used in the assessment”. Can you provide rationales that support this choice?

19. B1.3, Table 3 “Site parameters and Darlington characteristic values, composite table”: why is there no information on the BWRX-300 modular reactor design in

this table? In the absence of BWRX-300-specific data, how can the data in this table be used for a safety assessment of the BWRX-300 design?

   a. From the table it can be noted that if a reactor's design technology is to be rated based on the number of citations as a "limiting reactor" the descending order would be EC6 < EPR < ACR-1000= AP-1000. When selecting a certain design technology, how are "limiting reactor" citations handled? How would the BWRX-300 design compare with these other four designs in the absence of information or data to ascertain the limiting reactor for several PPE parameters?

20. B1.4, Table 4 "Consolidated PPE Parameters, their values, where used, and how used": the BWRX-300 modular reactor is cited least frequently as the "limiting reactor" for 5 PPE parameters (1.1.2, 7.1.1, 7.1.3, 9.4.2 and 17.1.2). Do fewer citations indicate non-availability of data? If so, how does this affect the comparison of the BWRX-300 modular reactor design with other designs in the EIS or SESs?

APPENDIX 1: Outstanding information requests from the Darlington Waste Management Facility (DWMF) relicensing process

	Questions sent December 6, 2022	**OPG Responses, received January 17, 2023**
1.	Copy of OPG's Design Manual (this was mentioned during our meeting as the best source for calculations and methodologies OPG uses to implement CSA standards N288.1 and 288.4 at the Darlington site)	[NTP awaiting response]
2.	The best source of information (i.e. a report or other type of assessment or plan) on which OPG relies to measure shoreline conditions at the Darlington site, especially lake water levels	[NTP awaiting response]
3.	The 2021 or 2022 risk assessment used to determine groundwater monitoring frequency for wells at the Darlington site	[NTP awaiting response]
4.	A map of stormwater management infrastructure at the Darlington site	[NTP awaiting response]

	(indicating catchments and identifying connections to on-site ponds)	
5.	Does OPG perform Standard Deviation (SD) analysis (i.e. plotting or calculating SD) of its tritium monitoring data?	OPG: Currently, the trend analysis methodology employed by OPG is commensurate with the objectives of the groundwater monitoring program, the complexity of the site, the level of risk posed to receptors, and the quantity and quality of monitoring data available. Areas of the DN Site where groundwater quality is or may be influenced by the activities at site are monitored by comparing measured concentrations of the parameters of interest to their background concentrations. Parameter concentrations vs. time are plotted in graphs and are examined for any significant increase and deviation in trends.
6.	Does OPG perform Regression Analysis (RA) of its groundwater monitoring data in order to identify temporal trends over time?	OPG: Refer to answer for question 5.
7.	Does OPG perform statistical analysis to calculate Normalized Mean (NM) values for its groundwater monitoring data to capture spatial variation in sample values at the Darlington site?	OPG: Refer to answer for question 5.
8.	Does OPG conduct generic monitoring of geochemical parameters in groundwater below or around the Darlington site? In particular, are any of the following routinely sampled for: a. pH b. Eh c. T	OPG: pH, temperature, electrical conductivity, oxidation-reduction potential, dissolved oxygen, and/or turbidity are monitored in-situ during the purging of groundwater in all monitoring wells, if possible. The monitoring frequency of these field parameters differs depending on the

	d. Dissolved Oxygen e. Electric Conductivity f. Total Dissolved Solids If any of these parameters are monitored, what is their frequency? Are measurements made in-situ?	monitoring wells and are based on the sampling schedule of each individual monitoring well.
9.	Does OPG monitor for any of the following major constituents in groundwater below or around the Darlington site? Namely: a. Na b. K c. Ca d. Mg e. Si f. Li g. Sr h. Cl i. SO4 j. Br k. HCO3 If any of these parameters are monitored, what is their frequency?	OPG: The listed parameters were not included in the previous groundwater monitoring program as they were not identified as parameters of interest in the Risk Assessment Report and the Conceptual Site Model.
10.	How often does the collection and processing of condensate for the reactor building occur? Does it occur on a regular cycle? Reference for this question: DN fig 2.6 (pp.17, 2021 EMP report), *"The increases in emissions observed in 2016 and 2017 are primarily attributed to the processing and discharge of condensate from reactor building air conditioning units (ACUs) through the active liquid waste system".*	[NTP awaiting response]
11.	Were any engineering solutions implemented to minimize the frequency of leaks of refrigerant?	[NTP awaiting response]

	Reference for this question: *Release of Ozone depleting substances (pp.21, 2021 EMP report),* Leaks of the of refrigerant R134a on Jan. 28, Aug. 26 and Oct. 11 which may be a concern.	
12.	Relating to the above, the EMP report mentions "There was no observed or presumed adverse environmental impact as a result of the spill". How was this observation or assumption made? Were event reports for these instances sent to the CNSC and/or provincial MECP? (This is unclear from the 2021 event reports posted to OPG's website.)	[NTP awaiting response]
13.	Relating to hydrazine: Are there any supplemental studies you could point us to that evaluate/monitor the chronic effects of the release of hydrazine on White sucker or Brown bull head (especially early developmental stages of these fish)? Are the potential or measured effects on terrestrial plants and animals monitored/ studied?	[NTP awaiting response]
14.	Relating to ammonia: Are there any supplemental studies to evaluate/monitor the chronic/long term effects of the release of ammonia on White sucker or Brown bull head (especially early developmental stages of these fish) or other fish species of ecological relevance?	[NTP awaiting response]
15.	For *Table D4- Darlington EMP-Fruits and Vegetables – (pp. 81, 2021 EMP report)* certain receptor locations (R19, R27, and R335) have comparably higher levels of HTO and C14 than the other sites (DF9 and F18). R27 appears to have higher levels in all the 3 EMPs (2019, 2020, and 2021) and same is the case with R275	[NTP awaiting response]

	(EMP 2019, and 2020). Do these sites have higher background levels of HTO and C14? It is unclear from the report alone. Further, in *Table D8- Annual Average Drinking Water and Lake Water Concentrations –EMP reports 2019, 2020, 2021:* The receptor well-R2 appears to have high background levels of Tritium (23.8- 27.7 Bq/L)? Is this is the case? And a follow-up question: if "R" indicates a receptor location, what does "D" stand for?	
16.	Relating to #15 the above, can OPG comment on the potential for receptor locations to appear more contaminated than test sites and how this might be taken into account in monitoring activities?	OPG: On-site perimeter monitoring wells are sampled on a regular basis. Sampling frequency will be increased when an abnormal level of parameters is detected in receptor locations to confirm if there is truly an increase in parameter concentrations.
17.	Does the variation in contamination of milk measured around nuclear sites call for more frequent supplemental studies or can these year-to-year variations be incorporated satisfactorily by the probabilistic models? Reference for this question: *Section 3.3.3.2- Milk and Animal Feed (pp. 33, 2021 EMP report): "The annual average HTO and C-14 in milk measurements around the nuclear sites vary from year to year due to changes in prevailing winds, emissions, humidity, cow's diet, feed sources, and water sources".*	[NTP awaiting response]
18.	Can you clarify whether the values for HTO in eggs reflect actual low levels that are hard to detect with monitoring equipment or whether they are meant to express high uncertainty?	[NTP awaiting response]

	<u>Reference for this question</u>: *Tables D-7, Annual Average Concentrations in Eggs, and Poultry – 2019 (EMP reports 2019,2020 and 2021):* The HTO in eggs is increasing slightly. It is hard to know whether there is a challenge detecting the small amounts or whether there is high uncertainty as the values are more than LC but less then LD.	
19.	*Table A7:* The 2020 DNGS ERA mentions excessive concentrations of lead were found in the radioactive liquid waste (RLW), and it is mentioned that this would have no impact on the lead concentration in the condenser cooling water and initial mixing zone. Can OPG confirm that same is true for excessive concentrations of Lithium in the RLW?	[NTP awaiting response]
20.	Are there plans for monitoring both total Ammonia (N) and total unionized ammonia in light of Environmental Study levels? <u>Reference for this question</u>: *Table A-10: Ecological Screening Criteria for Surface Water COPCs.* According to CCME CWQG the acceptable limit of total Ammonia (N) and total unionized ammonia are 0.044 and 0.019 mg/L (Selected Ecological Screening Criteria) and the 95th Percentile Background, 2019 Environmental Study levels were 0.01 and 0.2 mg/L.	[NTP awaiting response]
21.	Can you clarify or provide more evidence to support assumptions of people's movements when calculating exposure averages? <u>Reference</u> *Table 3-26 and 3-27 (DNGS ERA-2020): "for hydrazine the risk*	[NTP awaiting response]

	exceeds the associated target value. Incremental Lifetime Cancer Risks> 1E-06, HQ > 0.2. This is estimated for adult urban resident receptors at Oshawa/Courtice, Bowmanville and for campers in Table 3-26 and for sport fisher and campers in Table 3-27. However, the statement *“since people tend to average their exposure by spending time in various locations, the maximum is not considered representative of long-term exposure and results should be interpreted based on the UCLM”* gives a notion that these values are an overestimation of risk.	
22.	In Table A-15 of the DNGS-ERA 2020, the units are noted as “micrograms/s”. Is this indicating micrograms per second or does the "s" stand for something else?	[NTP awaiting response]

<u>Information requests from Nuclear Transparency Project (NTP) specific to the Darlington New Nuclear Project</u>

CATEGORY 1 – NTP's list of requested supplementary documents

In order to better understand OPG's EIS and PPE documents, we request electronic copies of the reports listed below. We understand there are several versions of some of these reports, some of which appear available online. For these reports, we have included links to the copies we have been able to find and request confirmation that these are the most recent versions and/or the versions of these reports being relied on for OPG's licensing application.

Document Requested	OPG Response
Calian Nuclear, "Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300";	Provided in email from Jesara Mar 13, 2023
WSP Golder, "Hydrology Memo to Assess Water Balance of Surface Water Features for the Darlington New Nuclear Project"	Document provided in attachment
WSP Golder, "Groundwater Modelling to Assess Effects from Construction-Related Dewatering for Darlington New Nuclear Project"	Document provided in attachment
OPG, "Darlington New Nuclear Project Commitments Report" (is this the most recent version and/or the version of this report being relied on for OPG's licensing application: https://archive.opg.com/pdf_archive/Nuclear%20Licencing%20Documents/Darlington%20New%20Nuclear/Commitments_Report.pdf);	Provided in email from Jesara Mar 13, 2023
OPG, "DNNP Site Evaluation Update Summary Report"	Document provided in attachment
OPG, "BWRX-300 Darlington New Nuclear Project Preliminary Safety Analysis Report" (is this the most recent version and/or the version of this report being relied on for OPG's licensing application: https://www.opg.com/documents/dnnp-bwrx-300-preliminary-safety-analysis-report-pdf/; and	Provided in email from Jesara Mar 13, 2023
Any draft environmental assessment follow-up monitoring program for BWRX-300 modular reactors, should they be approved for construction at the Darlington Nuclear site.	Provided in email from Jesara Mar 13, 2023

CATEGORY 2 – Additional information

There are six broad areas in which we require more information than is contained in either the 2022 EIS or PPE documents. These have been summarized in the enumerated list below. Some of this information may be contained in the reports we requested above. If this is the case, please let us know. If the requested information below is contained in reports we have not yet requested, please provide those additional reports for our reference.

1. Constituents of Potential Concern specific to the BWRX-300 modular reactor design:	OPG Response
a. Descriptions and analysis of the specific content and types of radionuclides in gaseous effluents, liquid effluents, and solid wastes from the proposed BWRX-300 modular reactor design. We are interested in descriptions that include analysis of applicable radionuclides that include their respective half-lives and chemical, biological, and environmental properties and pharmacokinetic profiles. Further, an explanation of exactly how they may vary from the radionuclides released by the reactor designs specified in the 2009 EIS would also be of special interest;	This information is provided in the following: • A discussion of gaseous airborne releases (Section 20.13 of the PSAR and Table 20.13). • A discussion of liquid effluent releases (Section 20.14 of the PSAR and Table 20.14-1). • A comparison of airborne releases, and liquid releases between the BWRX-300 and the bounding scenario reactors assessed in the EIS (Section 5.5.7 of the EIS Review Supporting Document.) • A similar comparison for solid radioactive waste (Table 5-25 of the EIS Review Supporting Document). • The effects of radioactive releases to the atmosphere and surface water (Section 5.5.7 of the EIS Review Supporting Document).
b. Descriptions and analysis of non-radiological substances in gaseous effluents, liquid effluents, and solid wastes from the proposed BWRX-300 modular reactor design. An explanation of exactly how they may vary from the non-radiological substances released by the reactor designs specified in the 2009 EIS would also be of special interest (other than or in addition to the chemicals from blowdown ponds for cooling or hydrazine which the 2022 EIS notes are not applicable for BWRX-300 modular reactors);	Information on non-radiological releases from the deployment of the BWRX-300 are provided in Section 20.8.4 and Table 2.4-1 of the PSAR. The effects of non-radiological releases to air and water on non-human biota is provided in Section 5.5.14.4 of the EIS Review Supporting Document.
c. Any cumulative analysis of radiological and non-radiological atmospheric or liquid effluent releases from a BWRX-300 modular reactor to the local environment.	Chapter 5.8 of the EIS Review Supporting Document describes the assessment of cumulative environmental effects. Sections 5.8.1 to 5.8.5 summarize the cumulative effects of BWRX-300 deployment in comparison with those assessed in the 2009 EIS.

2. Comparisons of wastes and waste management practices between BWXR-300 modular reactors and those for Darlington's current reactors and reactor technologies contained in the 2009 EIS:	OPG Response
a. Analysis comparing the classification of wastes (e.g. ILW or HLW) from BWRX-300 modular reactors and the current CANDU reactors operating at the Darlington site	The waste classification for the BWRX-300 will follow CSA N292.0, which is the same as the CANDU reactor at the Darlington site.
b. A comprehensive comparison between waste management activities required for the BWRX-300 modular reactors	The BWRX-300 used fuel will follow the same basic waste management activities as are employed at the existing Darlington site: following a period of wet storage in the used fuel

compared with those currently employed at the Darlington site for its existing CANDU reactors.	pool, the used fuel is transferred to dry storage containers and placed in appropriate storage facilities. The L&ILW will be processed on-site and stored or otherwise managed in appropriate facilities either on-site or shipped to OPG licensed off-site facilities. OPG's Nuclear Sustainability Services – Western Waste Management Facility currently receives and manages such waste from existing OPG nuclear generating stations.
c. A description of any differences in requirements for long-term waste storage between BWRX-300 used fuel and used fuel from existing CANDU reactors at the Darlington site and reactors considered in the 2009 EIS;	The general requirements for used fuel storage of BWRX-300 and CANDU are the same. Due to differences between the fuel of the BWRX-300 and the fuel from the existing CANDU reactors, different dry storage containers will be needed for the BWRX-300 fuel. These canisters will have the same function as the existing CANDU dry storage containers to safely contain the fuel and will be chosen from the various dry storage containers for boiling water reactor fuel used worldwide. For long-term storage, the BWRX-300 fuel can be stored consistent with what is described in the 2009 EIS (i.e., in waste storage buildings or outdoors on concrete pads). OPG is working with NWMO to ensure the plans for a DGR incorporate the design of the GNF2 fuel from the BWRX-300.
d. Safety analysis of the potential impacts to human and environmental health of the higher level of activity in BWRX-300 wastes, including potential impacts relating to BWRX-300 wastes being moved from fuel bays earlier (in time) than would be the case for other reactor technologies considered in the 2009 EIS;	When compared to the assessment from the 2009 EIS, the solid waste generated by the operation of the BWRX-300 has less radioactivity annually (Bq/year), the same principal radionuclides, and less annual volume. Section 5.7.3 of the EIS Review Supporting Document provides a discussion on postulated radiological and transportation malfunctions and accidents involving solid waste. The effect of the activity in BWRX-300 wastes is assessed in Section 5.7.3.1 of the EIS Review Supporting Document, and supports the conclusion there are no significant adverse effects. For used fuel, the dose consequences due to higher activity will be managed through appropriate cask selection and shielding design.
e. An assessment of potential effects on groundwater or soil biota in routine waste management operations for BWRX-300 modular reactors. Further, any analysis of potential impacts on groundwater or soil biota in case of any natural accidents relating to waste management activities.	As stated in the 2009 EIS construction-related waste will be sent to appropriately licensed off site waste management facilities for disposal or recycling (section 2.5.11, 2009 EIS). The generation of non-radioactive (i.e., conventional) wastes will be minimized to the extent practicable through re-use and recycling programs. All residual waste (i.e., that remaining after diversion programs) will be collected regularly by licensed contractors and transferred to appropriately licensed off-site disposal facilities and no waste disposal facilities will be established on the DN site (section 2.6.13, 2009 EIS). The management of construction waste and conventional waste is not predicted to interact with the ground water environment or non-human biota. Nuclear waste and used fuel transportation, processing and storage postulated accidents are discussed in section 5.7.3.1 of the EIS Review Supporting Document.

3. Construction of BWRX-300 embedded foundations:	OPG Response
a. Analysis of potential environmental impacts of required mining, excavating, grading, and/or blasting activities for the 38m embedment of BWRX-300 modular reactors. A comparison of groundwater impacts of the installation of BWRX-300 modular reactors with the installation of the other reactor designs specified in the 2009 EIS is of particular interest;	The requested analysis is provided in Section 5.5.6 of the EIS Review Supporting Document.
b. A comprehensive description of the composition, handling/treatment, and disposal of liquid effluent during BWRX-300 construction and installation; and	Refer to Section 5.3 Surface Water Environment of the EIS (NK-054-REP-07730-00029). Management of conventional releases in liquid effluent during construction will be addressed through compliance with applicable regulatory requirements and a Ministry of Environment, Conservation and Parks (MECP) Environment Compliance Approval, as applicable. The project will be in compliance with testing, monitoring, and discharge limits as well as volume.
c. Implications for stormwater management during BWRX-300 construction and installation.	Refer to Section 2.5.9 Management of Stormwater in the EIS (NK-054-REP-07730-00029) for this information. Management of storm water will be in compliance with applicable regulatory requirements and a Ministry of Environment, Conservation and Parks (MECP) Environment Compliance Approval, as applicable.

4. Comparisons of cooling water designs between BWRX-300 modular reactors and those for Darlington's current reactors and reactor technologies contained in the 2009 EIS:	OPG Response
a. Analysis comparing the pros and cons of having completely separated reactor coolant water and feedwater versus common reactor coolant water and feedwater, including probable environmental impacts of each design.	The EIS Review Report (NK054-REP-07730-00055, has confirmed the environmental impacts of the BWRX-300 are bounded by the approved EIS. The boiling water reactor design has a single coolant loop for the reactor and turbine. This simplification eliminates the need for a steam generator, results in less components to maintain, and generally results in higher thermal efficiency. With primary coolant entering the turbine, shielding and associated radiological monitoring and controls are required in the turbine area of the facility when the unit is operating. Turbine maintenance during outages also requires radiological considerations. The probable environmental impacts of the BWRX-300 design are outlined in the EIS Review Report, and as mentioned above, bounded by the approved EIS.

5. Environmental monitoring plans for the Darlington Nuclear site and potential BWRX-300 modular reactors:	OPG Response
a. A description (with a map) of how many new groundwater wells will be installed and each well's location around any constructed modular BWRX-30 reactors. This should include a discussion and supporting analysis of whether the BWRX-300 units will have their own groundwater monitoring program, or whether (and how) they will be integrated with the existing groundwater monitoring plan for the Darlington site;	The DNNP Environmental Monitoring and Environmental Assessment Follow up (EMEAF) Program includes a groundwater monitoring component. The EMEAF details the monitoring or assessment activities to be undertaken to confirm the predictions of environmental effects identified in the environmental assessment and to determine the effectiveness of mitigation measures. The follow-up groundwater monitoring program applies to the groundwater monitoring wells network within the DNNP site boundary and remains compliant with CSA N288.7.
b. A description (with a map) of the stormwater infrastructure that will be constructed around (or be restructured to accommodate) any installation of the modular BWRX-300 reactors. This should include how stormwater runoff from the BWRX-300 site would be monitored and collected and channeled into drainage systems of retention ponds. It should also explain how stormwater whether any treatment methods would be applied, and if so what these methods would be.	The stormwater infrastructure design is in progress. Stormwater management will be addressed through compliance with applicable regulatory requirements and a Ministry of Environment, Conservation and Parks (MECP) Environment Compliance Approval, as applicable. OPG has conducted a Flood Hazard assessment of the BWRX-300 site. The results of this assessment are summarized in Chapter 2 Section 2.5 Hydrology in the Preliminary Safety Analysis Report (PSAR).
c. A more fulsome description of potential surface water impacts by modular BWRX-300 reactors and exactly how these effects will be monitored and mitigated. This description should go beyond the assessment of water temperature already included in EIS materials. i. This should also include references to studies mentioned in the EIS which were undertaken to assess impacts of changes in hydrology or surface water to specific terrestrial elements such as amphibians and reptiles, and their habitat (e.g. EIS section 5.3.4). We also request electronic copies of these studies themselves;	Potential surface water impacts resulting from the BWRX-300 deployment are detailed in Section 5.5.3 of the EIS Supporting Document. Potential effects to the terrestrial environment resulting from hydrological changes are detailed in Section 5.5.5 of the EIS Supporting Document. OPG has an Environmental Monitoring and Environmental Assessment Follow up (EMEAF) Program that details the monitoring or assessment activities to be undertaken to confirm the predictions of environmental effects.
d. A description of how other existing environmental monitoring plans for both radionuclides and non-radionuclides in liquid effluent, gaseous releases to air, and aquatic and terrestrial species would be integrated with measures specific to monitoring impacts of the modular BWRX-300 reactors. i. Note: It appears as though gaseous releases of iodine are greater for the BWRX-300 than other reactor technologies assessed in the 2009 EIS. How is this specific issue being addressed (e.g. mitigated) in OPG's plans for a BWXR-300 modular reactor?	OPG has an Environmental Monitoring and Environmental Assessment Follow up (EMEAF) Program that details the monitoring or assessment activities to be undertaken to confirm the predictions of environmental effects. The total emissions to the atmosphere from the BWRX-300 are lower than reactor technologies considered in the EIS. Although the assessment of atmospheric emissions of iodine are slightly higher in the report, the dose from iodine is low. It should also be noted that the Iodine values were calculated using Industry Standards (NEDO-10871) that assume a conservative number of fuel failures in the reactor.

	OPG Response
6. What measures would be undertaken to mitigate fish impingement and entrainment in BWRX-300 intakes? EIS Table 7 (p68) notes a "Once-through-cooling porous veneer intake has been designed specifically for reducing entrainment and impingement of fish. The intake incorporates design features based on fish behavioural principles and is also located offshore at depths which are less productive than inshore locations. The expected losses will be low relative to Lake Ontario populations". Is this true for the BWRX-300 design as well, and where could we find BWRX-300-specific evaluations of the potential for fish impingement and entrainment? If this information is available in studies, we request electronic copies of them. Further:	The requirements for the once-through cooling system and its ability to mitigate fish impingement and entrainment is independent of the reactor technology. OPG has updated the impingement and entrainment analysis for the BWRX-300 and has confirmed it is within the conclusions of the approved EIS as described in the EIS Review Report (NK054-REP-07730-00055)
a. To what extent, to date, has the Department of Fisheries and Oceans and possibly Environment and Climate Change Canada assessed the BWRX-300 design for compliance (including via permit) with the Fisheries Act?	The design of the once through cooling system is in progress. Applicable regulatory requirements will be complied with and addressed through applicable permits, including engagement with Fisheries and Oceans Canada and Environment and Climate Change Canada.
b. EIS Table 7 (p67) notes mitigative efforts in the Fish Habitat Compensation Plan to ensure a minor residual adverse effect. Where could more information be found on these measures, and can we access an electronic copy of this plan?	The Fish Habitat Compensation Plan is dependent on the once through cooling system design and shoreline protection. When the design is finalized the compensation plan will be developed to support the Fisheries Act Authorization application to the Department of Fisheries and Oceans (DFO).

	OPG Response
7. The EIS asserts impacts on terrestrial and aquatic VECs posed by the BWRX-300 modular reactor design would be less significant than those posed by reactor designs considered in the 2009 EIS. Can you provide specific information or data used to support these claims (either from a more detailed EIS support document, data collected from mitigative measures, or proposed or in-place monitoring plans that assess effects on VECs)?	Detailed descriptions of the potential impacts on terrestrial and aquatic VECS are found in Sections 5.5.5, 5.5.5 and 5.9 of the EIS Supporting Document. Terrestrial and aquatic VECs are included in the DNNP Environmental Monitoring and Environmental Assessment Follow up (EMEAF) plan to confirm the predictions of environmental effects identified in the environmental assessment and to determine the effectiveness of mitigation measures.

CATEGORY 3 – Clarifying 2022 EIS and PPE reports

We request additional clarity on the following portions of the 2022 EIS document:	OPG Response
8. Table 3 “Comparison of how energy is produced” (pp19, 20, 22): according to what criteria were BWRX-300 and 2009 EIS reactors designated to be “similar” in design despite the fact that “In the BWRX-300, the reactor coolant water and the feedwater are the same” while “In the EIS (Environmental Impact Statement), the reactor coolant water and the feedwater do not mix”.	The single or separate cooling loop does not impact any EIS conclusions. Furthermore, as shown in Section 4.0 of the EIS Review, the vast majority of BWRX-300 design parameters are within the original PPE values. The effects of those BWRX-300 parameters that fall outside of their respective PPE values were assessed and their effects remain consistent with the conclusions of the EIS.
9. Table 4 “Project works and activities” (p24): “mobilization and preparatory works” appear to be defined as largely “clearing, grubbing, services and utilities, and on-site roads and related infrastructure”. On this basis, the 19 ha area on which the BWRX-300 would be built was considered to constitute a “smaller footprint” than other reactor technologies considered in the 2009 EIS. Why was the deeper foundation embedment and related preparatory activities below ground, not included in the analysis of the construction footprint of the BWRX-300 in this table?	The footprint refers to the surface area of the facility. The deeper foundation embedment has been assessed separately in Section 4.1.2 of the EIS Review.
10. Table 6 “Summary of residual adverse effects and relevant VECs”: certain cells in this table are highlighted in pink with a note that “pink shades indicate that there is potential for a Residual Adverse Effect from BWRX-300 deployment that is different than that described in the EIS OR was not considered in the EIS”. However, all the columns in the shade of pink then conclude: “Residual adverse effect not considered in the EIS”. Can OPG provide more clarity on the rationale behind these decisions? a. Use of the qualifying words “potential” and “some” relating to environmental effects are imprecise and indicate some uncertainty. Will further clarity and verification happen in a future follow-up monitoring program, or before then? b. Relating to potential effects on habitat and species conservation associated with the deployment of modular BWRX-300 reactors, could you provide some clarity around which effects were anticipated to be less significant and which were not considered in the EIS?	The reactors considered in the EIS required a much larger footprint, hence the removal of all terrestrial habitats on the DNNP site were assumed in the EIS and their residual adverse effect did not need to be considered at that time. The BWRX-300 requires a smaller footprint, as such opportunities to preserve some terrestrial habitats exist but need to be explored to confirm the feasibilities of such reservation and the potential residual adverse effect. Where it was noted that further study was required to assess effects to habitats that may be retained due to the smaller scale of the DNNP, these studies have been completed since the completion of the EIS review report and are reflected in the EIS Review Supporting Document NK054-REP-07730-00058.
11. Section 5.3.14 (p64) notes a decline in bank swallow burrows since 2008. How would future monitoring differentiate between this ongoing decline and impacts specific to the installation of BWRX-300 modular reactors? a. Further, if the loss of nesting habitat exceeds the 1000 burrow threshold, how could the potential contribution of BWRX-300 reactor operations to this trend be defined?	As noted in the question, the decline of bank swallow burrows is well documented. Natural forces, such as groundwater and erosion, constantly erode the face of shoreline embankments and effect habitat contained within them. (EIS section 8.4.3 (NK054-REP-07730-00029). The DNNP environmental monitoring and EA follow-up program details the monitoring to verify predictions of the environmental effects identified in the environmental assessment, and to determine the effectiveness of mitigation measures. This includes monitoring for

b. What plans have been developed to mitigate decreasing groundwater flow to the bluffs that would disrupt bank swallow habitat?	effects on bank swallows. This EIS Review concluded that the EA follow-up and monitoring programs remain suitable for BWRX-300 deployment. OPG continues to monitor the Bank Swallow colonies on an annual basis at both the Bank Swallow Evaluation Area which includes the Darlington site, as well as a reference location at Bond Head bluffs. As bank Swallows and their habitat are protected under the provincial Endangered Species Act, measures to mitigate impacts to Bank Swallows from the Project will be addressed through an Endangered Species Act (ESA) permit issued by the Ministry of Environment, Conservation, and Parks, as applicable. Any effect on groundwater during the construction is expected to be temporary.
12. EIS Table 7 (p81) notes "Five (5) residual adverse effects have been identified that require additional studies. These residual adverse effects were not considered in the EIS and are anticipated to be not significant. 1. On-site Aquatic Habitat (ponds, intermittent tributaries to Darlington Creek and to Lake Ontario, Darlington Creek, 2. VECs in the Cultural Meadow and Thicket Ecosystem,3. Wetland and Woodland Ecosystems, Rare Plant Species, Amphibians and Reptiles, Insects – Dragonflies and Damselflies, Mammal communities and species, 4. Bank swallows, 5. Bats". Since these conditions were not considered in the EIS, what is the status of the assessments? Are these studies a part of the environmental assessment follow up monitoring program and will these assessments be completed before any BWRX-300 licensing hearing before the CNSC?	Additional studies on groundwater, hydrology, noise, dust, and vibration (from blasting) were completed following the submission of the EIS Review Report. The results of the studies are provided in the EIS Review Supporting Document and confirm that any residual effects do not alter the conclusion of the EIS.
13. EIS Table 4 (p25) notes, "For BWRX-300, the water intake and the discharge pipes will be sized for four reactors. The discharge pipe includes a series of diffusers from which the water is discharged to promote rapid thermal mixing in the lake". This statement raises the question of heat rejection to lake water, but a more detailed discussion of this aspect is not in the EIS. If the reliance of BWRX-300 on once-through cooling water for both primary and secondary cooling alter the overall need of water from lake, what could the impacts of rapid thermal mixing of discharge water be, and what are the advantages of choosing a design that would not use atmosphere as the ultimate heat sink? Further what will the actual size of BWRX-300 discharge pipes be? We understand they have been designed with the capacity to function for 4 modular reactors at the Darlington site.	The EIS considered both atmosphere (cooling tower) and lake water (once through cooling) as a heat sink. OPG has completed commitment D-C-1.1 to conduct a Best Available Technology Economically Achievable (BATEA) assessment for once through cooling and mechanical draft cooling towers, which concluded a once through cooling system was the BATEA technology. The CNSC accepted that this assessment addressed the Joint Review Panel action and closed the commitment. OPG has updated the thermal plume analysis for the BWRX-300 and has confirmed it is bounded by the approved EIS as mentioned in the EIS Review Report (NK054-REP-07730-00055). The current design of the discharge tunnel is approximately 6m in diameter. The diffusers are approximately 60cm in diameter.

We request additional clarity on the following portions of the 2022 PPE document:	OPG Response
14. B1.1, Table 1 points 1.2.1 and 1.4.1: what climate change model (if any) is being used to predict probable maximum precipitation (PMP)? What are the worst-case scenarios being used and how will the PMP accommodate heavy rainfall or potential flash flood events?	The PMP value in the PPE is taken from Table A.4 in Appendix A of the Lakes and Rivers Improvement Act Technical Guidelines (OMNR, 2004). The values provided in Lakes and Rivers Improvement Act Technical Guidelines do not incorporate any climate change modelling to OPG's knowledge. However, the value for PMP selected for the DNNP site is considered by OPG to be conservative even when accounting for potential effects of climate change. As part of commitment D-C-7 (see NK054-REP-01210-00078, DNNP Commitments Report), OPG has undertaken a systematic approach to assess the resiliency of the proposed facility against the effects of climate change. OPG has assessed projected future conditions for the site, to the extent practical, using regional downscaled multi-model ensembles constructed from several global climate models (GCMs). OPG has assessed data from these models for two Representative Concentration Pathway (RCP) scenarios, RCP4.5 and RCP8.5. The results of these assessments have shown that the predicted extreme rainfall amounts for a 12-hour period are projected to be well below the OPG PMP identified in the PPE for both RCP4.5 and RCP8.5. OPG has used the PMP value along with other data to conduct a Flood Hazard assessment of the facility for a variety of extreme and combination of extreme events. The results of these assessments are summarized in Chapter 2 Section 2.5 Hydrology in the Preliminary Safety Analysis Report (PSAR).
15. B1.3, Table 3, points 1.2.2: Can more analysis be provided to support how valid and conservative anticipated maximum estimates of snow and ice loads are for the root of the building housing the BWRX-300 modular reactor(s)?	Table 3 parameter 1.2.2, snow and ice load, shows the limiting value (3 kPa), limiting reactor (EC6) and the Darlington site characteristic (2.2 kPa from the NBCC). The BWRX-300 is not the limiting reactor for this parameter. The BWRX-300 will follow the appropriate codes and standards for roof design for the applicable site snow load.
16. B1.3, Table 3, points 1.4.1 and 1.4.2: Can OPG clarify what is meant by the comment, "This is a design assumption, rather than a site characteristic" relating to maximum groundwater and maximum flood descriptions?	The phrase is noting that the parameters are a simplifying assumption rather than a specific modeled site characteristic. In the example, 1.4.2 'maximum groundwater' is simplified to a conservative limiting value of –1m from plant grade.
17. B1.3, Table 3, points 4.1., 14.1.1, and 14.1.3: it is noted at these points that wet bulb (WB) temperature is not a limiting temperature. Is this explained by the phrase elsewhere that "Wet bulb temperature values are not normally collected as part of standard meteorological monitoring at the Darlington station and thus do not exist specifically for the Darlington site"? If so, why is this explanation not included in points 4.1., 14.1.1, and 14.1.3?	The quoted statement (from parameter 2.1.2) is noting the source of the wet bulb temperature used for that site characteristic. The note for other parameters, which are dry bulb temperatures, is noting that the wet bulb is not limiting to the shown dry bulb value.
18. B1.4, Table 4: for all PPE parameters for which the "where used" column notes either the N/A or "not used in EIS or Site Evaluation Studies", can OPG explain the rationale for this	The PPE was developed consistent with the Nuclear Energy Institute (NEI) guidance on a PPE. The initial version of the PPE was also developed in parallel with the Environmental Impact Statement (EIS) and Site Evaluation (SE) work.

designation? How is the exclusion of these PPE parameters justified, e.g. on the basis of redundancy, non-requirement by the CNSC or other technical reasons like prorated values? Further, how are these exclusions consistent with the criteria described in section B3.2 “Limiting factors to environmental impact”? a. For this same table, there are a few places in column 2 where it notes that values of PPE parameters are prorated (Y), but in column 4 exactly the same values are provided for both the single unit and the prorated value (e.g., see points 7.3.1, 9.3.2, 12.3.3). How can these same values be explained? b. In column 5 of the same table “where used”, can you clarify if the prorated values of the PPE parameters were used for EIS and SES wherever applicable (e.g., see points 2.4.15, 2.5.15, 2.6.2, 9.5.1, 9.5.3, 10.3.1, 10.3.2, 13.4, 16.1.1 and more). c. Several places (e.g., see points 9.3.1, 9.3.2, 11.2.3, 12.4.3, 16.1.3, 16.1.4 and 18.4) note in the last column that “this PPE value was considered but not used in the assessment”. Can you provide rationales that support this choice?	Upon review of the completed EIS, SE and supporting documents, it was confirmed that several parameters were not used in these documents and had no impact on the environmental effects and conclusions. It was decided to note these parameters as “Not used in EIS or Site Evaluations studies” but maintain them in the PPE. Section B3.2 illustrates some types of parameters which are limiting factors to Environmental Impact. Answers to bullets as follows: a. For several parameters it would be contrary to the applicable regulations to prorate the parameter. For example, parameter 9.3.2 is a CNSC dose limit and would be applicable to the licensed facility. b. All prorated values were used in the EIS and SE as noted in the “where used” and “how used” columns. c. When conducting the review mentioned above, several parameters were mentioned in the EIS but not used in the assessment of environmental effects. This note was used for parameters that met this criteria.
19. B1.3, Table 3 “Site parameters and Darlington characteristic values, composite table”: why is there no information on the BWRX-300 modular reactor design in this table? In the absence of BWRX-300-specific data, how can the data in this table be used for a safety assessment of the BWRX-300 design? a. From the table it can be noted that if a reactor’s design technology is to be rated based on the number of citations as a “limiting reactor” the descending order would be EC6 < EPR < ACR-1000= AP-1000. When selecting a certain design technology, how are “limiting reactor” citations handled? How would the BWRX-300 design compare with these other four designs in the absence of information or data to ascertain the limiting reactor for several PPE parameters?	Each parameter is defined as a minimum or maximum value. The parameter value and limiting reactor is assigned based on the maximum or minimum value for all reactor technologies under consideration. The other reactor technologies will be bounded by that limiting reactor. The BWRX-300 does not appear in Table 3 as a limiting reactor, as it was not the bounding value for any of the site characteristics presented in this table.
20. B1.4, Table 4 “Consolidated PPE Parameters, their values, where used, and how used”: the BWRX-300 modular reactor is cited least frequently as the “limiting reactor” for 5 PPE parameters (1.1.2, 7.1.1, 7.1.3, 9.4.2 and 17.1.2). Do fewer citations indicate non-availability of data? If so, how does this affect the comparison of the BWRX-300 modular reactor design with other designs in the EIS or SESs?	Any parameter where the BWRX-300 was the limiting technology was updated to reflect the new value and the limiting reactor updated to the BWRX-300.