



## **Supplementary Information**

### **Written submission from the Nuclear Transparency Project**

In the Matter of the

#### **Ontario Power Generation Inc. - Darlington Waste Management Facility**

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Application to Renew the Class IB Waste  
Facility Operating Licence for Ontario Power  
Generation in Darlington, Ontario

**Commission Public Hearing**

**January 26, 2023**

## **Renseignements supplémentaires**

### **Mémoire du Nuclear Transparency Project**

À l'égard de

#### **Ontario Power Generation Inc. - Installation de gestion des déchets de Darlington**

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Demande de renouvellement du permis  
d'installation de déchets de catégorie IB pour  
Ontario Power Generation à Darlington  
(Ontario)

**Audience publique de la Commission**

**26 janvier 2023**



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Submitted by email

January 18, 2023

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

Re: Supplemental submissions from NTP relating to Ontario Power Generation's request to relicense the Darlington Waste Management Facility

Thank you for this opportunity to submit supplemental recommendations for your consideration in this matter.

Our original submission has been included below without amendment. Two appendices have then been added to the end of these original submissions: the first is just over two pages long and contains additional recommendations to improve the quality of publicly-available groundwater monitoring data, and the efficacy of surface water monitoring. The second appendix contains a summary of information requests we have made to OPG and their responses to date. This appendix has only been provided as a reference for those who may be interested, for transparency purposes. We will continue to follow up with OPG on outstanding requests after next week's public hearing in order to deepen our understanding of the Darlington site with the hope that this work will inform interventions we may make concerning the site in future regulatory reviews.

With much appreciation for the Commission's accommodation and OPG's time and cooperation throughout,

Pippa Feinstein, JD LL.M.  
Coordinator, NTP



nuclear  
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Submitted by email

December 5, 2022

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

Re: Ontario Power Generation’s request to relicense the Darlington Waste Management Facility

We would like to begin by thanking the Commission for this opportunity to provide comments on this relicensing application. 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 responding to our ongoing information requests and for meeting with us last month to discuss their application.

This intervention concerning the Darlington Waste Management Facility (DWMF) 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 hydrogeologist Dr. Ekaterina Markelova and environmental toxicologist Dr. Shamaila Fraz.

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

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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 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 relicensing application

The Darlington site is subject to two licences granted by the Canadian Nuclear Safety Commission (CNSC):

Darlington Nuclear Generating Station (DNFS)	Darlington Waste Management Facility (DWMF)
<i>electricity generating</i> operations which include managing: <ul style="list-style-type: none"><li>- the reactors;</li><li>- once-through cooling system, and</li><li>- used fuel bays.</li></ul>	<i>storage of waste</i> in warehouse-type buildings. This waste is primarily: <ul style="list-style-type: none"><li>- High Level Waste (HLW): used fuel that has been cooled for at least a decade in the generating station's used fuel bays.</li><li>- Intermediate Level Waste (ILW): miscellaneous waste resulting from ongoing refurbishment work of Darlington's reactors).</li></ul>

OPG is also in the process of applying to construct new reactors at the Darlington site. The review process for this application has just begun. If approved, these new reactors would be governed by a separate licence, granted by the CNSC.

In its relicensing application for the DWMF, OPG is requesting the ability to continue to operate the DWMF as well as permission to construct two additional storage buildings with the capacity to store double the quantity of waste. It is also requesting that any new licence for its facility reflect a name change from 'Darlington Waste Management Facility' to 'Nuclear Sustainability Services'.

Two of Darlington's four reactor units have been refurbished. Refurbishment of the third unit has begun, and the fourth unit's refurbishment is yet to be undertaken. The waste these refurbishments produce is partly responsible for the added storage capacity that is being requested.

Waste is being stored at the DWMF until a long-term repository is constructed to hold these wastes permanently. Current planning assumes a deep geological repository (DGR) will be built and a host community for such a facility is currently being sought. With this process still ongoing, it is unknown how long wastes are likely to remain on the Darlington site, though it will likely be for many more years.

### Concerns relating to transparency in public communications

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, 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 the use of 'sustainability' language in describing waste at the Darlington nuclear site. Here, NTP cautions against the exclusive use of 'sustainability' as a framework for understanding OPG's nuclear waste management practices. The second area relates to the public communication of environmental monitoring and sampling results at the Darlington site. Here, NTP has prepared a list of recommendations to assist both OPG and CNSC staff to better communicate environmental monitoring plans, the data this monitoring generates. Nuclear site like Darlington are large and complicated. Being clear about how their impacts to the local environment are known and managed helps members of the public to both better understand existing conditions at the site, and contribute their expertise to ensure management is adequately protective.

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

1) Concerns over the use of a ‘sustainability’ framework for characterizing nuclear waste

In its application, OPG states that it believes “‘nuclear waste’ is a term with negative associations in the public mind”.<sup>1</sup> The company argues this term is “inaccurate” if used to describe the substances stored at its DWMF, since it believes some of these substances are “clean, recyclable, and valuable” (e.g. the copper, steel, heavy water, and medical isotopes on site).<sup>2</sup>

CNSC staff accept this language-shift, arguing “the name of the facility has no impact on regulatory activities”.<sup>3</sup> They argue the name change is “administrative” only and that it “has no impact on the activities authorized in the licence or CNSC regulatory oversight of the waste management facility”.<sup>4</sup>

The ‘Darlington Waste Management Facility’ is a name that clearly describes what is on site: namely, nuclear waste being stored and managed. The new name ‘Nuclear Sustainability Services – Darlington’ obscures OPG’s activities and frustrates public awareness of what is being held on site and how it is being managed. NTP strongly objects to the use of ‘sustainability’ language in this way, as we argue below. We urge the Commission Tribunal to discourage this move by OPG. We also request that OPG’s name change for the facility not be reflected in any licence the Commission Tribunal may grant.

NTP cautions against OPG’s narrative for the following reasons. First, not all materials held in the DWMF can be recycled – even by OPG’s admission. If the ‘sustainability’ of OPG’s waste management relies on the company’s ability to recycle its waste, and not all of its waste can be recycled, the name change promotes a misinformed public perception that all these wastes can be recycled.

Second, recycling itself is a type of waste management – not separate from it. Recycling does not return waste substances to their respective original sources. Rather, recycling processes generate their own products, by-products, and waste. Transparency requires these additional waste streams to be proactively managed as well as recognized and explained in regulatory documents and public communications.

Third, NTP cautions against the use of ‘sustainability’ as a euphemism that generally obscures the transparent and accurate characterization of nuclear wastes and by-products resulting from fission processes. Wastes are produced at all steps along the nuclear fuel chain and an honest and accessible description of these wastes is required

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<sup>1</sup> Written Submission from OPG re: “Application to Renew Class IB Waste Facility Operating licence for Ontario Power Generation in Darlington, Ontario”, CMD 23-H9.1, at pp 2-3, online:

<https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD23/CMD23-H9-1.pdf>.

<sup>2</sup> *Ibid.*

<sup>3</sup> Written submissions from CNSC Staff re: “Application to Renew Class IB Waste Facility Operating licence for Ontario Power Generation in Darlington, Ontario”, CMD 23-H9, at p 7, online:

<https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD23/CMD23-H9.pdf>.

<sup>4</sup> *Ibid* at p 78.

to ensure industry and regulatory transparency. If members of the public have ‘negative associations’ with ‘nuclear waste’ as a term, it is likely due to associations with instances in which this waste has been poorly managed in the past, legacy wastes in many communities that are still in need of remediation, and the challenges posed by long-lived radionuclides in contaminated areas. Such associations are best addressed with clear and comprehensive waste management practices, not by rebranding facilities in a way that minimizes these ongoing challenges. Transparency requires the avoidance of euphemisms.

Finally, OPG’s rebranding effort appears to be an attempt to reinforce the company’s belief that nuclear energy is a “clean energy” and necessary for net-zero climate action. However, the desirability of nuclear energy as a source of electricity (now and in the future) is a contentious one that requires open, equitable, and informed public discussion, consideration, and reflection. Debates are ongoing and animated by wide-ranging and diverse values and visions for Canadian society and its economy. This extends to the relationship between nuclear energy and sustainability, which is also complex and contentious. By changing the DWMF’s name, OPG is pre-emptively attempting to curb this important debate, silence or marginalize dissenting views, and present the ‘sustainability’ of nuclear energy (and nuclear waste recycling) as a matter that has been settled.

By accepting this name change, and refusing to consider the significance of this messaging, CNSC staff threaten to perpetuate OPG’s troubling narratives above on behalf of the regulator. NTP cautions against CNSC staff adoption or support for this change, as to do so would be inconsistent with its enabling legislation. Section 9(b) of the *Nuclear Safety and Control Act* notes the CNSC’s objects (i.e. purposes) include

“to disseminate objective scientific, technical and regulatory information to the public concerning the activities of the Commission and the effects, on the environment and on the health and safety of persons, or the development, production, possession and use of nuclear energy and the production, possession, and use of nuclear substances”.<sup>5</sup>

Continued reference to OPG’s facility as one that manages nuclear waste better meets CNSC staff’s obligation to ensure an informed public and ensures their nuclear regulation remains within the CNSC’s legislative mandate.

Ultimately, OPG is seeking to renew a “waste operating licence” for the DWMF. The name of this type of licence cannot be changed because the activities associated with this site are considered to constitute ‘waste management’ under Canadian regulatory frameworks. The facility’s name should be consistent with its licensed activities, and CNSC staff should preserve this consistency.

*Recommendation 1: that CNSC staff and the Commission Tribunal discourage OPG’s renaming of its DWMF and not adopt this name change in its own regulatory documents.*

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<sup>5</sup> *Nuclear Safety and Control Act*, SC 1997, c 9, at s 9(b), online: <https://laws-lois.justice.gc.ca/eng/acts/n-28.3/FullText.html>.

## Need for clearer public communications relating to environmental reporting

NTP is currently preparing a series of recommendations to improve the public communication of environmental monitoring plans and data for the Darlington site. Our recommendations also identify some potential data gaps in existing plans. Rather than produce all of our draft recommendations here, we provide the more general ones at this time. We hope to get additional information from OPG to confirm the information we are using, and our assumptions are correct for our more specific recommendations. We are doing this to help ensure against any misinformation on the record in these proceedings, and to respect our ongoing communications with OPG.

NTP's experts have been diligently working on their reviews since the organization received confirmation of funding for this process, and they began their communications with OPG proactively even before the finalized application and CNSC staff CMD was made available. Further, OPG has been providing information in a timely manner. Still, more time is required to provide these technical recommendations, and they will be shared in supplemental submissions to the Commission Tribunal in advance of the January 18, 2023 deadline for supplemental submissions for the public hearing for this matter.

### 1) Access to raw data

Several graphs and data visualizations are not easily legible in current formats used in OPG's environmental monitoring reports. Including the raw data relied on for the graphs in excel or other machine-readable formats as attachments to its reports will better facilitate the understanding and interpretation of OPG's data by members of the public.

*Recommendation 2: that OPG proactively share disaggregated environmental monitoring data with the public in machine-readable formats (preferably excel spreadsheets).*

### 2) Groundwater monitoring frequency

OPG has explained monitoring frequency of groundwater wells is determined each year according to a risk analysis. This means that wells with higher measured contamination concentrations are measured more frequently than those displaying lower concentrations of contaminants. Greater transparency of how these risk calculations are made each year is required and should be included in OPG's annual groundwater monitoring reports.

*Recommendation 3: that OPG provide its risk calculations and consequent adjustment of its sampling schedule in its annual groundwater monitoring reports.*



### 3) Event reporting

Public notices of planned and unplanned release events from the Darlington site should link to copies of CNSC and/or provincial Ministry of the Environment, Conservation, and Parks (MECP) reports filed with those respective regulatory authorities. Otherwise, public notices of events should at least contain:

- a. the date and time the release event began and when it ended,
- b. the estimated or measured release volume and concentration of each known or suspected contaminant released,
- c. remediation measures taken and their expected success,
- d. predicted or measured ecological impacts of the release, and
- e. follow-up measures taken to address potential or identified effects and/or ensure against the reoccurrence of a similar event.

*Recommendation 4: that the CNSC require that OPG's public notices of planned and unplanned release events from the Darlington site link to copies of CNSC and/or provincial Ministry of the Environment, Conservation, and Parks (MECP) reports filed with those respective regulatory authorities. Or, that the CNSC require that OPG's public notices of events at least contain:*

- a. the date and time the release event began and when it ended,*
- b. the estimated or measured release volume and concentration of each known or suspected contaminant released,*
- c. remediation measures taken and their expected success,*
- d. predicted or measured ecological impacts of the release, and*
- e. follow-up measures taken to address potential or identified effects and/or ensure against the reoccurrence of a similar event.*

### Concerns over the requested licence length

Years ago, when relicensing hearings first started to introduce extended 10-year licence terms for CNSC-regulated nuclear facilities (as opposed to the usual two to five-year terms that preceded them), civil society organizations unanimously opposed this trend, and have continued to do so consistently since then.<sup>6</sup>

CNSC staff have regular contact with licensees between licence renewal proceedings to inspect facilities, verify compliance with regulations and licence terms, and amend Licence Condition Handbooks as required. Whereas civil society organizations have few supported opportunities to engage with licensees or CNSC staff on matters of regulatory

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<sup>6</sup> For an overview of concerns over less frequent licence hearings, see for example: Lake Ontario Waterkeeper and Ottawa Riverkeeper, Written Submission in the Matter of SRB Technologies, 15-H5.2, online (by request): [http://nuclearsafety.gc.ca/eng/the-commission/hearings/documents\\_browse/results.cfm?dt=14-May-2015&yr=2015&pedisable=true](http://nuclearsafety.gc.ca/eng/the-commission/hearings/documents_browse/results.cfm?dt=14-May-2015&yr=2015&pedisable=true). For concerns relating to licenses and democratic process, see for example: Greenpeace Canada, Oral Presentation In the Matter of Bruce Power Inc. – Bruce A and B Nuclear Generating Station, CMD 18-H4.99, online: <http://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD18/CMD18-H4-99.pdf>, p 2.

oversight. Licensing and relicensing hearings are the most procedurally robust mechanism for this kind of public engagement and offer the most capacity support (including access to information and funding).<sup>7</sup>

There are currently no substitute processes for these licensing and relicensing hearings. Public interest organizations have long stressed that Regulatory Oversight Report (ROR) meetings cannot compare procedurally with facility-specific licensing or relicensing hearings, held in local host communities. Further, in recent years, civil society organizations have generally not been invited or permitted to make oral submissions before the Commission during ROR hearings. As such, licensing and relicensing hearings provide the most significant existing opportunities for members of the public and public interest organizations to engage in two-way dialogue with nuclear licensees and the regulator. Finally, the future of ROR proceedings are currently uncertain as there is an ongoing regulatory review process under which they may potentially be redesigned.<sup>8</sup>

Proactive public disclosure of periodic regulatory reports (such as Probabilistic Safety Assessments, Environmental Risk Assessments, Preliminary Decommissioning Plans and other) do not provide supported avenues for public feedback, nor can they facilitate structured two-way communication between the public, regulators, and licensees. As such, like ROR proceedings, they should not be considered adequate alternatives to licensing and relicensing hearings. As such, NTP recommends that if any licence is renewed for the DWMF, that the length of its term not exceed five years.

*Recommendation 5: that if any licence renewal is granted for the DWMF, its licence term not exceed five years.*

### Concerns with the current CNSC review process

#### 1) Indigenous jurisdiction and the CNSC's regulatory context

NTP recognizes the sovereignty and jurisdiction of the Indigenous Nations on whose land the Darlington facility 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 these facilities 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

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<sup>7</sup> NTP recognizes Indigenous Nations have their own preferences and requirements with regard to engagement and nuclear decision-making. NTP supports Nations' inherent rights to determine the nature and extent of these processes for themselves.

<sup>8</sup> Canadian Nuclear Safety Commission: Regulatory Oversight Report Review, Discussion Paper, April 2021, online: [https://www.nuclearsafety.gc.ca/eng/pdfs/Discussion-Papers/21-01/Discussion\\_Paper\\_DIS-21-01\\_The\\_Canadian\\_Nuclear\\_Safety\\_Commission\\_Regulatory\\_Oversight\\_Report\\_Review.pdf](https://www.nuclearsafety.gc.ca/eng/pdfs/Discussion-Papers/21-01/Discussion_Paper_DIS-21-01_The_Canadian_Nuclear_Safety_Commission_Regulatory_Oversight_Report_Review.pdf).

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) The need to coordinate multiple Darlington licences

There are multiple overlapping licences and licence review processes for the Darlington site: the current DWMF relicensing process, an upcoming Darlington Nuclear Generating Station (DNGS) relicensing process before that licence expires in 2025, the current regulatory review process being initiated for the Darlington New Build, and the recent hearing conducted in writing this past September for OPG's consolidated guarantee. Some formal institutionalized process by which all these interdependent licences can be considered in relation to one another is crucial, yet missing.

The DWMF does not have a separate environmental monitoring program or separate financial guarantee from those set for the DNGS. As such, both facilities should be assessed together: they effectively rely on much of the same evidentiary basis for potential renewal. Similarly, any consideration of new build reactors for the Darlington site will have to consider the wastes that will be produced by these smaller reactors and how (or whether) they will be managed at the DWMF.

NTP recommends the Commission Tribunal include provisions in its Record of Decision, or that CNSC staff include provisions in licences for Darlington facilities, that allow for cross-referencing between facilities' licences and programs at the Darlington site. This should explicitly include the ability to amend Darlington licences in hearings for any one of the facilities at the site to ensure licence terms remain consistent between facilities and that the Darlington site is regulated in a holistic way.

*Recommendation 6: that the Commission Tribunal or CNSC staff take measures to ensure that each of the upcoming Darlington hearings (DNGS relicensing and New Build) allow for potential amendments to any new licence the DWMF may receive, and that measures will be taken to ensure the consistency in terms between all three licences and any other CNSC licences governing the Darlington site.*

## 3) Insufficient time for this intervention

OPG's licence application was submitted to the CNSC on December 10, 2021. A PFP notice was posted online July 21, 2022 and sent to those on the CNSC's listserv on July 26. The PFP application deadline was set for August 19 and NTP received an offer of funding on September 29. OPG's finalized application and CNSC staff's evaluation of it was provided to intervenors by email on October 28, 2022. Final written submissions were originally due November 28, but later extended to December 5, 2022 with no reasons given for what precipitated this change. While we appreciated this extension, NTP's experts still have not had enough time to prepare these interventions and are still in the process of engaging with OPG in relation to ongoing information requests.

We understand once the application from OPG was received by CNSC staff in 2021, staff put together an internal CMD to outline a process by which the application would be heard, as is their usual procedure. NTP argues public input and a notice for PFP applications should also have been posted and sent via the Commission's listserv at this time - with the assumption that intervenors could have received an additional few months of preparation time this way.

NTP's network of contributors work full-time, and their consultation with NTP is in addition to their full-timework, family/care, and community commitments. This is likely true to the majority of intervenors in CNSC proceedings: whether salaried staff or volunteer members of other civil society organizations, short notice and short timeframes for preparing interventions work to frustrate intervenors attempts to provide the quality analysis we are funded to contribute to these processes.

These short timeframes deny intervenors sufficient time to properly rearrange their schedules to ensure they can meet these short deadlines for often very complex facilities. They deny intervenors the ability to review, digest, and reflect on the original applications, CNSC staff comments, and additional research as required – often amounting to hundreds of pages of demanding technical material. The short timeframes make the information request process highly stressful, and can effectively limit their use.

*Recommendation 7: that submission timeframes are extended for public interventions by initiating the PFP process sooner after receiving initial licensee applications.*

## APPENDIX 1

There are two categories of additional recommendations NTP would like to submit for the Commission Tribunal's consideration: the first category relates to groundwater monitoring; the second relates to surface water quality monitoring.

### Groundwater

There are three types of data analysis that would increase public understanding and the usability of OPG's publicly available groundwater data: standard deviation, regression analysis, and calculating normalized means. OPG has indicated some of this analysis may already be conducted at the Darlington facility. However, NTP notes such analyses are not included in publicly available materials. As such, we recommend that OPG regularly conduct these analyses for all groundwater monitoring data, and ensure they are shared proactively and regularly with the public in annual groundwater reports for the Darlington site.

*Recommendation 8: that OPG routinely perform Standard Deviation (SD) analysis (i.e. plotting or calculating SD) of its tritium monitoring data.*

*Recommendation 9: that OPG routinely perform Regression Analysis (RA) of its groundwater monitoring data in order to identify temporal trends over time.*

*Recommendation 10: that OPG routinely 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's groundwater monitoring program could also be upgraded by measuring more comprehensive parameters both *in-situ* and in the analytical lab. OPG has noted that 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, when possible. For consistency, NTP recommends the following be routinely and consistently sampled at all monitored wells: pH, Eh, T, Dissolved Oxygen, Electric Conductivity, Total Dissolved Solids. These parameters are simple and inexpensive to monitor *in-situ* and can quickly indicate potential water intrusion and contamination. Routine monitoring of these parameters could also provide effective quality checks of tritium monitoring results ensuring against possible misinterpretation of tritium results.

*Recommendation 11: that OPG routinely sample for pH, Eh, T, Dissolved Oxygen, Electric Conductivity, and Total Dissolved Solids in groundwater monitoring wells.*

Finally, groundwater composition monitoring could include more geochemical data for other non-radiological contaminants. According to international best practices, tritium monitoring should be accompanied by basic analyses of water composition.<sup>9</sup> This

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<sup>9</sup> See: Sten Berglund and Tobias Lindbord, eds, Swedish Nuclear Fuel and Waste Management Co, Technical Report, TR-15-01 <https://www.skb.com/publication/2489674/TR-15-01.pdf>.

additional analysis can produce a deeper understanding of groundwater behaviour over time, and ultimately help to develop more detailed groundwater mixing models and predict contaminant pathways. Again, these additional parameters are significantly less costly to monitor than tritium. Thus, while these lists may appear long, measures would be relatively inexpensive and provide a deeper understanding of groundwater conditions and trends.

*Recommendation 12: that OPG upgrade groundwater monitoring program by analysing major constituents such as: Na, K, Ca, Mg, Si, Li, Sr, Cl, SO<sub>4</sub>, Br, and HCO<sub>3</sub>.*

#### Surface water

The lake water bordering the Darlington site is dynamic and impacted by a variety of natural and industrial conditions. OPG should better take into consideration the fact that high concentrations of cations in local lake water (Ca and Mg) can later cause water hardness which may change the toxicity of other metals present and released into surface water. For reference, Table A-11 of the Darlington Nuclear Generating Station's 2020 Environmental Risk Assessment (ERA) shows concentrations of Ca and Mg as 62,100 and 11,400 µg/L.

*Recommendation 13: CNSC staff and OPG should consider whether effluent release limits account for high concentrations of cations in receiving lake water.*

Monitoring parameters for lake water can also be expanded. In particular, periodic measurements should be made of hydrazine in effluent and surface water. Further, releases of hydrazine and ammonia are not steady or uninterrupted. Rather they are released in periodic "pulses". As a result, monitoring of these substances should occur in a way that ensures samples are taken at times that coincide with these release pulses.

*Recommendation 14: hydrazine and ammonia should be monitored to coincide with release pulses of these substances.*

The following substances should also be included in Darlington's environmental monitoring plans: hydrazine in CCW effluent for Human health, monitoring of lake water for ecological health (including total ammonia, total unionized ammonia, field pH, suspended solids, total Ba, Ca, Mg, Zn) and screening of CCW effluent and storm water for ecological health.

*Recommendation 15: OPG's environmental monitoring plan should include hydrazine in CCW effluent for Human health, monitoring of lake water for ecological health (including total ammonia, total unionized ammonia, field pH, suspended solids, total Ba, Ca, Mg, Zn) and screening of CCW effluent and storm water for ecological health.*

Finally, more frequent monitoring of pond water would be protective of the local area as these could be small ecosystems that are permanent or temporary and could be significantly affected by potential contaminants in storm water from the Darlington site. Lake Ontario water sediment should also be examined more regularly for ecological

health, as it can constitute a pathway for potential contaminants of concern including heavy metals and legacy PAHs.

*Recommendation 16: local pond water and sediment in Lake Ontario should be monitored more regularly to get a more fulsome understanding of local ecosystem health.*

## APPENDIX 2

First round of Information requests:

	<b>NTP Questions sent October 27<sup>th</sup>, 2022</b>	<b>OPG Responses</b>
1.	Copies of annual groundwater monitoring program reports between 2015 – 2017 and 2021	Provided on Nov. 2, 2022
2.	Copies of Environmental Monitoring Program (EMP) reports for the Darlington site from 2018 and 2021	Report provided Nov. 11, 2022
3.	A copy of the current version of the Environmental Monitoring Plan (EMP) for the Darlington site	After email correspondence to clarify request, Environmental Manual for the Darlington site provided Nov. 14, 2022
4.	Copies of stormwater and foundation drainage monitoring results from the last 3 years (either via summary reports or raw data)	Data posted regularly online, OPG clarified monitoring parameters Nov. 11.

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Meeting then held between Pippa Feinstein (on behalf of NTP) and Raphael McCalla and Ali Esmaeily (on behalf of OPG), November 21<sup>st</sup>, 2022.

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Second round of Information requests:

	<b>Questions sent December 6, 2022</b>	<b>OPG Responses, received January 17, 2023</b>
1.	Copy of OPG's Design Manual (this was mentioned during our meeting as the best	[NTP awaiting response]



	source for calculations and methodologies OPG uses to implement CSA standards N288.1 and 288.4 at the Darlington site)	
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 (indicating catchments and identifying connections to on-site ponds)	[NTP awaiting response]
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	OPG: Refer to answer for question 5.

	order to identify temporal trends over time?	
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: <ul style="list-style-type: none"> <li>a. pH</li> <li>b. Eh</li> <li>c. T</li> <li>d. Dissolved Oxygen</li> <li>e. Electric Conductivity</li> <li>f. Total Dissolved Solids</li> </ul> If any of these parameters are monitored, what is their frequency? Are measurements made in-situ?	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 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: <ul style="list-style-type: none"> <li>a. Na</li> <li>b. K</li> <li>c. Ca</li> <li>d. Mg</li> <li>e. Si</li> <li>f. Li</li> <li>g. Sr</li> <li>h. Cl</li> <li>i. SO4</li> <li>j. Br</li> <li>k. HCO3</li> </ul> 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.	<p>How often does the collection and processing of condensate for the reactor building occur? Does it occur on a regular cycle?</p> <p><u>Reference for this question:</u> DN fig 2.6 (pp.17, 2021 EMP report), <i>“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”.</i></p>	[NTP awaiting response]
11.	<p>Were any engineering solutions implemented to minimize the frequency of leaks of refrigerant?</p> <p><u>Reference for this question:</u> <i>Release of Ozone depleting substances (pp.21, 2021 EMP report)</i>, Leaks of the of refrigerant R134a on Jan. 28, Aug. 26 and Oct. 11 which may be a concern.</p>	[NTP awaiting response]
12.	<p>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.)</p>	[NTP awaiting response]
13.	<p>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?</p>	[NTP awaiting response]

14.	<p>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?</p>	[NTP awaiting response]
15.	<p>For <i>Table D4- Darlington EMP-Fruits and Vegetables – (pp. 81, 2021 EMP report)</i> 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 (EMP 2019, and 2020). Do these sites have higher background levels of HTO and C14? It is unclear from the report alone.</p> <p>Further, in <i>Table D8- Annual Average Drinking Water and Lake Water Concentrations –EMP reports 2019, 2020, 2021:</i> The receptor well-R2 appears to have high background levels of Tritium (23.8- 27.7 Bq/L)? Is this is the case?</p> <p>And a follow-up question: if “R” indicates a receptor location, what does “D” stand for?</p>	[NTP awaiting response]
16.	<p>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?</p>	<p>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.</p>
17.	<p>Does the variation in contamination of milk measured around nuclear sites call for more frequent supplemental studies or can</p>	[NTP awaiting response]

	<p>these year-to-year variations be incorporated satisfactorily by the probabilistic models?</p> <p>Reference for this question: <i>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”.</i></p>	
18.	<p>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?</p> <p>Reference for this question: <i>Tables D-7, Annual Average Concentrations in Eggs, and Poultry – 2019 (EMP reports 2019,2020 and 2021):</i> 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 than LD.</p>	[NTP awaiting response]
19.	<p><i>Table A7:</i> 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?</p>	[NTP awaiting response]
20.	<p>Are there plans for monitoring both total Ammonia (N) and total unionized ammonia in light of Environmental Study levels?</p>	[NTP awaiting response]

	<p>Reference for this question: <i>Table A-10: Ecological Screening Criteria for Surface Water COPCs</i>. 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.</p>	
<p>21.</p>	<p>Can you clarify or provide more evidence to support assumptions of people’s movements when calculating exposure averages?</p> <p><u>Reference Table 3-26 and 3-27 (DNGS ERA-2020)</u>: “for hydrazine the risk exceeds the associated target value. Incremental Lifetime Cancer Risks &gt; 1E-06, HQ &gt; 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.</p>	<p>[NTP awaiting response]</p>
<p>22.</p>	<p>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?</p>	<p>[NTP awaiting response]</p>