



CMD 23-M36.10

Date: 2023-10-30

File / dossier : 6.02.04

Edocs pdf: 7157880

**Written submission from the
Mississaugas of Scugog Island
First Nation**

**Mémoire de la Première
Nation des Mississaugas de
Scugog Island**

Regulatory Oversight Report for
Canadian Nuclear Power Generating
Sites: 2022 and Mid-term update for
Ontario Power Generation's Pickering
Nuclear Generating Station

Rapport de surveillance réglementaire
des sites de centrales nucléaires au
Canada : 2022 et Rapport de mi-parcours
d'Ontario Power Generation pour la
centrale nucléaire de Pickering

Commission Meeting

Réunion de la Commission

December 13 and 14, 2023

13 et 14 décembre 2023

Intervenor Submission: Mid-term Update for Ontario Power Generation's Pickering Nuclear Generating Station



22521 ISLAND ROAD · PORT PERRY, ON · L9L 1B6 · TEL: 905-985-3337 · FAX: 905-985-8828 ·
www.scugogfirstnation.com

Mississaugas of Scugog Island First Nation
Consultation Office

October 30, 2023



1.0 Introduction

The Mississaugas of Scugog Island First Nation (MSIFN) is pleased to provide the following Intervenor Submission for the Mid-term Update for Ontario Power Generation's Pickering Nuclear Generating Station. Comments are focused on two Risk Assessment Reports, Environmental Risk Assessment (ERA) Report for the Pickering Nuclear Generating Station and the Predictive Effects Assessment (PEA) for Pickering Nuclear Safe Storage – 2022 Addendum Report for the Pickering Nuclear Generating Station (Pickering NGS). MSIFN received consulting support for this review from Colin Macdonald, Ph.D., Northern Environmental Consulting. These comments have also been sent to Ontario Power Generation ahead of this intervention.

MSIFN has had discussions at the staff and advisor level with OPG on OPG's plans for Pickering NGS with respect to the late-2022 announcement to seek Canadian Nuclear Safety Commission authorization to operate Pickering NGS Units 5 to 8 to December 2026 and to conduct a feasibility study on potential refurbishment. MSIFN leadership has instructed staff and advisors to continue this engagement through review and comment on appropriate technical and regulatory reports.

2.0 Environmental Risk Assessment Report for Pickering Nuclear

OPG has completed an updated Environmental Risk Assessment (ERA) for the Pickering NGS. The report was submitted to the CNSC in April 2023. The purpose of the Pickering NGS ERA is to assesses potential human health and ecological risks from exposure to radiological contaminants, conventional contaminants, and physical stressors (e.g. noise) present in the environment as a result of site operations. The ERA includes a human health risk assessment (HHRA) and an ecological risk assessment (EcoRA).

The ERA is written to meet the requirements of the Canadian Standards Association (CSA) N288.6-12 standard, Environmental risk assessments at Class I nuclear facilities and uranium mines and mills. The data considered for this ERA includes results of the 2014/2015 sampling programs and OPG's routine environmental and effluent monitoring data from 2016 to 2020 including data from the Environmental Monitoring Program for radiological contaminants; waterborne emissions data from Environmental Compliance Approval (ECA) monitoring programs; and predicted airborne emissions through annual Emission Summary and Dispersion



Modelling (ESDM) reports. OPG says the ERA confirms that Pickering NGS is *continuing to operate* in a manner that is protective of the health of the public and the environment.

The ERA report evaluates the risk to human health and the environment from radiological and non-radiological contaminants of potential concern (COPCs) and other hazards (e.g., noise, thermal pollution) released from the Pickering NGS. It follows guidance from the CSA in the calculation of exposure to humans from COPCs from the nuclear facility and builds on reports from previous ERAs conducted at the Pickering NGS, the work of sub-contractors, and Ontario Power Generation (OPG). None of these previous reports were located or reviewed here for errors or conformity with the current report. Construction of the facility started in 1965 and there is no evidence that environmental work was conducted prior to construction, to establish baseline aquatic conditions in the nearshore environment. These surveys came much later.

There is no evidence of MSIFN or other First Nations being engaged by OPG or other parties responsible for the construction of the Pickering NGS in the assessment of the original baseline aquatic conditions for the Pickering NGS. This is despite evidence of First Nation historic use of the site area between Frenchman's Bay and the Duffins Creek Marsh for time immemorial. In the absence of MSIFN and other First Nations contributing to assessments of environmental baseline conditions, there is no way for OPG to conclude that current and historic operations of the Pickering NGS have not created human health or environmental risks from exposure to radiological contaminants, conventional contaminants, and physical stressors present in the environment as a result of over fifty years of site operations.

The comments below arose from a single reading of the Environmental Risk Assessment (ERA). Providing comments on this document is difficult because there is little or no recent direct field evidence presented to support many conclusions regarding exposure to COPCs. The potential of harm to the receiving environment is largely glossed over. It is important to note that much of the human health and ecological risk assessment (Table in Appendix A) is based on a single set of samples collected in 2015, roughly 7+ years ago. Older ERS studies are also referenced. The Pickering facility has been operating for several decades and presumably releases to air and water have been occurring during that time. The nearshore aquatic community in Lake Ontario between Frenchman's Bay and the Duffins Creek Marsh, have been significantly modified over that time. A sampling program conducted every five or so years, with an absence of original baseline data, will probably not document the potential hazards and cumulative effects of releases from the Pickering NGS facility on human health and the environment.



2.1 General Comments

Despite guidance from the Canadian Nuclear Safety Commission (CNSC) in the form of REGDOC 3.2.2 (first draft issued in 2014, with comments from OPG in March 2015), there was almost no consideration of potential impacts on Indigenous rights or how releases from Pickering NGS might impact First Nations. A Land Acknowledgement at the beginning recognizes the land on which the facility is located is on the treaty and traditional territory of the Williams Treaties First Nations. In the development of the Valued Ecosystem Components (VECs) for the ecological risk assessment, two potential species offered by MSIFN representatives were not considered. Other similar species were rolled together, and risk estimated as a group.

The assessment relies almost exclusively on the CSA guidance for exposure models and exposure data for human health and ecological risk. These standards documents were largely written by the nuclear industry (CANDU Owners' Group, OPG, CNSC and others) as acknowledged by the CSA, with little or no input from First Nations, despite their knowledge of lands and water. OPG should use endorsed and/or carried out by MSIFN and other First Nations to fulfill obligations to MSIFN and other First Nations, including attempts to characterize the baseline environment prior to operations, and to assess the cumulative impacts on ecosystem components valued by First Nations including VECs related to harvesting, consumption, medicinal uses, and spiritual uses.

The assessments themselves follow standard methods of hazard estimation due to chemical exposure, and the risk of adverse impacts to humans and the environment, however many of the studies referenced in the ERA are ~30 years old, with references from the 1970s and 1980s. A 5 minute on-line search for copper toxicity found a 2007 reference for copper toxicity from sediment to benthic organisms of 3.3 to 47.1 mg Cu/kg dw (Roman et al, STOTEN 387: 128-140.), lower than the reference used here. There have been a lot of advancements in the understanding of chemical effects to humans and receptor organisms in the last few decades, and old standards are often found to be inadequate.

The risk assessments also consider each single stressor from the Pickering NGS facility (aerial and water-borne contamination, groundwater, stormwater, noise, thermal) but do not consider cumulative impacts of all those stressors on receptor organisms, and certainly do not consider cumulative impacts on species of interest identified by First Nations. Other industries have adopted environmental effects monitoring to test the receptor organisms for evidence of



adverse impacts. For example, tests of body condition in fish species such as the slimy sculpin may provide insight on impacts to fish with a small home range that has virtually 100% occupancy in the effluent plume. Metrics include the size at age (i.e. growth) and the size of the liver and gonads, all indicators of condition that translate into the status of the population. These types of studies are needed at Pickering NGS, as **computer modelling of risk is only useful as guidance to actual field measurements.**

In addition, there is no evidence in this assessment that OPG or its contractors have recently surveyed the biotic community in the local area for the presence/abundance of species and their status. In particular, there is no data on the concentrations of COPCs in the resident populations of aquatic and terrestrial organisms. Pickering NGS has been active for several decades and there is a strong likelihood of an accumulation of COPCs in the environment, particularly sediment, around the facility. More sampling of the state of the biotic community is required, and sediment sampling must be a primary step forward.

The human health assessment uses a lot of acronyms and references outside the current document. We suggest providing reviewers with ready access to these supplementary reports and literature to ensure that the data are accurately prescribed and used in the assessment.

We also recommend that the environmental data and environmental reporting conducted by OPG be audited and confirmed through independent detailed field programs. These programs should confirm the OPG sampling program (that the locations used by OPG are suitable for establishing risk to humans and the environment) and that the analysis of samples has reasonable detection levels, quality control, and includes a full suite of rad and non-rad COPCs that OPG might be missing in its monitoring program.

The CNSC Independent Environmental Monitoring Program (IEMP) is meant to fulfill this role but takes too few samples, misses some media (e.g., sediment and fish not sampled in 2017) and only selects a few analytes instead of providing a comprehensive analysis of environmental samples to oversee OPG programs. In its current form, the IEMP program at Pickering NGS is too limited to confirm data from the OPG program, and the function can be better conducted by an independent body that would include First Nation representatives.



2.2 Specific Comments

Table 1. Specific Comments on the Environmental Risk Assessment Report for Pickering Nuclear

Reference	Comment
Executive Summary Para. 1	- There is no mention of adaptive management and the linking of operations at the Pickering NGS facility with elevated levels of rad and non-rad COPCs in the environment. That should be a major objective of the ERA. The rationale for monitoring and risk analysis should be to reduce any predicted impacts by changing plant operations. Please comment on the absence of such an adaptive management program at Pickering NGS.
Executive Summary, Pg viii	- “To establish an updated environmental baseline condition” – the Pickering NGS facility has been running for several decades. The local biotic and abiotic environment has been influenced by air-borne and water-borne releases during that time. There is no “baseline”. Please revise this statement for accuracy.
Executive Summary, Objectives	- The objectives of any monitoring program should be to control hazards, which will reduce the risk of harm to humans and the environment. No recommendations are presented in this report to improve monitoring or to modify Pickering NGS operations. Please provide recommendations to improve monitoring or modify Pickering NGS operations to control hazards and reduce risks.
Executive Summary, Human receptors	- The selection of these specific groups is unusual and selected due to specific pathways (farming, fishing, etc.). It isn’t clear why the correctional institution is included, as the residents will have the same exposure pathways as the urban population. It is also assumed that the critical groups all have the same socio-economic and health status and equal sensitivity to COPCs. A critical group that includes characteristics of Indigenous groups living near Pickering NGS and within the Treaty area should be included in an appropriate manner.
Executive Summary, Pg x	- Non-rad HHRA – the lack of data on the environmental behavior of hydrazine is a huge gap in the assessment. OPG needs to conduct a study to obtain the necessary data, given its importance in facility releases and in the risk assessments.



<p>Executive Summary – Pg xii</p> <p>List of VECs</p>	<ul style="list-style-type: none"> - The assessment leaves the impression that detailed pathways assessments and exposure estimates will be presented for all listed species, however only the general assessment models are evaluated. Zebra mussels can be included in the benthic invertebrates; a very large generic grouping that includes stationary species (infauna, mussels, etc.) and motile species (amphipods, larval insects, hirudinea, etc.). Small benthic fish with a small range (e.g., slimy sculpin, if present) should also be included. The majority of fish species considered are mobile and have low occupancy near Pickering NGS. There are a lot of larval fish and small fish species that are more highly exposed. - It appears that this modelling exercise has little relationship to the actual exposed aquatic community in the nearshore between Frenchman’s Bay and the Duffins Creek Marsh. No survey data of resident species, other than pelagic species, is provided or referenced. The aquatic community has probably been impacted significantly in the past 60 years, but this ERA is estimating impacts to the community now. Some field data, and body burden data of resident fish, would add realism and validation.
<p>Executive Summary, Pg xii</p>	<ul style="list-style-type: none"> - The assessment endpoint for all receptors is “population abundance” but it is unlikely that OPG or its contractors can test that endpoint or monitor it, making this hypothetical.
<p>Executive Summary, Pg xii</p>	<ul style="list-style-type: none"> - Many of the screening criteria from the literature reported later, as in the Appendix, are from old papers (1970s, 1980s) or compiled reports (e.g. Suter and Tsao 1996) that were advanced for their time but were not peer reviewed and are now very dated. There have been significant advancements in methods since the 1996 report. Please comment.
<p>Executive Summary, Pg xiv</p>	<ul style="list-style-type: none"> - It is not clear why the highest concentrations are converted to annual concentrations. This may be a concern for chronic exposure, but it is likely more significant to use short-term exposure (hours or days) that would cause acute effects or possible mortality.
<p>Executive Summary – Page xvi</p>	<ul style="list-style-type: none"> - Effects to fish – this conclusion is probably accurate for large-bodied fish species with a large home range (the VECs). It might not be accurate for small-bodied forage species (not included in the VEC selection; e.g. slimy sculpin, shiners) with a small home range close to the outfall with 100% occupancy in areas of higher concentration (i.e., prior to dilution). It is



	likely that these populations have been impacted in prior years, but the ERA does not consider such cumulative impacts.
Executive Summary, Pg xvii	<ul style="list-style-type: none"> - “Overall, while metal effects on a few individuals may occur in Frenchman’s Bay, effects on their larger populations are not expected.” This type of conclusion, without any supporting evidence, is found through the human health and ecological risk sections. Evidence to support the conclusion needs to be provided or the conclusion removed. For example, how large is the population, how many individuals are impacted, is reproduction of those individuals impacted? - The following page has this statement: “Although localized effects to individual earthworms/plants may occur, the earthworm community (sic) and terrestrial plant population on the site as a whole are not expected to be affected.” Again, evidence must be provided.
Executive Summary	<ul style="list-style-type: none"> - “Radiation dose benchmarks of 400 microGray per hour (9.6 milliGray per day) and 100 microGray per hour (2.4 milliGray per day) (UNSCEAR, 2008) were selected for the assessment of effects on aquatic biota and terrestrial biota, respectively, as recommended in the CSA N288.6-12 standard (CSA, 2012).” - These benchmarks have undergone considerable review in the last 15 years as research is able to measure impacts at lower doses. The CSA is a very poor reference for this. The ERICA 2 assessment tool uses a screening dose of 10 microGray per hour as a Tier 1 test and 40 microGray per hour for terrestrial biota in Tier 2 and 3. There are a large number of references accepted by the scientific community corresponding to these newer dose values. Please address these issues.
Executive summary, Pg xxi	<ul style="list-style-type: none"> - “Following the 2017 ERA, Environment and Climate Change Canada (ECCC) recommended that future ERA iterations use existing habitat information to estimate the percentage of warmwater fish habitat (i.e., Emerald Shiner, Smallmouth Bass) that could be affected by the discharge.” MSIFN agrees with this recommendation which would add reality and validation to this assessment and may help to evaluate ongoing impacts to the nearshore aquatic community. Please address this issue.
Executive Summary – Page xxi	<ul style="list-style-type: none"> - Stormwater outfalls - Based on the data report in Appendix Table A.8c, outflows from catchments 10 and 13 show a number of COPCs exceedances (e.g., zinc; maximum concentration of 190 ug/L on June 11, 2016, vs the criteria of 30. The value was not forwarded to the ERA and



	<p>high loadings in nearshore Lake Ontario. Aluminum hit a maximum of 1800 ug/L on August 20, 2015, with a screening level of 100 ug/L. Data is only from 2015/16 and it is likely that these loadings have occurred several times over the years. Is more monitoring required at these sites?</p>
<p>Executive Summary Page xxi</p>	<ul style="list-style-type: none"> - “It is recommended that OPG continue to engage with local Indigenous communities to develop ongoing and meaningful dialogue, and in particular, to engage prior to/during the preparation of the next ERA to incorporate Indigenous Knowledge and/or perspectives, as available. It is recommended that future ERAs include a section in the report that discusses what was heard from the engagement activities and how this feedback has been considered in the assessment.” - Given that this report is published in 2023 and the CNSC and others have been working on engagement with First Nations for over a decade, MSIFN fully agrees with this recommendation. Please describe OPG’s next steps in this regard.
<p>Page 1.2</p>	<ul style="list-style-type: none"> - “The results of the assessment identified no “significant” residual adverse environmental effects of the Pickering Waste Management Facility (PWMF) Phase II project with the proposed mitigation measures in place (emphasis added).” How was the “significance” determined? This report makes similar conclusions in a lot of areas with no supporting evidence. It established that adverse effects do occur, but they aren’t that important. - Again, on page 1.4 – “The ecological risk assessment concluded no significant adverse effects to non-human biota due to releases of chemicals or radionuclides to the environment during existing conditions or during refurbishment and continued operations. The human health risk assessment also concluded no significant adverse effects to the public due to releases of chemicals or radionuclides to the environment during existing conditions or during refurbishment and continued operations.” - The significance of effects is not something that should be determined by OPG and its contractors. Please address these issues.
<p>Page 1.4 - groundwater</p>	<ul style="list-style-type: none"> - “A follow up on site-specific risk assessment of non-potable groundwater was also conducted in 2007.” This was at least 15 years ago and should be updated. Where does the groundwater discharge? If it is Lake Ontario, then discharge zones should be identified and a risk assessment of the littoral aquatic community should be conducted.



Page 1.5	<ul style="list-style-type: none"> - The sampling program for 2015 did not include any biota to show the potential for accumulation of rad or non-rad COPCs. This is a significant gap in the OPG and CNSC programs.
Page 1.6	<ul style="list-style-type: none"> - “For non-radiological contaminants of potential concern (COPCs), the maximum concentration of copper in the outfall was above the fish and benthic invertebrate benchmarks; therefore, the hazard quotients (HQs) were above 1...” - The risk assessment should use the maximum value for copper (and other COPCs) because it could cause acute effects (i.e., death of organisms) and the mean is used here only to reduce the hazard coefficient to <1. Benthos are valuable indicators of environmental conditions because they integrate conditions through time (e.g., oxygen levels, temperatures, contaminants) and short-term exposure at high levels causes acute mortality in some species. Surveys of the benthic community would show a loss of diversity. It looks like such surveys have not been conducted at Pickering NGS recently. Please address these issues.
Page 1.12	<ul style="list-style-type: none"> - A probabilistic assessment would at least begin to address uncertainty in a rigorous way. Regardless of whether CSA recommends it or not, this assessment needs to add the concept of variability and uncertainty into the environmental concentrations and exposure estimates.
Section 2.3	<ul style="list-style-type: none"> - These reports were not available for this review. If surveys of the aquatic and terrestrial biological communities were conducted for the 2007 reports, then those data should be used in this ERA to explicitly define exposure populations and potential impacts. The surveys should be updated to determine changes in species abundance and their status. The VECs used in this report are largely hypothetical.
Page 2.74 – benthic community	<ul style="list-style-type: none"> - This text reports that the studies on the benthic community in the mid-1970s show lower diversity than at reference sites. This suggests adverse effects from the Pickering NGS operations thermal plume and effluent. Chironomids and oligochaetes are pollution tolerant organisms while more sensitive species have died out. More recent studies should be conducted to compare with the earlier data. These data should be used to validate the ecological risk estimates for the benthic community, and cumulative effects dating to the start of Pickering NGS operations.
Page 3.2	<ul style="list-style-type: none"> - The selection of critical groups is discussed in the General Comments section. It is assumed in the selection of critical human groups that all groups have equal socio-economic and health status, and sensitivity to rad



	<p>and non-rad COPCs. That is unlikely for the correction institution residents who may have poorer health conditions.</p>
<p>Page 3.2 – Indigenous Communities</p>	<ul style="list-style-type: none"> - “It is expected that Indigenous communities would receive doses that are equal to or lower than those received by these potential critical groups.” - First Nations would like to see their communities incorporated into the process of calculating risk from Pickering NGS. This should include lifestyle but also health concerns that might make some community members more sensitive to exposure to rad and non-rad. Given OPG’s interests in First Nation employment, the exposure conditions for Indigenous communities should also include First Nation peoples who are both exposed overtime as employees or contractors at Pickering NGS and who might also harvest or receive harvested plants and animals overtime from the vicinity of the Pickering NGS. - “OPG initiated engagement with the Williams Treaties First Nations in July 2021 to seek feedback on the list of Valued Ecosystem Components (VECs) that would be used in the 2022 Pickering NGS ERA (discussed further in Section 4.1.1). “ - Given the date of March 2022 for the release of the Pickering NGS ERA, the meetings of July 2021 would probably be too late to incorporate the information from Williams Treaties FN into the ERA. The selection of critical groups and VECS were likely all decided at that point. More engagement should occur by the next ERA, and OPG should outline its plans for such engagement in this report.
<p>Page 3.4</p>	<ul style="list-style-type: none"> - The text here, and elsewhere in this HHRA section, is impossible to review without comprehensive review of background documents. All comments on its suitability and accuracy are reserved. - <i>Contaminant emissions were assessed within the ESDM reports by comparing POI concentrations estimated from emission rates to POI exposure benchmarks listed in the MECP publication, Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants (the ACB list). The ACB list encompasses the air standards set out in O. Reg. 419/05, as well as a broader list of additional benchmarks further intended to aid facilities in preparing ESDM reports. Modelled POI concentrations were compared to respective MECP POI benchmarks with corresponding averaging periods, typically ½-hour, 24-hour, or annual averages. The air dispersion modelling results for nitrogen oxides from the testing of emergency standby equipment showed that the maximum predicted concentration was below the 1/2 -hour POI screening level of 1,800 µg/m3.</i>
<p>Page 3.12</p>	<ul style="list-style-type: none"> - Is the Lake Ontario water sample close enough to shore to be impacted by groundwater and stormwater discharge?



Page 3.14	<ul style="list-style-type: none"> - “Overall, the conclusions from the 1997, 2002, and 2006 studies indicate that stormwater quality has not resulted in any unexpected or adverse effects on the environment”. - Not a surprising conclusion, but the data from 2015 in Appendix A for at least 2 catchments indicates exceedance of the screening criteria for several COPCs. Has any attempt been made to factor in the long-term (60 years) exposure of the nearshore environment to stormwater releases with elevated concentrations of COPCs? Have sediment samples been taken to support water chemistry measurements?
Page 3.19 – groundwater	<ul style="list-style-type: none"> - This states that groundwater is contaminated with hydrocarbons, but the plume has not moved to Lake Ontario, yet. Also, the argument is made that COPCs in the groundwater would be diluted before hitting the drinking water intake which is some distance away. Are the concentrations of COPCs high enough in groundwater discharging into Lake Ontario to affect the aquatic community in the littoral zone of Lake Ontario? Once the plumes hit Lake Ontario, it will be costly to stop the impacts. Please address these outstanding issues in the report.
Table 3.3	<ul style="list-style-type: none"> - These emission averages should include some estimate of uncertainty, such as a standard deviation or standard error.
Table 3.4	<ul style="list-style-type: none"> - These nuclides are used to derive the DRL but only Cs-134 and Co-60 are monitored (and the additional nuclides are not monitored by the CNSC’s IEM Program). How often are scans done to support the selection of representative nuclides for monitoring?
Table 3.5	<ul style="list-style-type: none"> - PWMF doses – How do these dose rates compare to background rates at the same location, if the PWMF was empty? Or did not exist?
Page 3.43	<ul style="list-style-type: none"> - “The selected receptors are expected to lead to conservative estimates of health risks and are expected to be protective of any shorter-term exposures to environmental media in the vicinity of the Pickering NGS site”. Is there any evidence to support these conclusions? They may be protective of “shorter-term” exposures but long-term exposure leading to chronic effects may be an issue, which may especially present risk issues to Pickering NGS employees or contractors who are from area First Nations and who might also harvest or receive harvested plants and animals from the vicinity of the Pickering NGS.
Table 3.18	<ul style="list-style-type: none"> - The number of samples in which nuclides are measured is very low. Presumably, the rest are modelled values. This is unacceptable given the importance of maintaining and monitoring low concentrations of the nuclides in the environment around Pickering NGS. The CNSC should also be monitoring this larger series of nuclides.
Table 3.20	<ul style="list-style-type: none"> - The background dose across Canada varies. The background dose mentioned should be for the areas around Pickering as if Pickering NGS



	<p>was not present. Background is probably lower than the Canadian average and the percentage of background shown here is probably higher.</p> <ul style="list-style-type: none"> - Percent of regulatory limit. The concept of a constraint dose (the amount of radioactivity from a single source) that is promoted by CNSC and HC (0.3 of the regulatory limit) is not used here. Please provide an explanation.
Figure 3.17	<ul style="list-style-type: none"> - A legend for the symbols is required.
Page 3.59	<ul style="list-style-type: none"> - This derivation of solubility and uptake by fish is far too complicated, the uncertainty is high and relies on an old, single reference. OPG could conduct a study to determine a suitable value of uptake by fish and record any possible adverse effects in the fish.
Table 3.27	<ul style="list-style-type: none"> - MDL values are considered to “overestimate risk”. This conclusion is based on one year of data (2014) and apparently one study. What is the variability through time and how long has hydrazine been released?
Page 3.70	<ul style="list-style-type: none"> - As per above, shouldn’t a constraint dose be applied here?
Page 3.71	<ul style="list-style-type: none"> - “A probabilistic risk assessment to quantify uncertainty in the risk estimate has not been performed and is not considered necessary, since it is not likely to provide a better basis for risk management/decision making.” - A probabilistic assessment would help in determining the uncertainty that is missing in this assessment. It may be possible to do some sensitivity analysis as well. Single values are used here for hazard quotient estimates where some estimate of uncertainty should be reported.
Page 4.21	<ul style="list-style-type: none"> - The liquid effluent contains a number of COPCs, although they are low in concentration. Have toxicity tests been conducted on whole effluent?
Page 4.21	<ul style="list-style-type: none"> - Lake water – Does OPG conduct continuous monitoring of water samples that can be used here? Relying on a single sampling program in 2014 (almost 10 years ago) begs the question of what variability is like through time. Also, all sampling is done in the open water season. Has any sampling been done in the winter?
Page 4.28	<ul style="list-style-type: none"> - “Trigger levels developed by OPG, in consultation with the MOECC have been established for copper (0.15 mg/L) and zinc (0.9 mg/L) at the sampling locations for Ditch 4 and Ditch 6 (OPG, 2011c). These levels are 30 times the PWQO.” - The trigger levels are 30 times higher than regular screening levels (water quality objectives)? And data from 2010 and 2012 (which are now old data) do not exceed these levels? If these are discharge levels to Lake Ontario, an assessment of the impacts needs to be conducted.
Table 3.34	<ul style="list-style-type: none"> - This list of “uncertainties” spells out that large parts of the environmental assessment have data gaps. OPG should consider research projects on filling those gaps, especially for hydrazine and morpholine. Many literature



	<p>sources used in the assessment are decades old and may not be applicable under Pickering NGS conditions. The assessment recognizes that it is not possible to state if the values used in the assessment produce risk values that over- (too conservative) or under-estimate risk because the information is not available. Please comment on how these issues impact the report.</p>
Page 4.38	<ul style="list-style-type: none"> - It's concerning that dilution in Lake Ontario is often used in this report to justify releases from groundwater and stormwater. What is the size of the expected plume before dilution?
Table 4.42 and 4.43	<ul style="list-style-type: none"> - The assessment shows that some aquatic species are exposed to concentrations of COPCS that may result in adverse biological effects. Given the 60 years that Pickering NGS has been operating, these exposures have probably been on-going for decades. Effects monitoring and population surveys should be conducted as a follow-up, and steps taken to reduce the release of the compounds.
Page 4.48	<ul style="list-style-type: none"> - Frogs are more closely associated with sediment than fish, and remain there over the winter (i.e. long contact time and absorption through skin). Small fish (e.g. sculpin) that can be monitored for adverse environmental effects and health indices should be included in the assessment to add realism and validation. - Transfer factors – Factors based on beef and poultry are probably for transfer to meat or maybe whole body. Target organs for some nuclides in wildlife will be the liver, kidney, bones, etc. and doses in those organs might increase whole body dose estimates. Transfer factors for some wildlife species are available. Concentration ratios (Beresford et al. 2008 J. Environ. Radioactivity 99:1393-1407), transfers factors (Berereford et al. 2004, J. Radiol. Prot. 24: A89-A103) and dose conversion factors for individual isotopes (Ulanovsky et al. 2008 J. Environ. Rad 99:1440-1448) are available rather than using values based on domestic livestock.
Page 4.104	<ul style="list-style-type: none"> - Thermal effects on round whitefish eggs. “The largest relative survival loss observed was 3.8% in 2018-2019 and 1.5% in 2019- 2020, at plume locations closest to the Pickering NGS Pickering NGS B discharge channel. These values are well below the CNSC threshold of concern of 10% relative survival loss.” - It's not clear if the estimates of losses of whitefish eggs are from models or are observed losses. OPG's “thermal survival model” and COG “Block 3 Model” were used to provide estimates for egg losses, but it isn't clear if there was any field validation. The loss of 3.8% seems low but is probably based on a lot of assumptions and the uncertainty is probably high, approaching the 10% value. Are there any estimates of how many whitefish eggs there are in the thermal plume, and how many eggs from other fish species are affected?



Page 5.4	- The argument of “dilution” of effluent and fish swimming in a large area may apply to the VECs as adults but probably doesn’t apply to larval forms, eggs and resident small-bodied fish with small ranges. It probably doesn’t apply to the benthic community that has been impacted for decades. The conclusion should be supported by rigorous surveys and effects studies.
----------	--

3.0 Predictive Effects Assessment for Pickering Nuclear Safe Storage – 2022 Addendum

3.1 General Comments

The following comments are based on a single reading of report Predictive Effects Assessment for Pickering Nuclear Safe Storage – 2022 Addendum: P-REP-07701-00006 R001. The 2017 PEA report was not available for review, but comments on the 2023 draft of the ERA are being submitted concurrently with these comments. There are a lot of similarities between the 2023 ERA and this PEA, with many of the same strengths and weaknesses. OPG’s current report leans heavily on earlier work (i.e., the 2017 PEA) that has not been reviewed so comments are limited to questioning the overall approach to this updated assessment.

OPG notes that the purpose of conducting a predictive effects assessment is to identify and assess the potential interactions with the environment as a result of future site activities and to determine whether or not adequate provision for the protection of the environment and health of persons has been considered. In 2017, OPG undertook a PEA as required under the *Nuclear Safety and Control Act* to support the Pickering NGS power reactor operating licence renewal application process and to evaluate the potential for adverse effects to human health and the environment from the activities associated with transitioning the station from the end of commercial operation (ECO) to a safe storage state. The 2017 PEA focused on the Stabilization Phase (transition to safe storage which includes defueling and dewatering reactor units) and the first ten years of Storage with Surveillance Phase (to allow for natural decay of radioactivity) after which the transfer of all used fuel to dry storage would be completed.

In 2022, OPG issued a PEA Addendum Report focused on assessing continued protection of human health and the environment based on updated baseline environmental conditions and current operational assumptions. The 2022 PEA Addendum Report was updated in April 2023



to address comments received from the Canadian Nuclear Safety Commission (CNSC) and to reflect continued operation of Pickering NGS until 2026.

Through the 2017 PEA, the 2022 PEA Addendum Report, and the April 2023 update of the 2022 PEA Addendum Report, OPG outlines a process to stabilize all of the reactors on the Pickering NGS site, place them into long-term storage to reduce radioactivity, and prepare the land for future land uses (see Executive Summary). It is vital that OPG work with MSIFN on future uses of the lands and an acceptable condition of the lands at closure (termed the “end state”). OPG and the CNSC should not be the only groups to decide what the final closure condition of the Pickering NGS site should include. Also, there are several areas in Table 7.1 (Pg 7.1, Monitoring Programs) in which MSIFN should be engaged and consulted for monitoring, and to aid in determining the end-state of the Pickering NGS site.

There are many similar issues in this PEA and the 2023 ERA, although the PEA assessment is in some ways more comprehensive than the ERA, which closely conforms to the CSA standards. The two reports still use outdated references for some water quality objectives, although this report does better at acknowledging that fact. The two assessments are difficult to review in the context of other issues going on at the site at the same time.

MSIFN recommends that OPG prepare a comprehensive assessment that includes the history of the Pickering NGS site since construction began, all sources of rad and non-rad contaminants of potential concern (COPCs), dose rate, and physical and chemical hazards from all sources and risk to human health across the site. Currently, risks are estimated for individual rad and non-rad COPCs, but no attempt is made to cumulatively sum the risks of all hazards.

There is a danger in transferring the conclusions from the 2017 PEA to the current assessment. Changing conditions on the site between 2017 and today might have changed the release of rad and non-rad COPCs, which need to be assessed again. This is mentioned in the text (nothing has changed with respect to non-rad COPCs) but there may be unexpected environmental changes that have modified the hazards from releases, or could modify the hazards in the future. This is particularly the case for hydrazine and morpholine which were identified in the 2023, and previous, ERAs.

An issue that makes the report difficult to understand is the use of jargon in place of plain language. Terms such as “interaction with the environment” (i.e., releases from the facility), “conservative” (implies that estimated risks are higher than expected), “bounding” (used in several different contexts throughout the report but should indicate extreme high and low conditions). For example, “the air emissions during the Stabilization Phase are considered to be



bound by current operational conditions.” Can the current conditions cover the potential release from the site, and does this mean high or low? The use of jargon like “bound” or “bounding” is used throughout the text and it is not clear the meaning. A global search and replace for “interactions with the environment” with “*releases to the environment*” would clear up some text.

The flow path of stormwater from the individual catchments after the removal of condenser cooling water (CCW) is still not clear. The 2023 ERA reported high metal levels in stormwater, reproduced here in Appendix A. It is understood that the flow from some of these catchments was mixed with cooling water and diluted prior to flowing into Lake Ontario. From the ERA, two catchments with high metal levels (exceeding water quality guidelines) flowed directly into Lake Ontario. It is not clear from this PEA what the removal of the CCW will do to the flow path of the stormwater from the different catchments. If undiluted, the high metal concentrations will further impact the nearshore environment, an event which has probably occurred over the last 60 years.

As in the 2023 ERA, the assessment relies heavily on modelled estimates for flow dynamics in the forebay and the estimation of concentrations of COPCs in air and water. There is very little or no field validation or formal verification of modelled results. Very little sampling of sediment or the aquatic community has been conducted to confirm modelled results and to verify predictions of concentrations. Again, most of the ecological risk estimates for the aquatic community relate to the adults of large-bodied fish, arguably the least sensitive of fish life stages. Small fish with limited range size and likely 100% occupancy need to be considered and should be the topic of the monitoring for ecological effects. The benthic community, the diversity of which is a good integrator of changing conditions in the water column, is grouped into a single valued ecosystem component (VEC).



3.2 Specific Comments

Table 1. Specific Comments on the Predictive Effects Assessment Report for Pickering Nuclear

Reference	Comment
Page vii	<ul style="list-style-type: none"> - “Changes to baseline conditions to determine whether the 2017 PEA remains bounding for current conditions.” - MSIFN also commented on the 2023 ERA for not providing estimates of uncertainty around average values reported. Ranges were usually not provided. If the 2017 PEA had a similar problem, then it would not provide “bounding conditions”. Please explain.
Page viii	<ul style="list-style-type: none"> - The text mentions Tier 1 and Tier 2 assessments. Please define in this context or place in the glossary.
Page viii	<ul style="list-style-type: none"> - The swim speeds are probably averages for adult fish and might not be sustainable. Younger fish and small-bodied species likely cannot swim faster than 11.5 mm/s. This is supported later in the report with the mention of juvenile fish captured in the water intake. Please explain the rationale for the swim speeds used.
Recommendations – Page ix	<ul style="list-style-type: none"> - “Based on the conclusions of the 2022 PEA Addendum, no additional risk management recommendations are identified.” As it is currently set up, this assessment predicts no impacts. The lack of field validation and lack of assessment of a larger group of aquatic organisms (e.g., different types of benthic organisms, smaller forage fish species) limit the application of the conclusions. Please explain why OPG is not assessing risks to different types of benthic organisms and smaller forage fish species. Please explain the lack of field validation.
Page 1.4 final paragraph	<ul style="list-style-type: none"> - The environmental data used for these assessments is spotty, relying on samples collected primarily in 2014/15 and several earlier studies – please explain why OPG uses this environmental data for deriving conclusions almost a decade later. Conditions change over time and more monitoring and surveillance is needed. Also, changes in the rad and non-rad COPC concentrations in the aquatic community and sediment during the 60 years of Pickering NGS operations need to be assessed – please explain why OPG is not integrating changes in the rad and non-rad COPC



	<p>concentrations during the 60 years of Pickering NGS operations in the assessment.</p>
Page 1.5 – Critical groups	<ul style="list-style-type: none"> - MSIFN stated in the ERA review that Indigenous groups need to be consulted, engaged, and explicitly included in the evaluation of critical groups and in the development of the use of the Pickering NGS site after closure. Please explain OPG’s past, current, and future approaches to involving Indigenous groups in Pickering NGS closure planning.
Figure 1.5	<ul style="list-style-type: none"> - The site characterization should be based on recent surveys of the aquatic and terrestrial communities for the ecological risk assessment. This has not been done here. Any recent surveys should be compared with earlier surveys to determine any changes in COPC concentrations and the aquatic/terrestrial communities that might have occurred during the 60-year operation at Pickering NGS.
Page 1.12	<ul style="list-style-type: none"> - Thermal effects. Most species can adapt to warmer or colder temperatures but fast changes (e.g., as a warm source is turned off) will kill fish in the discharge zone. Is there data describing temperature over time showing variability that might impact fish in the thermal plume?
Page 2.1	<ul style="list-style-type: none"> - The use of the term “baseline” suggests that conditions are the same as a background reference site. The water and sediment conditions suggest low impacts from Pickering NGS operations and releases but there is little data to support that conclusion. There are likely a lot of impacts after 60 years of operation. Please explain.
Page 4.1	<ul style="list-style-type: none"> - “The periodic review looks at changes to site ecology and surrounding land use, changes to the physical facility or facility processes, new environmental monitoring data, new or previously unrecognized environmental issues, and scientific advances.” See above.
Radiological emissions	<ul style="list-style-type: none"> - There is no data on radionuclide concentration in fish, fruits, garden vegetables, etc. No biological survey data are presented or referenced, it is all hypothetical. These field data are needed to verify the model projections, but nothing has been presented here or in the 2023 ERA. Please explain.
Groundwater monitoring at the end of 2020	<ul style="list-style-type: none"> - why has monitoring begun so late in the process? The facility has been operating for 60 years. The CSA standard is dated 2017. Please explain.



Indigenous Engagement	- Please define how this will take place and what form the engagement will take. MSIFN should be involved with the definition of the end state of the Pickering NGS area and how monitoring is conducted at the site.
Page 4.9	- “These changes will reduce the predicted COPC concentrations in the outfall during Storage with Surveillance due to the increased flow and dilution.” Will the loadings, or flux, of COPCs to Lake Ontario remain the same or increase? Continued effluents (i.e., interactions with the environment) may add significant amounts of COPCs to sediments. Also, sediment will be transferred to adjoining areas. Please explain.
Page 4.16 - Climate Change	- Changes in water temperature and water level are considered to be minor but changes in wind speed and direction, which drive the current, are not considered. Please explain why changes in wind speed and direction are not considered. The subsequent changes in the paragraph are major changes. Conditions in 2017 may be a reasonable approximation, but climate models for the north have consistently underestimated the extent of the changes to the environment.
Updated Tier 1 Assessment	- “Would result in a decrease in predicted interactions with the environment”. What are the predicted impacts to stormwater releases? Are all stormwater flows directed to Lake Ontario with no dilution? Please explain.
Page 5.2	- “Consistent with the 2017 conclusion, regardless of whether or not the microscrubber is in operation, the air emissions during the Stabilization Phase are considered to be bound by current operational conditions.” What is the purpose of the microscrubber if air emissions of tritium don’t change? How much do water-borne nuclides increase if tritium is removed from the air stream and redirected to water effluent?
Page 5.3	- How do modelled radiological doses at site boundaries compare to actual measurements at the boundary? Please provide actual measurement data at the site boundaries to verify the model.
Page 5.6	- An important component of the ALARA principle is that the human receiving additional dose should be informed and provide consent. They should also receive some benefits from elevated doses (e.g., X-rays, biomedical tracers, CAT scans, etc.). Does this apply to the fisher?
Page 5.6, Table 5.4	- Total doses should be reported here, including dose from the Pickering Waste Management Facility (PWMF) which provides for the interim storage of radioactive wastes produced at the Pickering NGS, including all



	<p>of the used nuclear fuel generated by the Pickering NGS for over fifty years since the start of commercial operation in 1971, to the end of its commercial operating life. Again, these assessments do not refer to a constraint dose (0.3 mSv/a), which has usually been required by Health Canada and CNSC.</p>
Page 5.7	<ul style="list-style-type: none"> - Individual air contaminants (including the carcinogenic benzpyrene) are assessed here but what is the cumulative risk of exposure to all the contaminants?
Table 5.8	<ul style="list-style-type: none"> - Average annual NOX concentrations are reported. What is the range (max and min of values)?
Page 5.14	<ul style="list-style-type: none"> - If CCW pumps shut down, what happens to stormwater that has been directed to the CCW?
Page 5.19 Sediment Quality and Transport	<ul style="list-style-type: none"> - “The high flow rates under current operational conditions have historically scoured away sediments from nearshore areas...connecting to shallow beaches to the east and west of PNGS.” This paragraph is confusing. The high flow rate (250,000 m³/d) will cause scouring and deposition of sediment to the surrounding nearshore environment. Presumably this will cause smothering of the benthic community and particle-bound contaminants to these new areas. Also, this has probably been standard practice during operation of Pickering NGS since the beginning of operation. Please explain the impacts of “scoured away sediments from nearshore areas” to the nearshore environment, and explain impacts on the benthic community, and the distribution of particle-bound contaminants.
Table 6.1	<ul style="list-style-type: none"> - The aquatic invertebrate category is used to estimate impacts to the general benthic community, where diversity should be a measurement endpoint. The community should consist of infauna and surface fauna and a wide range of groups of differing ecologies. This assessment considers only individual chemical/rad toxicity and not cumulative or additive impacts from combined hazards, or smothering from sediment transport (see above), temperature, etc. Comments on the use of these fish species have also been made by MSIFN before. Small forage species need to be included.
Table 6.2	<ul style="list-style-type: none"> - Protection goal – “Protect, restore, and sustain the diversity of the nearshore fish community, with an emphasis on self-sustaining native fishes” - “Comparison of estimated doses of COPCs to growth, survival and reproduction benchmark values (low-effect threshold doses) relevant to the assessment endpoint.” - The radiological assessment uses a generalised dose rate for a benchmark that does not predict the protection of any of these endpoints. The



	<p>benchmarks are not designed to protect “growth, survival (which is an acute response) and reproduction” and there is no evidence to support these statements. Overall, this table mischaracterises the measurement endpoints from comparison to general radiological benchmarks. Please explain why the protection goal is not the focus of the assessment of doses of COPCs, and what OPG will do to correct this.</p>
Table 6.6	<ul style="list-style-type: none"> - Muskrats live in burrows in soil/sediment and are covered in sediment. Occupancy can be virtually 100% for a good part of the year. Please acknowledge and explain the omission.
Table 6.8	<ul style="list-style-type: none"> - Transfer factors from beef and poultry are for the deposition of nuclides in meat consumed by humans. The nuclear industry has been using these values for decades, however there are databases available for transfer factors to liver and other organs in wildlife. The reference used is CSA 2020 which isn’t surprising as the nuclear industry has used these factors since the 1960’s for human health protection. Please explain why OPG is not using transfer factors from wildlife in the area.
Page 6.28	<ul style="list-style-type: none"> - The discussion on the debate of radiological benchmarks is welcome (and was missing in the ERA) however the assessment falls back on CSA values that are likely out of date. Please explain.
Page 6.30 entrainment	<ul style="list-style-type: none"> - “This table, however, is not an exhaustive list of fish species and may not apply to all life stages.” This indicates that the conclusions only apply to a select set of adult fish species. Please explain.
Table 7.1	<ul style="list-style-type: none"> - This table indicates several areas where First Nations can provide valuable advice on environmental monitoring and future land uses. Please comment.
Page 8.4	<ul style="list-style-type: none"> - This assessment indicates “no potential effects” however questions remain about sediment transport, and assessments to other fish species, such as forage fish, and less motile life stages have not been conducted. There is also a need for field validation of many of the modelled sediment transport and water temperature estimates. Do the higher flows smother benthic communities with higher sediment transport?

Miigwech,

Mississaugas of Scugog Island First Nation