ONTARIO POWER GENERATION

Report

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2025 Results of Environmental Monitoring Programs for the Darlington and Pickering Nuclear Sites

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2025 Results of Environmental Monitoring Programs for the Darlington and Pickering Nuclear Sites

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Land Acknowledgement

Ontario Power Generation's Darlington Nuclear (DN) and Pickering (PN) Nuclear sites are located on the Traditional and Treaty Territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations.

The DN and PN sites are within the Territory of the Johnson-Butler Purchase/Gunshot Treaty (1787-1788) and the Williams Treaties of 1923. These Treaty Rights were reaffirmed in 2018 in a settlement with Canada and the Province of Ontario.

To acknowledge the Treaty and Traditional Territory, is to recognize the Rights of the First Nations. It is to recognize the history of the land, predating the establishment of the earliest European colonies. It is also to acknowledge the significance for the Indigenous peoples who lived and continue to live upon it, to acknowledge the people whose practices and spiritualties are tied to the land and water and continue to develop in relation to the Territory and its other inhabitants today.

ALDERVILLE FIRST NATION
BEAUSOLEIL FIRST NATION
CURVE LAKE FIRST NATION
GEORGINA ISLAND FIRST NATION
HIAWATHA FIRST NATION
SCUGOG ISLAND FIRST NATION
RAMA FIRST NATION

Participant Acknowledgement

Ontario Power Generation (OPG) would like to thank the residents of the local communities in the vicinity of Pickering Nuclear and Darlington Nuclear sites and throughout the province of Ontario, who voluntarily participate in our environmental monitoring programs. Their support in allowing OPG to maintain air monitoring equipment on their properties and in supplying samples of vegetables, fruits, animal feed, milk, eggs, poultry, and water helps to produce realistic estimates of annual public dose.

Revision Summary

Revision Number	Date	Comments
R000	2026-04-21	Initial issue.

Executive Summary

Ontario Power Generation (OPG) maintains Environmental Monitoring Programs (EMPs) in the vicinity of Darlington Nuclear (DN) and Pickering Nuclear (PN) sites in accordance with operating licence requirements. The EMPs comply with Canadian Standards Association (CSA) N288.4:19, *Environmental monitoring programs at nuclear facilities and uranium mines and mills*. The program scope encompasses protection of both the public and the environment from nuclear substances, hazardous substances, and physical stressors resulting from the operation of DN and PN sites, including the on-site waste management facilities.

The EMPs are designed to satisfy the following four primary objectives of CSA N288.4:19:

1. Assess the impact on human health and the environment of contaminants and physical stressors of concern resulting from operation of OPG nuclear facilities.

2. Demonstrate compliance with limits on the concentration and/or intensity of contaminants and physical stressors in the environment or assess their effect on the environment.

3. Demonstrate the effectiveness of containment and effluent control and provide public assurance of the effectiveness of containment and effluent control, independent of effluent monitoring.

4. Verify the predictions made by the Environmental Risk Assessments (ERAs), refine the models used, and reduce the uncertainty in the predictions made by these assessments and models.

Additionally, environmental sampling and analyses for the EMPs support the calculation of annual radiological dose to the public resulting from operation of OPG nuclear facilities, as required by Canadian Nuclear Safety Commission (CNSC) REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*. To ensure activities at these sites are conducted in a manner that minimizes any adverse impact on the public and the natural environment, OPG has established an Environmental Management System (EMS) that is consistent with the CNSC Regulatory Document REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures*.

The 2025 program results contained in this report include concentrations of radionuclides in air, water, milk, vegetation, animal feed, eggs, poultry, beach sand, and fish samples taken in the vicinity of DN and PN sites, and the associated public radiation dose assessments. Samples from provincial background locations were used to determine background radiation levels in areas considered to be outside the influence of the nuclear stations.

In 2025, OPG operated seven of eight nuclear reactors, producing 38.0 terawatt hours (TWh) of electricity. Four reactors at PN site were operational and three of four reactors were operational at DN site in 2025, due to the recently completed Darlington Nuclear Refurbishment Project. Site radiological emissions remained at a very small fraction of their licensed Derived Release Limits (DRLs).

OPG performed a total of 889 laboratory analyses on a variety of environmental media used for the annual public dose calculation. The availabilities of DN and PN EMP samples analyzed for the dose calculation met annual performance requirements.

IMPACT 5.5.2 software was used for the dose calculations. It is aligned with CSA N288.1:20, *Guidelines for modelling radionuclide environmental transport, fate, and exposure associated with the normal operation of nuclear facilities*. Its equations are also consistent with CSA N288.1:14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities.* While a few parameters were updated in the 2020 version of the standard, none of these parameters are involved in the PN or DN site dose modelling scenarios. Though the dose calculation is compliant with both the 2014 and 2020 versions of the standard, this report references CSA N288.1:20 throughout as it is most recent and aligns with the PNGS operating licence. As noted in the DNGS Licence Conditions Handbook, compliance with CSA N288.1:20 will be achieved when new DRLs are implemented after the next revision.

The 2025 doses resulting from the operation of the DN and PN sites continue to be a very small fraction of both the annual regulatory limit of 1,000 microsieverts (µSv) and the estimated annual average background radiation dose of 1,400 µSv in the area of DN and PN sites. The 2025 public doses for the DN and PN sites were lower than those observed in 2024 and are summarized in Table 1-1.

Table 1-1: OPG Public Dose Estimates - 2025

Site	Critical Group (Receptor)	Effective Dose (µSv)	Percentage of Regulatory Limit (%)	Percentage of Background Radiation (%)
Darlington Nuclear	Farm (Adult)	0.45	< 0.1	< 0.1
Pickering Nuclear	Dairy Farm (Infant)	0.46	< 0.1	< 0.1

1.0 INTRODUCTION

Ontario Power Generation (OPG) owns and operates the Darlington Nuclear (DN) and Pickering Nuclear (PN) sites. To ensure nuclear activities at these sites are conducted in a manner that minimizes any adverse impact on the public and the natural environment, OPG has established an Environmental Management System (EMS) that is consistent with the Canadian Nuclear Safety Commission (CNSC) Regulatory Document REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures* [R-1] at both sites. Additionally, the EMS is registered to the International Organization for Standardization (ISO) 14001 Environmental Management Systems standard.

As part of the EMS, each site has an Environmental Monitoring Program (EMP), which identifies the nuclear substances, hazardous substances, and physical stressors to be monitored in the environment surrounding the site. The EMPs use a risk-based approach and rely on the results of site Environmental Risk Assessments (ERAs) as described in Section 3.1.1. Locations considered to be outside the influence of PN and DN site operations are also monitored to allow for a comparison with background values.

The EMPs are maintained in accordance with the operating licences issued by the CNSC to DN and PN sites and are required to comply with the Canadian Standards Association (CSA) N288.4:19 standard, *Environmental monitoring programs at nuclear facilities and uranium mines and mills* [R-2]. This report is prepared and submitted to the CNSC in accordance with Regulatory Document REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants* [R-3], as summarized in Appendix I. This report is also made available to the public on OPG's website at the following link: www.opg.com/reporting/regulatory-reporting/

This report provides the emissions and environmental data collected for both the DN and PN EMPs during the 2025 sampling year, data interpretations, and the estimates of radiation doses to the public resulting from the operation of the sites.

Emissions and environmental data are summarized in Sections 2.0 and 3.0, respectively. Assessment of the doses to the public is provided in Section 4.0.

1.1 Program Objectives

The PN and DN EMPs are designed to satisfy the following primary objectives:

(a) Assess the impact on human health and the environment of contaminants and physical stressors of concern resulting from operation of OPG nuclear facilities.

(b) Demonstrate compliance with limits on the concentration and/or intensity of contaminants and physical stressors in the environment or assess their effect on the environment.

(c) Demonstrate the effectiveness of containment and effluent control and provide public assurance of the effectiveness of containment and effluent control, independent of effluent monitoring.

(d) Verify the predictions made by the ERAs, refine the models used, and reduce the uncertainty in the predictions made by these assessments and models.

The EMPs are also designed to facilitate realistic estimates of radiation doses to the public resulting from the operation of DN and PN sites, and to demonstrate that these doses remain below the regulatory limit specified in the current Radiation Protection Regulations under the Nuclear Safety and Control Act [R-4].

1.2 Overview of Darlington and Pickering Nuclear Sites

1.2.1 Site Description

The DN and PN Generating Stations have a combined generating capacity of about 5,600 megawatts (MW). The following is a brief description of the two stations and their sites.

Darlington Nuclear Site

The DN Generating Station (DNGS) is an OPG CANada Deuterium Uranium (CANDU) nuclear generating station. It is a four-unit station with a total output capacity of 3,500 MW and is located on the shores of Lake Ontario in the Municipality of Clarington in Durham Region. Three of four reactors were operational at DNGS in 2025. Refurbishment of DNGS Unit 4 began in Q3 2023 and completed in Q1 2026. Prior to this, the refurbishment of Unit 2 at DNGS commenced in Q4 2016 and was completed in Q2 2020. The refurbishment of DNGS Unit 3 commenced in Q3 2020 and successfully returned to commercial operations in Q3 2023. DNGS Unit 1 refurbishment commenced in Q1 2022 and successfully returned to commercial operations in Q4 2024.

The DN site also contains the Tritium Removal Facility (TRF), where tritium is extracted from tritiated heavy water, the Nuclear Sustainability Services Darlington Waste Management Facility (NSS-DWMF), which is used for the processing and dry storage of used fuel, and the Darlington New Nuclear Project (DNNP) site. Note that the term “Darlington Property” has been used in the DNNP Predictive Environmental Risk Assessment (PERA; see Section 3.1.1) [R-59] and is synonymous with the term “DN site” used in this EMP report. “DNNP site” encompasses facilities east of Holt Road, including the planned four small modular reactor units and DNNP waste structures for low and intermediate-level waste (L&ILW) and used fuel. The EMP encompasses all the facilities on the DN site.

The immediate area around DN site is mostly rural and farmlands with some industrial/commercial areas. The residential locations of Oshawa, Bowmanville, and West/East Beach are more than three kilometres from the site.

Based on the results of site-specific surveys, the residents around the DN site are grouped into categories which best represent their locations and/or lifestyle characteristics. The categories are known as potential critical groups and are further described in Appendix E, Section E.1.0. The DN EMP focuses primarily on the Farm, Rural Resident, West/East Beach resident, and Dairy Farm potential critical groups as described in Section 4.0.

It is noted the DNNP Environmental Monitoring and Environmental Assessment Follow-up (EMEAF) activities are being conducted as project-specific studies and are carried out in accordance with the relevant requirements identified in EMP governance. The EMEAF monitoring verifies the predictions of the environmental effects in the DNNP Environmental Assessment and confirms the effectiveness of mitigation measures. The DNNP EMEAF results are not presented in this report, but are referenced in the DNNP Annual Report, which is submitted each year to the CNSC as per the conditions of DNNP’s Power Reactor Site Construction Licence (PRCL), issued in April 2025.

Pickering Nuclear Site

The PN Generating Station (PNGS) is located on the shores of Lake Ontario in the City of Pickering. The PN site includes the PNGS and the Nuclear Sustainability Services Pickering Waste Management Facility (NSS-PWMF), which consists of facilities located inside and outside of the station protected area. The EMP encompasses all the facilities on the PN site.

In 2025, PNGS had four operating CANDU reactors. This station had a total output capacity of 2,100 MW. PNGS Units 1 and 4 were shut down in October and December 2024, respectively. PNGS Units 1, 2, 3 and 4 are in safe storage.

The area around the PN site is mainly urban residential and industrial/commercial. The closest farmlands are more than six kilometres from the station.

Based on the results of site-specific surveys, residents around the PN site are grouped into categories which best represent their locations and/or lifestyle characteristics. The categories are known as potential critical groups and are further described in Appendix E, Section E.2.0. The PN EMP focuses primarily on the Urban Resident, Dairy Farm, Industrial/Commercial Worker, and Sport Fisher potential critical groups as described in Section 4.0.

1.2.2 Nuclear Generation Performance

In 2025, OPG operated seven of eight nuclear reactors and produced 38.0 terawatt hours (TWh) of electricity. This production is broken down as follows:

Darlington Nuclear Generating Station: Net electrical output in 2025 was 21.6 TWh.

Pickering Nuclear Generating station: Net electrical output in 2025 was 16.4 TWh.

2.0 EFFLUENT MONITORING PROGRAM RESULTS

2.1 Radiological Emissions

The radiological emissions from DNGS and PNGS in 2025 remain at a very small fraction of the Derived Release Limits (DRLs). The DRLs represent radionuclide release rates that correspond to an exposure at the regulatory public dose limit of 1,000 microsieverts per year (μSv/year) for the most affected critical group. See Section 4.0 for the description of a critical group.

Table 2-1 shows the 2025 total airborne and waterborne emissions for radionuclides measured at the DNGS and PNGS, including the NSS-PWMF and NSS-DWMF facilities, and the percentage of their respective DRLs.

Table 2-1: DN and PN Annual Site Radiological Emissions 2025

Site Emissions[d]	DN		PN	
	Bq	% DRL	Bq	% DRL
AIR				
Tritium Oxide	1.9E+14	0.48	3.5E+14	0.31
Elemental Tritium [a]	5.3E+13	<0.01	NA	NA
Noble Gas [b]	1.2E+13	0.03	1.6E+13	0.05
I-131[c]	1.1E+08	<0.01	1.1E+07	<0.01
Particulate	2.4E+07	<0.01	1.1E+07	<0.01
C-14	2.7E+12	0.35	2.4E+12	0.07
WATER				
Tritium Oxide	2.5E+14	<0.01	3.2E+14	0.04
Gross Beta/Gamma	2.1E+10	0.06	7.4E+10	4.97
C-14	1.7E+09	<0.01	7.8E+09	0.03

NOTES: NA = Not Applicable, Bq = Bequerels

(a) Emissions from Darlington Tritium Removal Facility

(b) Units for noble gas emissions are Bq-MeV

(c) Weekly samples are usually < Method Detection Limit (MDL)

(d) Annual air emissions are the sum of continuous samples analysed weekly.
Note that if interim Noble Gas sampling is in place, samples may not be continuous.
Annual water emissions are the sum of monthly composite samples for C-14, and weekly composite samples for tritium oxide and gross beta/gamma.

2.1.1 Radiological Emissions Graphs

Graphs displaying the past 10 years of tritium and C-14 emissions to air and tritium emissions to water from DNGS and PNGS are provided in Figures 2-1 to 2-7. DNGS and PNGS gross beta-gamma emissions to water are provided in Figures 2-8 and 2-9. Given that the reported noble gas stack emissions are often below the instrument detection limits, they are not graphed, but the results of environmental noble gas monitors are used to trend the station noble gas emissions as described in Section 3.3.2.3. Iodine and particulate in airborne emissions and C-14 waterborne emissions are not graphed because their contribution to the overall public dose is minimal.

Elemental Tritium Airborne Emissions

DN – Figure 2-1

Elemental tritium (HT) emissions from DNGS shown in Figure 2-1 are mainly associated with the TRF. As of 2017, these emissions include HT emissions from the powerhouse.

The HT emissions in 2025 were 5.3 x 10^{13} Bq, which is comparable with 2024 levels. The 2024 and 2025 emissions are lower than those in 2023, i.e., 1.8 x 10^{15} becquerels (Bq). The increase in 2023 was attributed to an adverse condition with the Tritium Immobilization System (TIS) at the TRF. Corrective actions were implemented to minimize further releases.

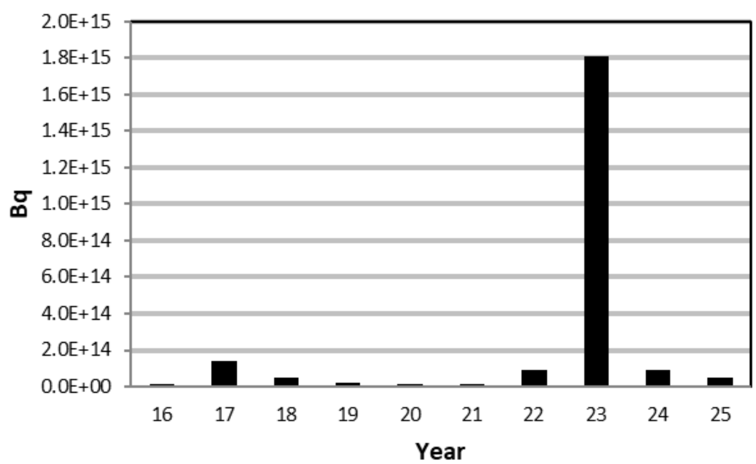

Figure 2-1: Darlington Nuclear Airborne Elemental Tritium Emissions

PN

The PN site does not have a TRF, and as such, there are no appreciable HT emissions.

Tritium Oxide Airborne Emissions

DN – Figure 2-2

Airborne HTO emissions for DNGS in 2025 were 1.9 x 10^{14} Bq, showing a decrease since 2023, when airborne HTO emissions for DNGS were 5.3 x 10^{14} Bq. The increase in tritium oxide emission in 2023 (compared to prior years) was attributed to an adverse condition with the TIS at the TRF referenced above, which was subsequently resolved.

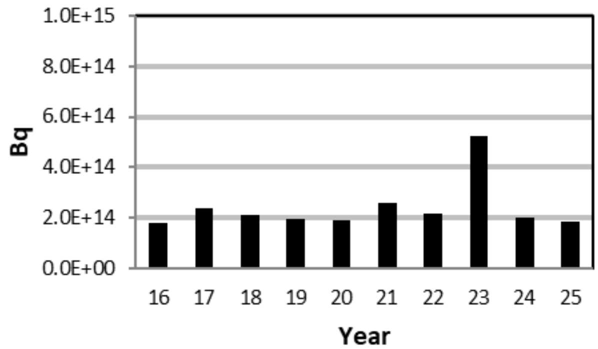

Figure 2-2: Darlington Nuclear Tritium Oxide Air Emissions

PN – Figure 2-3

In 2025, airborne HTO emissions for PNGS were 3.5 x 10^{14} Bq. This reduction, as compared to 2024, may be attributable to PNGS Units 1 and 4 being shut down in October and December 2024, respectively, as they transitioned into a safe-storage state. In 2020, HTO emissions increased due to a heat transport system leak in Unit 1 and a moderator purification valve leak on Unit 6. Corrective actions were taken to repair the leaks. A microscrubber was installed on Unit 4 in October 2020 and approved for service in 2021. The microscrubber removes some of the tritium from airborne emissions and converts it to waterborne tritium effluent, which is directed to the Active Liquid Waste (ALW) Tanks for controlled release to the condenser cooling water (CCW) within acceptable limits.

Similar emissions were observed in 2017, primarily attributed to dryer performance issues and a rupture disk failure on Unit 1, which has since been corrected.

PNGS HTO airborne emissions were higher in 2016 primarily due to the presence of tritiated water in a Fuel Transfer Conveyor Tunnel, and the resulting airborne HTO emissions being vented to a monitored stack. Mitigating actions were taken to reduce HTO airborne emissions from this source.

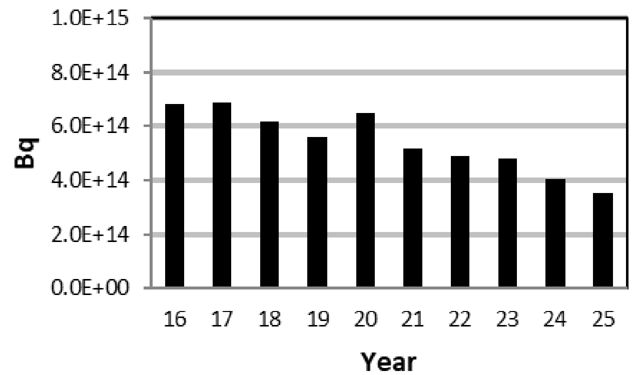

Figure 2-3: Pickering Nuclear Tritium Oxide Air Emissions

Carbon-14 Airborne Emissions

DN – Figure 2-4

The 2025 C-14 airborne emissions were 2.7 x 10^{12} Bq, which is a further increase from 2024.

DNGS C-14 airborne emissions in 2024 were elevated, as documented in Station Condition Record (SCR) D-2024-18523. C-14 emissions have been increasing since October 2024. A Corrective Action Plan investigation has been completed and the suspected cause was identified as inadequate water levels exposing spent resin to air in the Spent Resin Storage Tanks (SRSTs) resulting in increased airborne C-14 emissions. The second suspected cause was overspent Ion Exchange columns leading to ineffective moderator purification. The initial corrective actions focused on adding water to the SRSTs. However, C-14 emissions continued trending upwards throughout the first half of 2025. In response, a High Impact Team was established in 2025 to further address the elevated C-14 emissions. As a result, the following corrective actions were taken:

- Ensure appropriate water level in SRSTs and plan for resin shipment to lower spent resin inventory in tanks.
- Maintain adequate moderator purification in all units with focus on Unit 2 by ensuring Ion Exchange columns are changed frequently and as needed.
- Establish plans to repair a suspected ruptured disk during the U2 outage in 2027.

These latest corrective actions have contributed to a decrease in C-14 emissions in the second half of 2025 and actions remain ongoing.

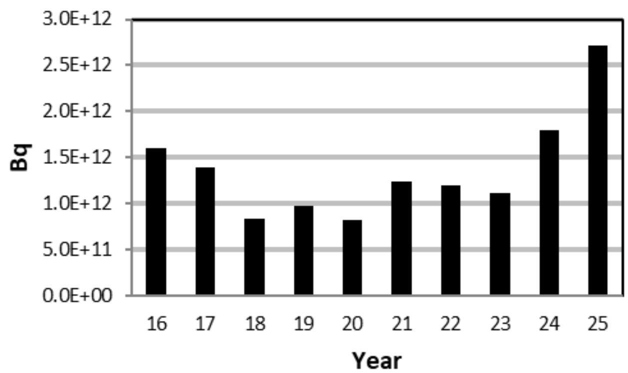

Figure 2-4: Darlington Nuclear C-14 Air Emissions

PN – Figure 2-5

PNGS C-14 airborne emissions were 2.4 x 10^{12} Bq in 2025. The 2024 PNGS C-14 airborne emissions in 2024 were the same.

The elevated C-14 emissions in 2023 were primarily attributed to the removal of the Unit 6 moderator purification system from service in preparation of a planned Unit 6 outage in Q1 and moderator cover gas purging on Unit 4 in Q2. The increase observed in 2018 was due to work associated with the moderator purification system on Units 1 and 6.

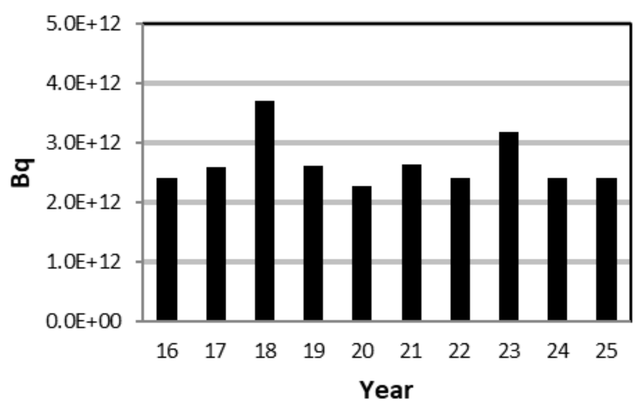

Figure 2-5: Pickering Nuclear C-14 Air Emissions

Tritium Oxide Waterborne Emissions

DN – Figure 2-6

The 2025 DNGS tritium to water emission was 2.5×10^{14} Bq, indicating that waterborne HTO emissions remain stable.

The higher DNGS waterborne HTO 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. The majority of ACU coils were replaced during unit outages in 2018.

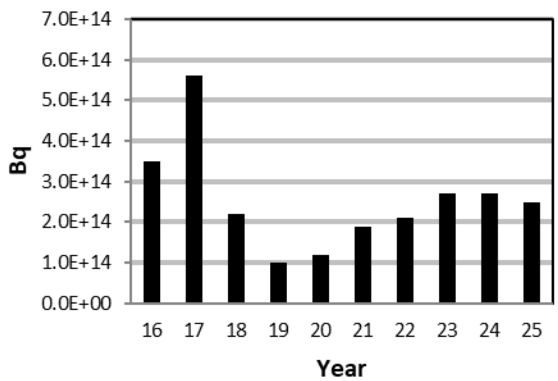

Figure 2-6: Darlington Nuclear Tritium Oxide Water Emissions

PN – Figure 2-7

The PNGS tritium to water emission in 2025 was 3.2×10^{14} Bq, This is a slight decrease from 2024 and can be attributed to the shutdown of PN Units 1 and 4 in Q4 2024.

A slight increase in tritium to water emissions was observed in 2022, over 2021, resulting from prolonged operation of PNGS Units 1 and 4 throughout Q1 to Q3 of 2022, as the station approached the vacuum building outage which took place in Q4 of 2022.

Slightly elevated HTO emissions from 2018 to 2020 were attributed to increased processing of ALW. A microscrubber was installed on Unit 4 in October 2020 and approved for service in 2021. The microscrubber removes some of the tritium from airborne emissions and converts it to waterborne tritium effluent, which is directed to the ALW Tanks for controlled release to the CCW within acceptable limits.

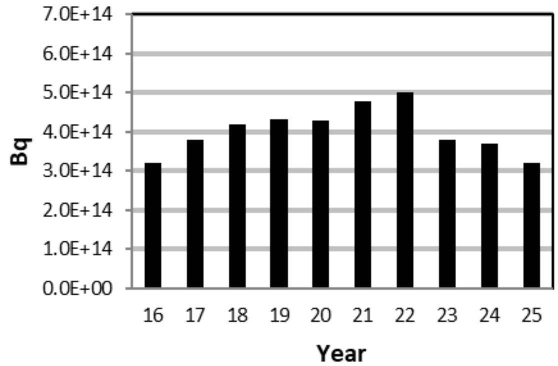

Figure 2-7: Pickering Nuclear Tritium Oxide Water Emissions

Gross Beta-Gamma Waterborne Emissions

DN – Figure 2-8

The 2025 gross beta-gamma water emission was 2.1 x 10^{10} Bq. Over the past 10 years, the DNGS gross beta-gamma emissions to water remain low.

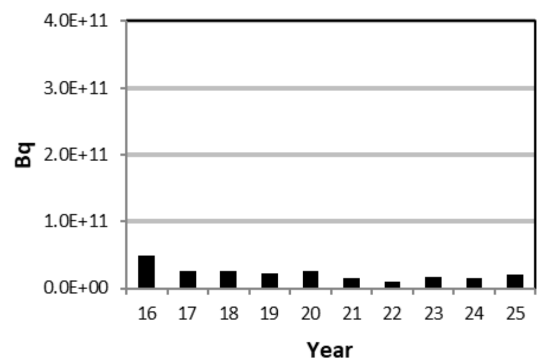

Figure 2-8: Darlington Nuclear Gross Beta-Gamma Water Emissions

PN – Figure 2-9

In 2025, the gross beta-gamma water emission was 7.4 x 10^{10} Bq, which is in line with gross beta-gamma emissions typically observed from PNGS.

The elevated gross beta-gamma waterborne emissions seen in 2020 was primarily attributed to spontaneous releases of concentrated, entrained active lake sediment materials from the Reactor Building Service Water system and not a station generated source of activity. Similar to 2020, higher than normal Gross Beta/Gamma reported values in April 2024 were determined not to be representative of PNGS operational effluent. The likely cause of the elevated activity was entrained sediment from Lake Ontario that entered PNGS through the Unit 014 service water. These events, while infrequent in nature, occur due to PNGS' unique shallow intake and nearby discharge outfalls. This design can result in lake sediment becoming easily entrained and accumulating within the piping systems over time.

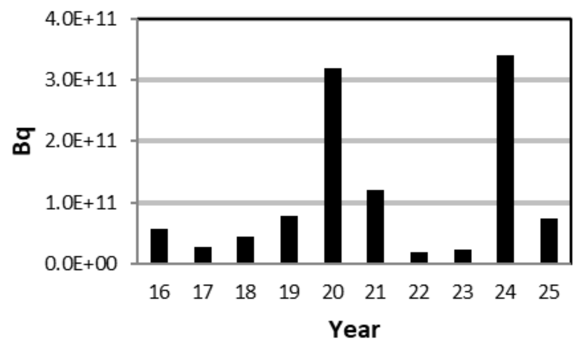

Figure 2-9: Pickering Nuclear Gross Beta-Gamma Water Emissions

2.1.2 OPG Carbon-14 Inventory Data

The C-14 inventories within the DNGS and PNGS are included in this report to fulfill a regulatory commitment to the CNSC [R-5]. The 2025 estimates of C-14 inventory within the DNGS and PNGS are 8.9 $\times 10^{14}$ Bq and 8.2 $\times 10^{14}$ Bq, respectively [R-6].

2.2 Conventional Emissions

OPG monitors conventional substances emitted to air and water as a result of DN and PN site operations. Reports on emissions of both conventional hazardous and non-hazardous substances are prepared in accordance with regulatory requirements and submitted to provincial and federal agencies throughout the year. Reports are available on the OPG website: https://www.opg.com/reporting/regulatory-reporting/ and emissions data are also available online from the Government of Canada's National Pollutant Release Inventory (https://pollution-waste.canada.ca/national-release-inventory/). As the submission of 2025 reports continues through 2026, conventional hazardous substances released from DN and PN sites in 2024, as required under National Pollutant Release Inventory, are provided in Table 2-2. 2025 emissions will be summarized in the 2026 EMP report.

Table 2-2: DN and PN Annual Total Site Emissions of Conventional Hazardous Substances – 2024

Hazardous Material [(a)]	DN	PN
	Mg	Mg
AIR		
SO_2 to Air[(b)(c)]	1E-01	3E-02
NO_2 to Air[(c)]	5.6E+01	1.6E+01
CO_2 to Air[(b)(c)]	1.03E+04	3.03E+03
Ammonia to Air	1.8E+01	6.6E+00
Hydrazine to Air[(d)]	3.6E-02	5.2E-03
Ozone Depleting Substances (ODS) Releases[(e)]	4.05E-01	0
WATER		
Ammonia to Water	2.9E+00	5.5E-01
Hydrazine to Water[(d)]	2.6E-01	2.3E-01

NOTES:

Mg = Megagrams

(a) Hazardous Materials as calculated for NPRI reporting requirements

(b) Reported in OPG Sustainable Development Report as an OPG Nuclear aggregate value.

(c) Based on annual fuel consumption.

(d) Based on annual consumption.

(e) Based on estimated quantity when a release occurs.

Sulphur Dioxide, Nitrogen Oxides and Carbon Dioxide Emissions

The DN and PN sites have standby diesel generators to provide back-up electrical power to the station if required. These generators are routinely tested to ensure availability, which accounts for sulphur dioxide (SO_2), nitrogen oxides (NO_x) and carbon dioxide (CO_2) emissions. There were no regulatory non-compliances associated with the air emissions from these generators in 2024 from the DN or PN sites.

Hydrazine and Ammonia

Hydrazine is used in station water systems to prevent corrosion, and ammonia is a resulting by-product. These chemicals are released in very small amounts when steam is vented to the atmosphere and when water is drained to Lake Ontario. There were no regulatory non-compliances associated with hydrazine and ammonia emissions in 2024 for the DN or PN sites.

Ozone Depleting Substances

Ozone-depleting substances (ODS) are used in refrigeration systems. Refrigerant leaks to air are minimized through routine inspections and maintenance of equipment. ODS releases between 10 kg and 100 kg are reported to Environment and Climate Change Canada in semi-annual halocarbon release reports. There were three releases of ODS that were reportable as spills in 2024 for the DN site:

- On March 1, a degraded oil filter housing outlet led to a release of 38.5 kg of refrigerant R-143a from a refrigeration system. The outlet and inlet to the filter housing were isolated to prevent oil and refrigerant from entering the oil filter cannister and the unit was repaired. To prevent reoccurrence, periodic sniffer tests and annual preventative maintenance leak testing is in place.

- On November 28, a leak on the liquid line isolation valve flange led to a release of 19.05 kg of refrigerant R-134a from a refrigeration system. The leak was repaired at the joint sealing surface. To prevent reoccurrence, ongoing scheduled preventative maintenance is in place to monitor and ensure effective joint sealing performance.

- On December 31, a leak on an oil reservoir tank led to a release of 50 kg of refrigerant R-134a from a refrigeration system. Repairs were made on the affected tank. To prevent reoccurrence, scheduled preventative maintenance and monitoring is in place to ensure efficient performance.

There were zero releases of ODS that were reportable as spills in 2024 for the PN site.

3.0 ENVIRONMENTAL MONITORING PROGRAM

3.1 Design of EMPs

The EMPs were developed using the guidance in CSA N288.4:19 to address site specific objectives covering the aspects of regulatory requirements, ERA results, confirmation of effluent control, areas of regulatory interest, and stakeholder commitments.

3.1.1 Environmental Risk Assessments

The PN and DN site ERAs assess potential human health and ecological risks from exposure to radiological contaminants, conventional contaminants, and physical stressors present in the environment as a result of site operations. The ERAs help to identify monitoring to include in the EMPs.

3.1.1.1 DN Site Environmental Risk Assessment and Addendum

The 2020 DN ERA update was issued in 2021, and most recently revised in 2022 [R-7], in accordance with the requirements of CSA N288.6-12, *Environmental risk assessments at class I nuclear facilities and uranium mines and mills* [R-8] and concluded that the DN site is operating in a manner that is protective of human and ecological receptors residing in the surrounding area. Furthermore, a 2024 ERA Addendum was completed for the DN site [R-43], which met the requirements of CSA N288.6:22. The ERA addendum report serves as an interim update to the 2020 DN ERA, encompassing available data from 2020 to 2022 (and 2023, where available), supporting OPG's request for the renewal of the DNGS Power Reactor Operating

Licence. The ERA addendum report demonstrates that the DN site continues to operate in a manner that is protective of human and ecological receptors residing in the surrounding area. There are no new risk management recommendations identified since the 2024 ERA Addendum for the DN site.

The 2020 DN ERA recommended that lake water samples should be analyzed for hydrazine at a lower detection limit of 0.05 µg/L along and at the outlet of the DNGS diffuser prior to the next ERA update. The ERA Addendum indicated that there are currently no commercial laboratories available at this time that can achieve a lower detection limit for hydrazine in surface water. OPG will continue to explore opportunities to achieve a lower detection limit if hydrazine is measured in lake water in the future and such a method is deemed necessary. OPG currently monitors hydrazine in effluent in accordance with its provincial Environmental Compliance Approval (ECA) requirements and operates below the prescribed ECA limits.

Other recommendations from the 2020 DN ERA pertained to the collection and use of new monitoring data. It was recommended that new nitrogen dioxide (NO_2) air monitoring data be used to support future DN ERAs. As one-hour and 24-hour NO_2 data collected between 2021 and 2024 were assessed in the ERA Addendum, this recommendation is now considered fulfilled.

The 2020 DN ERA also recommended that new impingement and entrainment study results be considered in future risk assessments. Under the Department of Fisheries and Oceans Canada (DFO) Fisheries Act Authorization for the DNGS, OPG must conduct a two-year impingement and entrainment monitoring study now that refurbishment is complete. The impingement study will occur in 2027 and 2028, and the entrainment study is expected to occur between 2027 and 2029. This recommendation is considered in progress.

A final recommendation in the 2020 DN ERA was to use new soil quality data from the yard waste and building materials storage area to determine next steps for managing soils and mitigating potential risks to ecological receptors. These new soil quality data were assessed in the ERA Addendum. This recommendation is now considered fulfilled.

The next DN ERA update is currently underway and is scheduled to be completed in 2026.

3.1.1.2 DNNP Predictive Environmental Risk Assessment and Target Delivery System Predictive Effects Assessments

A PERA for the DNNP, specifically for the deployment of up to four BWRX-300 small modular reactors at the DNNP site within the DN site, was completed in 2024. Revision 1 of the PERA incorporates comments from First Nations and regulators on Revision 0 and was submitted to the CNSC in March 2026. Revision 1 of the PERA also incorporates the Low and Intermediate-Level Waste Storage Structure and the Independent Spent Fuel Storage Installation, as well as the annual BWRX-300 skyshine dose [R-59]. The PERA concludes that the DNNP is not predicted to result in any adverse effects to the human and/or ecological receptors groups evaluated.

In 2020, a Predictive Effects Assessment (PEA)[1] was conducted to evaluate the environmental impacts associated with the installation of a Target Delivery System (TDS) to produce radiopharmaceutical grade isotopes in Unit 2 of DNGS. The assessment concluded that the TDS would not pose unacceptable risks to human or ecological receptors near the DN site, and the system was commissioned in 2023. An update to the TDS PEA for Unit 2 was completed in 2025 to assess the impacts of adding production of two additional radiopharmaceutical isotopes [R-62]. This update concluded that emissions from the Co-60 and TDS systems represent only a small fraction (approximately 1%) of existing DN site emissions, and that there was no unacceptable risk to human and ecological receptors from all facilities at the DN site.

Following this, a PEA was completed in 2022 for the Co-60 Production System, an isotope used in medical and food applications, across all four DNGS units [R-60]. The assessment considered both the direct impacts of the Co-60 system and the cumulative effects of its operation together with the TDS in Unit 2 and existing DN site facilities, including DNGS and DWMF. The PERA concluded that the combined operations would not result in unacceptable risks to human or ecological receptors residing in the vicinity of the DN site. A Co-60 Production System was subsequently installed at Unit 1 in 2024, and at Unit 4 in 2025. A Co-60 Production System is planned for installation at Unit 3 in 2026.

Another TDS is also planned for installation at Unit 3 in 2026. As the TDS to be installed in Unit 3 is identical to the existing TDS in Unit 2, its contribution to overall DN emissions is also expected to be minor [R-61].

3.1.1.3 PN Site Environmental Risk Assessment

The PN ERA was updated in 2022 [R-44] in accordance with the requirements of CSA N288.6-12 [R-8] and included the results of the 2014/2015 sampling programs and routine environmental and effluent monitoring data from 2016 to 2020. Overall, the PN ERA concluded that the PN site is operating in a manner that is protective of human and ecological receptors residing in the surrounding area. A revision of the PN ERA was issued in March 2023 [R-44] to address regulatory comments.

The 2022 PN ERA [R-44] recommended that future air dispersion modelling scenarios include an estimation of the predicted air concentrations at the potential critical groups to reduce uncertainty regarding the short-term NOx concentrations at the locations of the Sport Fisher and other potential critical groups. The air monitoring program conducted to support the 2025 PN PERA (detailed below) established that existing air quality conditions on the PN site were below applicable ambient air quality criteria [R-63][R-64]. This indicates that NOx concentrations at off-site critical group locations would not pose a risk to these human receptors. Therefore, predicting air concentrations through air dispersion modelling is no longer required.

Furthermore, as changes to the facility are periodically reviewed per the requirements of CSA N288.6:22 [R-51], the expansion of NSS-PWMF Phase II will likely result in changes to the stormwater catchments in the East Complex. The appropriate stormwater outfalls in the East

1 A predictive effects assessment (PEA) is, from a risk assessment perspective, equivalent to a predictive environmental risk assessment (PERA). Both assessments are completed in accordance with CSA N288.6 and CNSC REGDOC-2.9.1.

Complex should be reviewed and sampled accordingly to be representative of the catchment areas after the completion of the NSS-PWMF Phase II expansion.

The next PN ERA update is currently underway and is scheduled to be completed in 2027.

3.1.1.4 Predictive Environmental Risk Assessment for Pickering Refurbishment, Decommissioning, and Continued Operations

A PERA was completed in 2025 to quantify and characterize the risk to representative human and ecological receptors posed by proposed activities from the PNGS Units 5-8 Refurbishment, PNGS Units 1-4 Decommissioning, and Continued Operations [R-55]. The 2025 PN PERA concludes that most activities associated with the proposed activities are not likely to result in adverse effects to human and/or ecological receptor groups evaluated. Some aquatic habitat will be disturbed or removed due to the proposed construction of a deepwater intake. OPG will meet all Fisheries and Oceans Canada authorization requirements including implementation of fish habitat compensation measures to offset the loss of habitat and associated productivity. As such, the effect of aquatic habitat loss should be minimal with implementation of mitigation measures. While some individual exceedances of air quality or noise guidelines were identified, monitoring and mitigation measures identified will be implemented to ensure there are no adverse effects. Revision 1 of this PERA will be issued by the end of May 2026. The revision incorporates comments from First Nations and regulators on Revision 0, as well as additional air quality monitoring data and aquatic data collected in 2025.

3.2 EMP Sampling Plan

The EMP sampling plan outlines the contaminants monitored, the sampling locations, the sample types, and the frequency of collection. Sample collection and analysis, as well as data interpretation, support the EMP objectives as follows:

1) Public Dose Calculation

   To ensure the public dose estimation from radiological emissions is as realistic as possible, various exposure pathways, such as food ingestion, inhalation, and water ingestion are assessed for radionuclide concentrations resulting from site operations. Samples are collected at property boundary locations as well as at potential critical group locations. A description of critical groups is provided in Section 4.0, Assessment of Radiological Dose to the Public. For sample types that are not available at potential critical group locations, contaminant concentrations are estimated from concentrations measured at the boundary locations using ratios of modeled atmospheric dispersion factors.

2) Demonstration of Emissions Control

   To meet this objective, environmental measurements at the property boundary are used to confirm that concentrations are as expected based on effluent monitoring. Similarly, lake water/drinking water monitoring demonstrates waterborne emissions are properly controlled. Environmental monitoring provides an independent ongoing check on the effectiveness of containment and effluent control.

3) Refining ERA Models and Predictions

   Sampling to verify ERA predictions and assist in refining models used in the ERAs is included in the EMPs and handled through supplementary studies based on ERA recommendations, and is documented in this annual EMP report.

3.2.1 Radiological Contaminants

Radionuclides that are emitted as a result of PN and DN site operations and monitored in the EMPs are listed below. They are identified through the pathway analyses as discussed in Section 4.2 of this document. The routine sample analyses used in the public dose calculation are indicated in Table 3-1.

Carbon-14 (C-14) – is produced from the operation of nuclear stations. It is also a naturally occurring radionuclide and a by-product of past nuclear weapons testing from the early 1960s. C-14 values detected above background are included in the dose calculations. C-14 background concentrations around the world are decreasing as weapons test C-14 levels naturally decay over time.

Tritiated Water (HTO) – is a normal station emission of CANDU plants. Concentrations measured in plants and animals refer to the HTO concentration in the free water portion of the sample.

Tritiated Hydrogen Gas (HT) – is emitted to air primarily as a result of the operation of the TRF at the DN site. HT contributes a very small percentage to the total dose relative to HTO, and HT concentration in air is modeled from emissions and not monitored in the environment. A portion of the HT is converted to HTO in the environment, and this HTO is monitored.

Organically Bound Tritium (OBT) – is tritium that is bound to the organic molecules in organisms and is not readily exchanged with other hydrogen atoms. In accordance with CSA N288.1:20, OBT concentrations used in the dose calculation are modeled from HTO concentrations measured in sample media at each potential critical group location and in fish. OPG dose calculations incorporate dose from OBT via intake of terrestrial plants and animal products, and from fish. OBT is measured in a few environmental samples for informational purposes and these results are presented in Appendix D.

Noble Gases – Radioactive noble gases released from the DNGS and PNGS are mostly Argon-41 (Ar-41), Xenon-133 (Xe-133) and Xenon-135 (Xe-135). The environmental detectors that measure noble gas doses may also detect Iridium-192 (Ir-192) skyshine from industrial radiography carried out in the stations.

Iodine-131 – The dose from radioiodine emissions is modeled from I-131 emissions, with the assumption that I-131 emissions are accompanied by an equilibrium mixture of other short lived iodine fission products (i.e., I-132, I-133, I-134 and I-135) or mixed fission products [I(mfp)].

Particulates and gross beta-gamma – Atmospheric particulate emissions are represented by Cobalt-60 (Co-60) and liquid effluent beta-gamma emissions are represented by Cesium-134 (Cs-134) as this provides the most conservative assignment of dose based on the pathway analyses in the program design reviews [R-41][R-42]. Cs-137 is present in the environment as a result of historic weapons testing. Co-60 and Cs-134 are representative of station emissions and are analyzed together with Cs-137, which helps distinguish between the Cs-137 resulting from station operations and that from past weapons testing.

Table 3-1: Routine Environmental Samples Used for the DN and PN EMPs

Environmental Medium of Interest	Monitored For	Sampling Frequency	Analyses Frequency
SAMPLES USED FOR PUBLIC DOSE CALCULATIONS			
Atmospheric Sampling			
Air	HTO (active monitor)	Continuous	Monthly
Air	C-14 (passive monitor)	Continuous	Quarterly
Air	Noble gases (Ar-41, Xe-133, Xe-135), Ir-192[(a)]	Continuous	Reported monthly
Terrestrial Sampling			
Fruits and Vegetables[(c)]	HTO and C-14	3 grab samples/year	3 times/year
Animal Feed	HTO and C-14	Bi-annual grab samples	Bi-annual
Eggs	HTO and C-14	Quarterly grab samples	Quarterly
Poultry	HTO and C-14	Annual grab samples	Annual
Milk[(b)]	HTO and C-14	Monthly grab samples	Monthly
Aquatic Sampling			
Municipal Drinking Water	HTO	2-3 grab samples/day	Weekly composite
Well Water	HTO	Monthly grab samples	Monthly
Lake Water	HTO	Monthly grab samples	Monthly
Fish	HTO, C-14, Cs-137, Cs-134, Co-60	Annual grab samples	Annual
Beach Sand	Cs-137, Cs-134, Co-60	Annual grab samples	Annual
SAMPLES USED FOR OTHER EMP OBJECTIVES			
Vegetables	OBT	Annual grab samples	Annual
Soil	Cs-137, Cs-134, Co-60	Grab samples every five years	Every five years
Milk	OBT	Monthly grab samples	Monthly
Municipal Drinking Water	Gross beta	2-3 grab samples/day	Monthly composite
Fish	OBT	Annual grab samples (composite)	Annual
Sediment	C-14, Cs-137, Cs-134, Co-60	Grab samples every five years (composite)	Every five years
Lake water	Potassium	Grab samples every three years (composite)	Every three years

(a) Air kerma is measured and converted to external air immersion dose.
(b) Sampling frequency is quarterly for provincial background locations.
(c) Sampling frequency is annual for provincial background locations.

3.2.2 Conventional Contaminants

Conventional contaminants emitted as a result of DN and PN site operations may be monitored in the environment as part of the EMPs to confirm predictions in the ERA and/or to demonstrate that concentrations are below benchmark values. The monitoring of these contaminants is generally carried out through supplementary studies.

No supplementary studies were conducted in 2025 with respect to the above. However, DNNP EMEAF activities are being conducted as project-specific studies in accordance with relevant requirements identified in EMP governance. Results of the DNNP EMEAF are referenced in DNNP Annual Reports submitted to the CNSC.

3.3 Environmental Monitoring Program Results

This section contains a summary of the results of the EMPs for the DN and PN sites and those of the provincial background locations. All sampling locations are shown in Appendix C, Figures C1 to C3, and are selected based on the pathway analyses and site-specific survey reviews as described in Section 4.2 of this report. Detailed data are given in Appendix D.

3.3.1 Protocol for Reporting Data and Uncertainties

Statistical analyses typically performed on datasets include determination of the mean and standard deviation, trend analysis, demonstration that the concentrations of contaminants are below the benchmark value, and dataset comparison.

Trend analysis is performed on most EMP data; however, it is more meaningful when sampling locations and frequencies remain consistent throughout the trending period. As air monitors are sensitive to changes in location, only locations that were active for the entire trending period are used in the trend analysis of property boundary air data. For other sample media, all locations that are currently active are included in the trend analysis. Fruits and vegetables are the exception in that all sample locations, both current and historical, are included in the trend analysis even though these sample locations change frequently. For animal feed, the EMPs include trend analysis for forage only, and not dry feed, for which locations have changed over the years and samples have been unavailable in the last several years. Therefore, the trend analysis of EMP environmental sample media, other than air, contain a degree of inaccuracy when comparing year to year averages since the same set of locations may not have been used for the entire trending period.

Radionuclide concentrations in the environment are low, and at times, below levels which can be detected by routine analytical techniques. In these situations, the analytical result is reported as being below the critical level (Lc) or the detection limit (Ld).

Lc: The critical level is the level (relative to background) below which a quantity cannot reliably be measured. More specifically, the critical level is the largest value of the quantity for which the probability of a wrong conclusion that a quantity is present exceeds a specified probability [R-2]. The EMPs use a probability of 5%. For the EMPs, Lc is approximately equal to half of the Ld.

Ld: The detection limit is the level (relative to background) above which a quantity can confidently be measured. More specifically, the detection limit is the smallest value of the quantity for which the probability of a wrong conclusion that the quantity is not present does not exceed a specified probability [R-2]. The EMPs use a probability of 5%.

When reporting the analytical data in Appendix D tables, the following conventions are used:

- Where a measured value is below the analytical Ld but above the Lc, the measured value is reported in bold type.
- Where a measured value is below the Lc, then “< Lc” is reported without an uncertainty measure.
- Where a measured value is censored at the Ld, it is reported as “< Ld”. This is the case for gamma spectrometer results, noble gas data, and conventional contaminants.
- For a dataset comprised of a single measured value, the associated uncertainty is the laboratory analytical uncertainty for that particular sample.
- For a dataset without any data censored at the Ld, the arithmetic mean is reported and associated uncertainty is two times the standard deviation of the dataset.
- An asterisk “*” is used to identify datasets containing some data censored at the Ld. For datasets with less than 50% of values censored at the Ld, the Kaplan-Meier (KM) method is used to estimate the mean. The KM mean is reported and its associated uncertainty is two times the KM standard deviation of the dataset.
- For datasets with 50 to 80% of values censored at the Ld, the Regression on Order Statistics (ROS) estimation method was used. This method was selected, consistent with the guidance in [R-56], as it provides more reliable estimates of central tendency than the KM method at this level of censoring. The ROS mean is reported and its associated uncertainty is two times the ROS standard deviation of the dataset.
- For datasets with greater than 80% of values censored at the Ld, the arithmetic mean is reported and the associated uncertainty is two times the standard deviation of the dataset. This method was selected as both the KM and ROS estimates become unreliable at this level of censoring. The arithmetic means calculated for these datasets are likely biased upward relative to the true mean due to the high proportion of non-detects and therefore represent a conservative estimate.
- For a dataset that consists entirely of data censored at the Ld, the average is reported as “<Ld” without an uncertainty measure.
- For a dataset that consists entirely of data below the Lc (with no censored data), the average is reported as “< Lc” without an uncertainty measure.

See Appendix F.2.0 for treatment of background data for dose calculation purposes.

3.3.2 Atmospheric Sampling

Samples of air are collected to monitor the environment around the DN and PN sites. Background samples are also collected to allow determination of net values for dose calculations. The radionuclide analyses performed and the sample collection frequency are detailed in Table 3-1 and results are summarized in Sections 3.3.2.1 to 3.3.2.3. Detailed data are given in Appendix D, Environmental Monitoring Data, Tables D1 to D3.

3.3.2.1 Tritium Oxide

The active tritium-in-air sampler collects water vapour by passing air continuously at a steady rate through two molecular sieve canisters in series. The active samplers are located at six property boundary EMP monitoring locations around the DN site (D1, D2, D5, D9, D10 and D11) and six around the PN site (P2, P3, P4, P6, P10, and P11), as identified in Figures C1 and C2 in Appendix C. These samples are collected and analyzed monthly.

The background concentration of HTO in air is measured at Nanticoke, which is considered to be far from the influence of nuclear stations. The annual average HTO in air measured at the background location in recent years has been at or below the active sampler detection limit of 0.2 Bq/m^3. In 2025, HTO in air measured at Nanticoke ranged from 0.01 to 0.1 Bq/m^3 and the location average was below the Lc (0.1 Bq/m^3).

The 2025 annual average results of airborne HTO at the DN, PN, and background monitoring locations, are summarized in Appendix D, Table D1. The levels of HTO observed in the environment depend on station emissions, wind direction, wind speed, ambient humidity, and seasonal variations. As such, fluctuations from year to year are expected even if site HTO emissions remain similar.

For the purpose of statistical trend analyses, Figures 3-1 and 3-2 include all of the DN and PN monitoring locations listed above. All of the locations were active during the last 10 years and can therefore be used to provide a representative year to year comparison.

<u>DN – Figure 3-1</u>

The 2025 HTO in air annual average concentrations measured at DN site property boundary locations ranged from 0.1 to 0.9 Bq/m^3, with an average concentration of 0.5 Bq/m^3. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend over the past 10 years. The increase in HTO observed in 2023 is likely attributed to issues with the TIS at the TRF described in section 2.1.1.

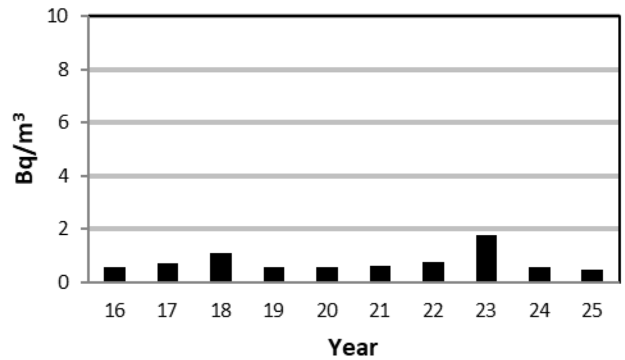

Figure 3-1: DN Annual Average HTO in Air

PN – Figure 3-2

The 2025 HTO in air annual average concentrations measured at PN site property boundary locations ranged from 0.9 to 7.0 Bq/m^3, with an average concentration of 3.6 Bq/m^3. A Mann-Kendall trend analysis at the 95% confidence level indicates a statistically significant decreasing trend over the past 10 years.

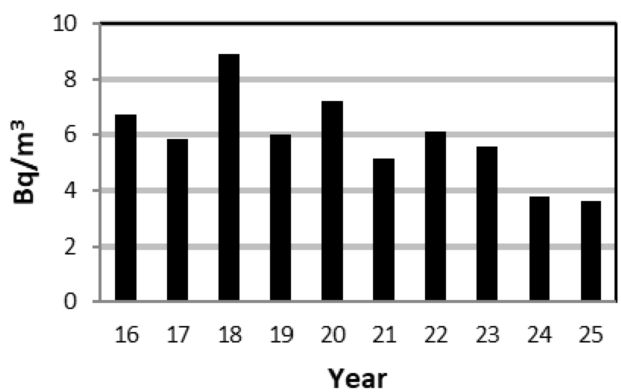

Figure 3-2: PN Annual Average HTO in Air

3.3.2.2 Carbon 14

C-14 in air is sampled using passive sampling technology. The passive C-14 sampler works by absorption of CO_2 in air into soda lime pellets exposed for a period of an annual quarter. Samples are analyzed after each quarter.

The annual average C-14 in air concentration observed at the Nanticoke EMP background location in 2025 was 237 Bq/kg-C. This is within the range typically seen as average background concentrations of C-14 in air observed at the Nanticoke EMP background location, which ranged between 198 Bq/kg-C and 238 Bq/kg-C over the last 10 years. Pre-atmospheric weapons test levels for C-14 were measured at 226 Bq/kg-C [R-9].

In the EMPs, C-14 in air is monitored at four property boundary locations for the DN site (D1, D2, D5, and D10) and four property boundary locations for the PN site (P3, P4, P6, and P10). Appendix D, Table D2, provides the 2025 annual averages of airborne C-14 measured at the DN, PN, and background sampling locations.

For the purpose of statistical trend analyses, Figures 3-3 and 3-4 utilize only locations which were active for all of the last 10 years in order to provide a representative year to year comparison. For the DN and PN EMPs, this includes all monitoring locations listed above.

<u>DN – Figure 3-3</u>

The 2025 annual average C-14 in air concentrations measured at DN site property boundary locations ranged from 217 to 278 Bq/kg-C, with an average concentration of 249 Bq/kg-C. A Mann-Kendall trend analysis at the 95% confidence level does not indicate a statistically significant trend over the past 10 years.

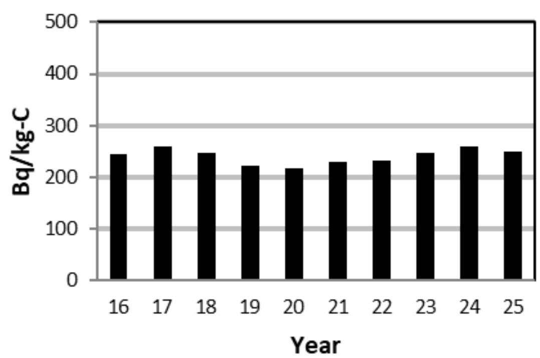

Figure 3-3: DN Annual Average C-14 in Air

<u>PN – Figure 3-4</u>

The 2025 annual average C-14 in air concentrations measured at the PN site property boundary locations ranged from 228 to 338 Bq/kg-C, with an average concentration of 280 Bq/kg-C. A Mann-Kendall trend analysis at the 95% confidence level does not indicate a statistically significant trend over the past 10 years.

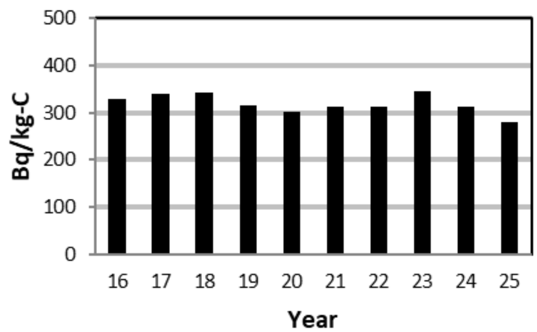

Figure 3-4: PN Annual Average C-14 in Air

3.3.2.3 Noble Gas Detectors

Under a Memorandum of Understanding between OPG and Health Canada (HC), established in 2009, HC operates and maintains OPG's network of noble gas detectors. In exchange, OPG allows HC to release the detector results on their public website as part of their Fixed Point Surveillance network [R-10].

OPG uses the noble gas dose results generated by HC for calculation of the annual public dose. Noble gas data generated by HC is reviewed by OPG on an annual basis.

External gamma radiation doses from noble gases and Ir-192 are measured using sodium iodide spectrometers set up around the DN and PN sites. There are a total of eight detectors around the DN site and eight detectors around the PN site that monitor the dose rate continuously. Natural background dose has been subtracted from noble gas detector results.

The annual property boundary average noble gas dose rate is estimated from the monthly data from each detector. Results obtained in 2025 from the noble gas detectors are summarized in Appendix D, Table D3 and discussed below.

<u>DN</u>

Due to a different station design, DNGS does not experience the same level of noble gas emissions as PNGS. The DN site property boundary average dose rates for Ar-41, Xe-133, Xe-135, and Ir-192 are typically near or below the detection limits. Therefore, no trend graph is presented for the DN site.

<u>PN – Figure 3-5</u>

Ar-41 is the predominant radionuclide measured in noble gas around the PN site followed by Xe-133 and Xe-135. Figure 3-5 illustrates the property boundary average Ar-41 dose rate for the PN site from 2016 to 2025 in units of nGy/month.

Higher Ar-41 emissions are largely related to a higher operating time of PNGS Units 1 and 4. In 2025, the Ar-41 dose rate in air dropped below the detection limit of 6 nGy/month at the PN site, representing a notable departure from levels observed over the past 10 years. This reduction is attributed to PNGS Units 1 and 4 being shut down in October and December 2024, respectively, as they transitioned into a safe-storage state. The lower Ar-41 emissions observed in 2020 were associated with a relatively lower operating time of Units 1 and 4 that year. Other factors, such as calandria vault dryer performance and the influence of meteorological conditions (e.g., wind direction), contribute to interannual variability in Ar-41 emissions.

A Mann-Kendall trend analysis at the 95% confidence level does not indicate a statistically significant trend over the past 10 years.

In 2025, Xe-133 was, at times, measured above the detection limit at the PN site. The measured property boundary average value for Xe-133 was 3.1 nGy/month which is within the range typically seen. Xe-135 remained below the detection limit (<3 nGy/month). Ir-192 was not detected at the PN site in 2025.

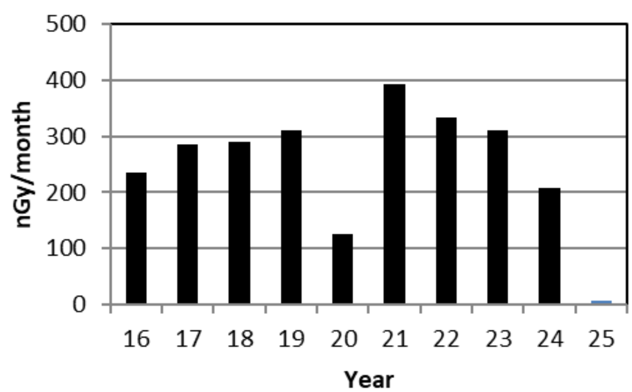

Figure 3-5: PN Annual Average Ar-41 Dose Rate in Air

3.3.3 Terrestrial Sampling

Terrestrial biota receive exposure from both airborne and waterborne emissions as indicated in Figure 4-1. Cow’s milk, for example, is affected by the air, plants, and water sources that the cow consumes. It is therefore important to consider the combined effect of all these pathways when assessing the station impact on terrestrial samples.

Samples of soil, fruits, vegetables, animal feed, milk, eggs, and poultry are collected to support the public dose calculation for the DN and PN sites. Background samples are also collected for calculating net concentrations for dose calculations. The radionuclides monitored and the sample collection frequencies are summarized in Table 3-1 and the 2025 results are discussed in the following sections. Detailed data are given in Appendix D, Tables D4 to D7.

3.3.3.1 Fruits and Vegetables

In the EMPs, fruits and vegetables are sampled three times from each location for a representation of the entire growing season. Each sample is analyzed for C-14 and HTO. Sampling locations for 2025 are shown in Appendix C.

A total of four locations for fruits and two locations for vegetables were sampled for the DN EMP and four locations for fruits and five locations for vegetables were sampled for the PN EMP. Fruits were samples from two background locations and vegetables were sampled from one background location.

The results for vegetation are provided in Appendix D, Table D4.

Tritium Oxide

HTO concentrations in vegetation around the nuclear sites tend to vary from year to year due to prevailing winds, HTO emissions, humidity, etc. Furthermore, the number and types of samples and their locations change over the years. These variations should be considered when reviewing the following graphs and trend analysis as these factors could have an impact on the results for fruits and vegetables.

The average HTO concentrations measured in fruits and vegetables from the background locations in 2025 were 2.9 Bq/L and below the Lc (2.3 Bq/L), respectively. In 2025, the annual average HTO concentration in fruits and vegetables from background locations was 2.6 Bq/L.

DN – Figure 3-6

The 2025 average concentration for HTO was 14 Bq/L in fruits and 11 Bq/L in vegetables. Figure 3-6 illustrates the combined fruit and vegetable annual average HTO results over the past 10 years. In 2025, the annual average HTO concentration in fruits and vegetables for the DN EMP was 13 Bq/L. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend.

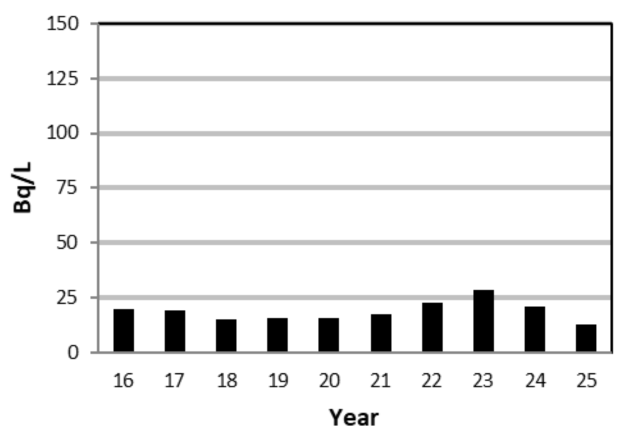

Figure 3-6: DN Annual Average HTO in Vegetation

PN – Figure 3-7

The 2025 average concentration for HTO was 46 Bq/L in fruits and 38 Bq/L in vegetables. Figure 3-7 illustrates the combined fruit and vegetable annual average HTO results over the past 10 years. In 2025, the annual average HTO concentration in fruits and vegetables for the PN EMP was 42 Bq/L. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend.

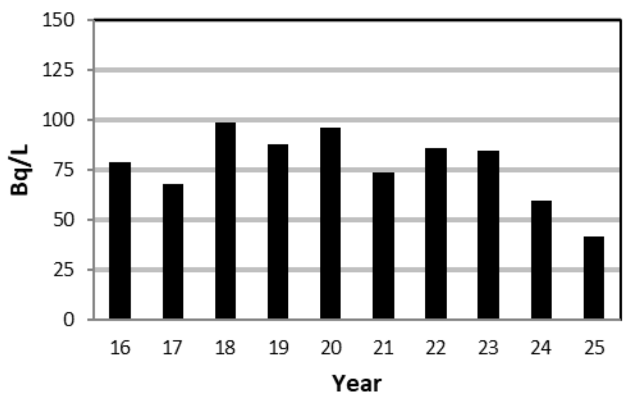

Figure 3-7: PN Annual Average HTO in Vegetation

Carbon-14

The number and types of fruit and vegetable samples, their locations, and sampling frequencies have changed over the years, which should be considered when reviewing the following graphs and trend analysis as these factors could have an impact on the results for fruit and vegetables.

The average C-14 concentrations measured in fruits and vegetables from the background locations in 2025 were 215 Bq/kg-C and 230 Bq/kg-C respectively. In 2025, the annual average C-14 concentration fruits and vegetables from background locations was 220 Bq/kg-C.

DN – Figure 3-8

The 2025 average concentration of C-14 was 251 Bq/kg-C in fruits and 247 Bq/kg-C in vegetables. Figure 3-8 illustrates the combined fruit and vegetable annual average C-14 results over the past 10 years. In 2025, the annual average C-14 concentration in fruits and vegetables for the DN EMP was 249 Bq/L. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend.

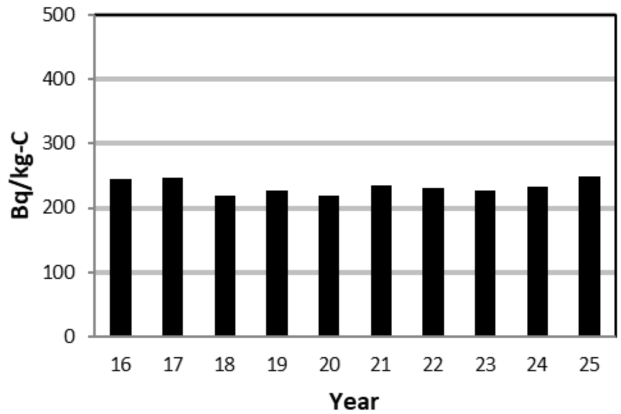

Figure 3-8: DN Annual Average C-14 in Vegetation

PN – Figure 3-9

The 2025 average concentration of C-14 was 243 Bq/kg-C in fruits and 236 Bq/kg-C in vegetables. Figure 3-9 illustrates the combined fruit and vegetable annual average C-14 results over the past 10 years. In 2025, the annual average C-14 concentration in fruits and vegetables for the PN EMP was 239 Bq/L. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend.

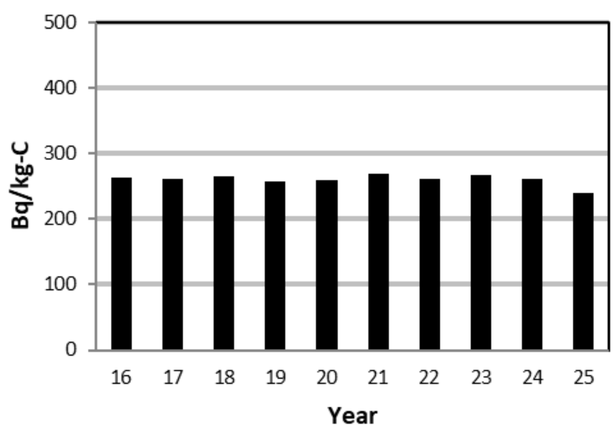

Figure 3-9: PN Annual Average C-14 in Vegetation

3.3.3.2 Milk and Animal Feed

Milk sampling is used to estimate the portion of dose received from milk ingestion for the Dairy Farm potential critical group. Milk consumed by other members of the public comes from commercial dairies whose products consist of composites from many dairy farms across

Ontario. Values in this report are only applicable to residents of the surrounding dairy farms who consume raw milk and are not representative of milk that is sold at a grocery store.

Milk samples are collected monthly from dairy farms around the DN and PN sites and analysed for HTO and C-14. Samples are collected from two dairy farms for the DN EMP and one dairy farm for the PN EMP. Quarterly milk samples are collected from one background location with three replicates collected per quarter.

Locally grown animal feed is collected from two dairy farms around the DN site, twice a year, with two replicates collected per visit. Animal feed is collected from one dairy farm around the PN site and one dairy farm from a background location twice a year, with four replicates collected per visit. Since 2013, dry feed (grains, hay, etc.) and wet feed (forage) have been collected separately. However, dry feed samples have not been available since 2019, and therefore, only wet feed samples were collected and analysed for HTO and C-14 in 2025.

Annual average values of HTO and C-14 in animal feed and milk are provided in Appendix D, Table D5 and D6, respectively.

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. These variations should be considered when reviewing the following graphs.

Tritium Oxide

The background average HTO concentration in milk was 2.4 Bq/L. For animal feed (wet feed, forage), the background average HTO concentration was 3.5 Bq/L.

DN – Figure 3-10

The 2025 average concentration of HTO in milk was 4.0 Bq/L based on two dairy farms around the DN site. Figure 3-10 illustrates HTO in milk results over the past 10 years. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend.

The average HTO concentration in animal feed was 9.8 Bq/L for wet feed (forage). A Mann-Kendall trend analysis of this forage at the 95% confidence level does not indicate any statistically significant trend.

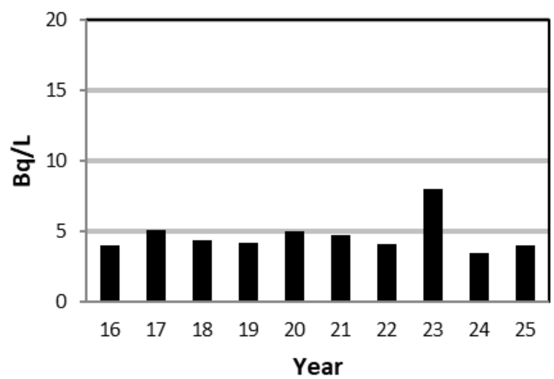

Figure 3-10: DN Annual Average HTO in Milk

PN – Figure 3-11

The 2025 average concentration of HTO in milk was 12 Bq/L based on one dairy farm located within 12 km of PN site. Figure 3-11 illustrates HTO in milk results over the past 10 years. A Mann-Kendall trend analysis at the 95% confidence level indicates a statistically significant decreasing trend.

The average HTO concentration in animal feed was 19 Bq/L for wet feed (forage). Trend analysis was not completed because there is not 10 years of data available from the same forage sampling location.

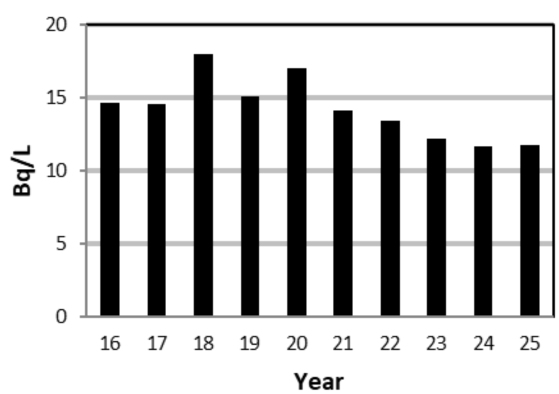

Figure 3-11: PN Annual Average HTO in Milk

Carbon-14

The background average C-14 in milk was 234 Bq/kg-C. C-14 in wet feed (forage) was 231 Bq/kg-C. No dry feed samples were available in 2025.

DN – Figure 3-12

The 2025 average concentration of C-14 in milk from dairy farm locations in the vicinity of the DN site was 231 Bq/kg-C. Figure 3-12 illustrates that C-14 levels in milk around the DN site have been near background levels and slightly decreasing for the past 10 years. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend in C-14 in milk.

The average C-14 concentration in animal feed was 219 Bq/kg-C for wet feed (forage). A Mann-Kendall trend analysis of this forage at the 95% confidence level does not indicate any statistically significant trend in C-14 in animal feed.

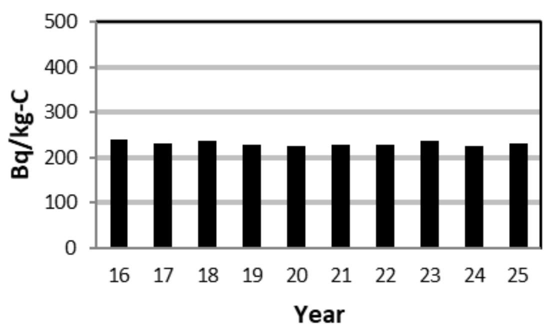

Figure 3-12: DN Annual Average C-14 in Milk

PN – Figure 3-13

The 2025 average concentration of C-14 in milk from the dairy farm location in the vicinity of PN site was 244 Bq/kg-C. Figure 3-13 illustrates that C-14 levels in milk around PN site have been near background levels. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend.

The average C-14 concentration in animal feed was 223 Bq/kg-C for wet feed (forage). Trend analysis was not completed because there is not 10 years of data available from the same forage sampling location.

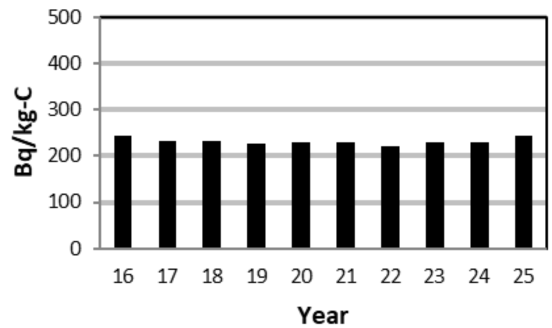

Figure 3-13: PN Annual Average C-14 in Milk

3.3.3.3 Eggs and Poultry

Eggs are sampled on a quarterly basis, and three sample replicates are collected per visit. Poultry is collected annually with eight sample replicates collected per visit. Both eggs and poultry are analyzed for HTO and C-14. Annual average values of HTO and C-14 in eggs and poultry are provided in Appendix D, Table D7.

One farm location around the DN site is sampled for eggs (D10) and one farm location is sampled for poultry (F16). No farm location selling fresh eggs and poultry could be found in the PN site vicinity, and therefore these pathways are modeled for the PN site dose. One background location is sampled for both eggs and poultry (Picton).

The background concentration of HTO was 3.7 Bq/L for eggs and 2.6 Bq/L for poultry. The background concentration of C-14 was 226 Bq/kg-C for eggs and 226 Bq/kg-C for poultry.

DN – Figure 3-14

The 2025 average concentration of HTO in eggs around the DN site was 9.3 Bq/L. A Mann-Kendall trend analysis at the 95% confidence level indicates a statistically significant upward trend. However, the average HTO concentration observed in eggs over the past 10 years remains low, ranging from 2.2 Bq/L to 13 Bq/L.

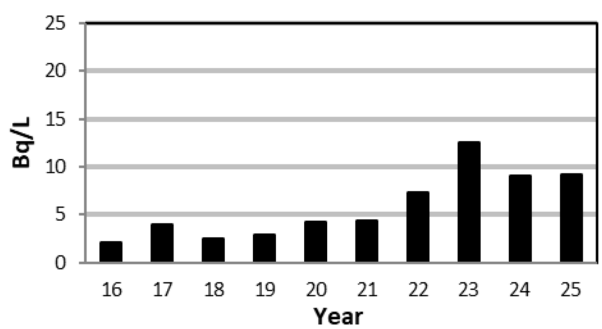

Figure 3-14: DN Annual Average HTO in Eggs

DN – Figure 3-15

The 2025 average concentration of C-14 in eggs around the DN site was 227 Bq/kg-C. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for C-14 in eggs. The average C-14 concentration observed in eggs over the past 10 years ranged from 219 Bq/kg-C to 251 Bq/kg-C.

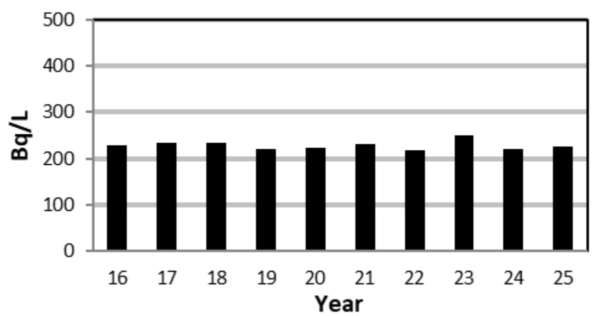

Figure 3-15: DN Annual Average C-14 in Eggs

DN – Figure 3-16

The 2025 average concentration of HTO in poultry was 8.6 Bq/L. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for HTO in poultry. The average HTO concentration observed in poultry around the DN site over the past 10 years remains low ranging from 6.6 Bq/L to 13 Bq/L.

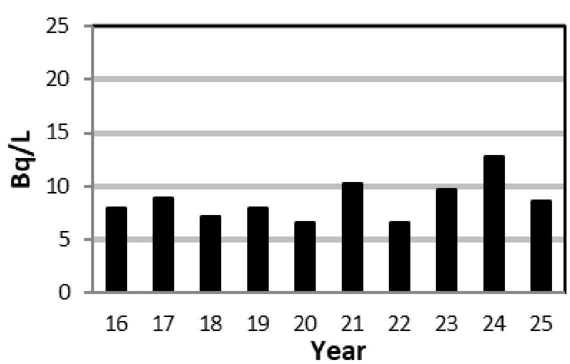

Figure 3-16: DN Annual Average HTO in Poultry

DN – Figure 3-17

The 2025 average concentration of C-14 in poultry was 221 Bq/kg-C. A Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for C-14 in poultry. The average C-14 concentration observed in poultry around the DN site over the past 10 years ranged from 220 Bq/kg-C to 290 Bq/kg-C.

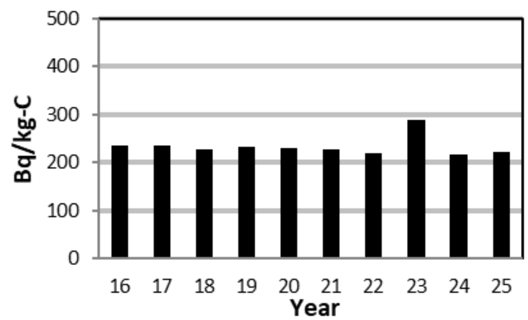

Figure 3-17: DN Annual Average C-14 in Poultry

3.3.3.4 Soil Sampling

Soil is sampled every five years to identify possible radionuclide accumulation over time. Sampling previously took place in 2017 [R-11] and most recently in 2022 [R-48]. The next set of soil samples will be obtained in 2027.

3.3.4 Aquatic Sampling

Samples of drinking water sources (municipal and well water), lake water, lake sediment, beach sand, and fish are collected to monitor the aquatic environment around the DN and PN sites. Background samples are also collected to provide a comparison benchmark and to allow determination of net values for dose calculations. The radionuclides monitored and the sample collection frequencies are detailed in Table 3-1. Detailed data for the results of aquatic sampling are given in Appendix D, Tables D8 to D10, and discussed in the following sections.

3.3.4.1 Water Supply Plants

Samples of drinking water are taken during each 8-12 hour shift at Water Supply Plants (WSPs) that supply water to Durham Region and the City of Toronto. Weekly composites of these samples are analyzed for HTO and monthly composites are analyzed for gross beta activity.

The locations of the WSPs, from which samples of drinking water are taken, relative to the nearest nuclear station discharge are indicated in Table 3-2. The results of water samples are provided in Appendix D, Table D8.

Table 3-2: Water Supply Plants Monitored and Distance from Stations

	Distance from Site
DN AREA WSPs	
Bowmanville WSP	7 km ENE of DN
Newcastle WSP	13 km E of DN
Oshawa WSP	8 km W of DN
PN AREA WSPs	
R.C. Harris WSP	22 km WSW of PN
F.J. Horgan WSP	11 km SW of PN
Ajax WSP	7 km ENE of PN
Whitby WSP	12 km ENE of PN

The impact of HTO emissions from OPG stations on the nearby WSPs varies depending upon distance from the station, lake current direction, location and depth of the WSP intake pipe, and general dispersion conditions. Annual average HTO levels at all WSPs are well below the Ontario Drinking Water Quality Standard of 7,000 Bq/L [R-12].

A single sample hypothesis test was performed to demonstrate that the annual average at each WSP meets OPG's commitment to maintain HTO in drinking water below 100 Bq/L. Results from all WSPs monitored showed annual averages below 100 Bq/L.

Tritium Oxide

HTO in Lake Ontario, and all the Great Lakes, originates from several sources: natural cosmogenic tritium, residual tritium fallout from atmospheric weapons testing in the early 1960s, current emissions from nuclear plants, and residual HTO from past emissions of nuclear plants. For the purpose of calculating public dose resulting from OPG operations, the sum of contributions from current emissions and residual HTO from past emissions was used. The background HTO value, subtracted from HTO measurements, includes only natural cosmogenic tritium and residual tritium fallout from historical weapons testing. This produces a conservative estimate of dose from tritium in lake water. This Lake Ontario background component for 2025 was conservatively estimated to be 1.18 Bq/L, using the Great Lakes Time-Concentration Tritium Model [R-13].

The annual average concentrations of tritium in drinking water at the WSPs are shown in Figures 3-18 through 3-24. A statistical trend analysis was performed for each WSP over a 10-year period.

DN – Figures 3-18 to 3-20

Annual average HTO concentrations measured at the Bowmanville, Newcastle, and Oshawa WSPs ranged from 5.7 to 7.0 Bq/L. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for HTO at any WSP location near the DN site.

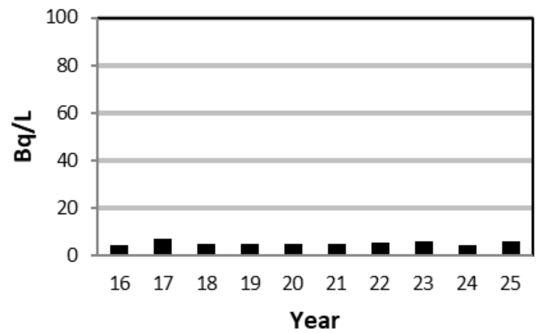

Figure 3-18: Bowmanville WSP – Annual Average HTO in Water

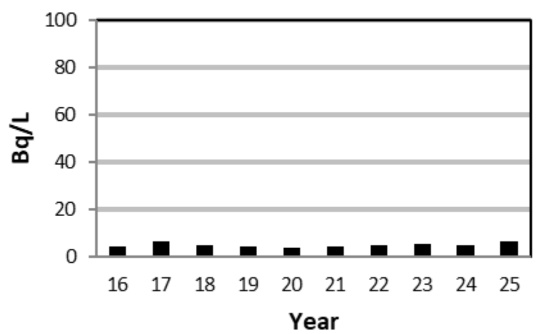

Figure 3-19: Newcastle WSP - Annual Average HTO in Water

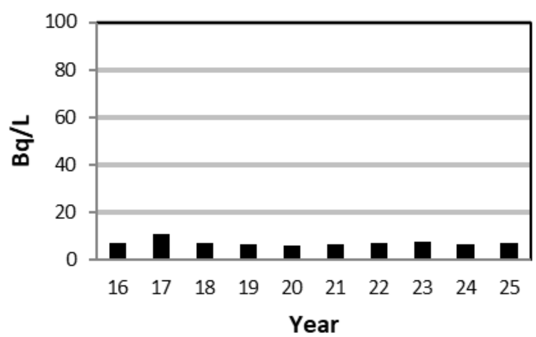

Figure 3-20: Oshawa WSP – Annual Average HTO in Water

<u>PN – Figure 3-21 to 3-24</u>

Annual average HTO concentrations measured at the Ajax, F.J. Horgan, R.C. Harris, and Whitby WSPs ranged from 4.2 to 5.4 Bq/L. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for HTO at any WSP location near the PN site.

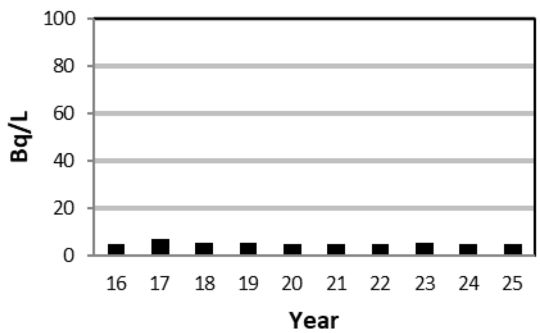

Figure 3-21: Ajax WSP – Annual Average HTO in Water

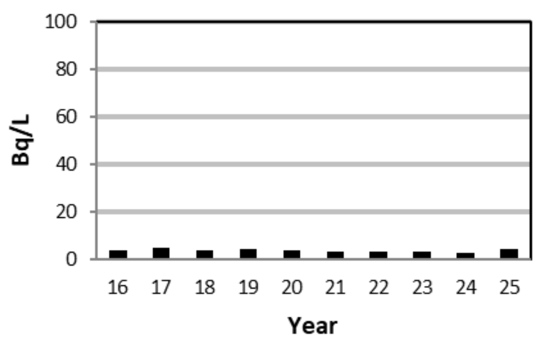

Figure 3-22: F.J. Horgan WSP – Annual Average HTO in Water

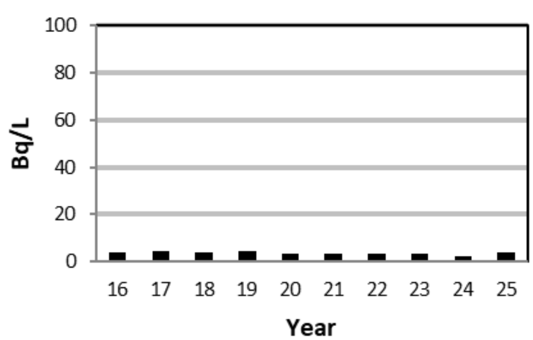

Figure 3-23: R.C. Harris WSP – Annual Average HTO in Water

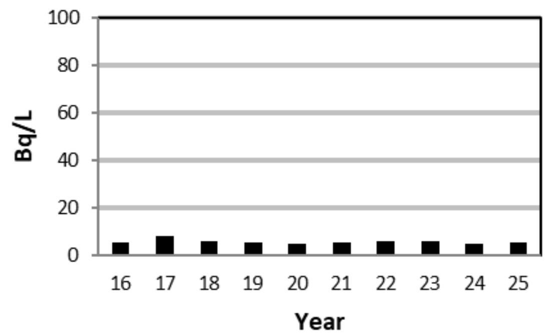

Figure 3-24: Whitby WSP – Annual Average HTO in Water

Gross Beta

The annual average gross beta activity level at WSPs near DN and PN sites was 0.14 Bq/L. This is well below the gross beta activity screening level of 1 Bq/L, which is both an internal OPG screening level and a drinking water level recommended by Health Canada [R-14].

3.3.4.2 Well Water

Monthly well water samples are collected from four wells as part of the DN EMP and two wells as part of the PN EMP. The wells sampled represent the potential critical groups for which the annual public dose is calculated under the EMPs. Samples are analyzed monthly for HTO. Analytical results are provided in Appendix D, Table D8.

Tritium Oxide

HTO concentrations in well water depend on the depth of the well and thus the amount of time it takes for precipitation to reach the aquifer from where the well draws its water. Radioactive decay of the tritium during its transit time to the aquifer determines the residual activity level in the well water. Deeper wells tend to have lower HTO concentrations. Well water HTO concentrations reflect the level of past atmospheric HTO releases because of the time it takes for precipitation to reach the well.

DN – Figure 3-25

The 2025 annual average HTO concentration observed in well water samples collected for the DN EMP was 14 Bq/L.

Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level indicates a statistically significant upward trend for HTO in well water. However, the average HTO concentration observed in well water sampling locations for the DN EMP over the past 10 years remains low ranging from 10 Bq/L to 14 Bq/L. Statistical trend analyses are based on locations with 10 consecutive years of data to ensure consistent year-to-year comparisons. In

2025, DF18 reached this threshold, resulting in all four DN EMP sampling locations (DF18, RF2, R316, and R329) being included in the analysis.

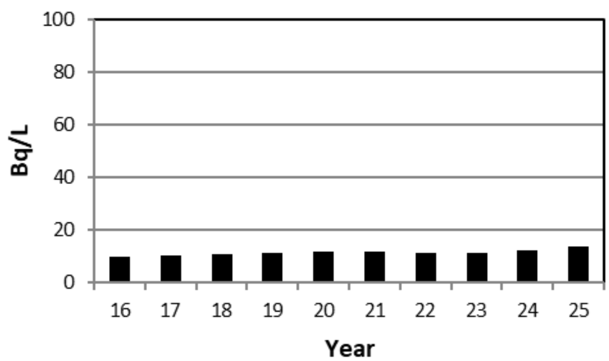

Figure 3-25: DN Annual Average HTO in Well Water

PN – Figure 3-26

The 2025 annual average HTO concentration observed in well water samples collected for the PN EMP was 9.5 Bq/L. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for HTO in well water.

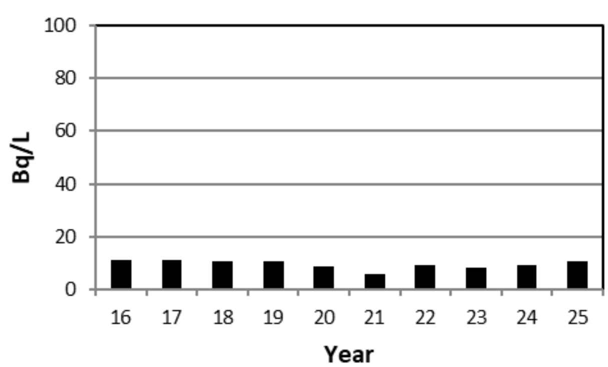

Figure 3-26: PN Annual Average HTO in Well Water

3.3.4.3 Lake Water

Lake water for recreational use is sampled from two beaches in the vicinity of the DN site and three beaches in the vicinity of the PN site on a monthly basis and analysed for HTO. It is used to assess the water immersion exposure pathway from swimming in lake water. Sampling of lake water is not required during the winter months as it is not representative of public exposure. Analytical results are provided in Appendix D, Table D8.

DN – Figure 3-27

The 2025 annual average HTO concentration observed in lake water samples collected from two beaches near the DN site was 16 Bq/L. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level indicates no statistically significant trend for HTO in lake water.

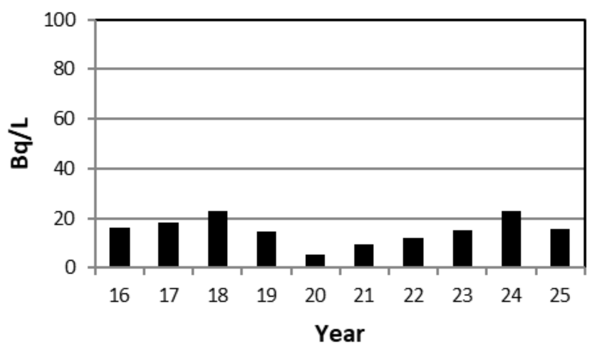

Figure 3-27: DN Annual Average HTO in Lake Water

PN – Figure 3-28

The 2025 annual average HTO concentration observed in lake water samples collected from three beaches near the PN site was 23 Bq/L. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level indicates no statistically significant trend for HTO in lake water.

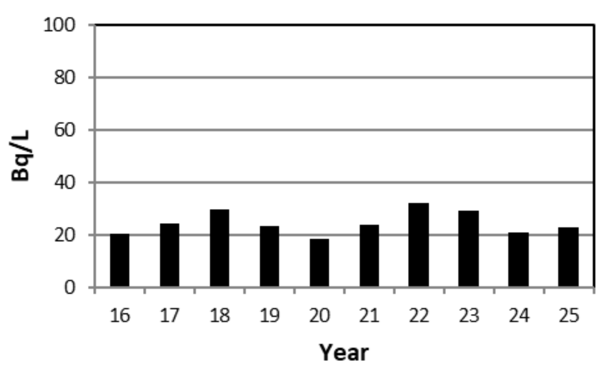

Figure 3-28: PN Annual Average HTO in Lake Water

3.3.4.4 Fish

For the DN EMP, fish sampling takes place over the cooling water discharge diffuser. For the PN EMP, the sampling location is in the PNGS outfall. Background samples are taken from the Bay of Quinte area of Lake Ontario.

The target fish species to be collected at DN, PN, and at background locations is White Sucker, with Brown Bullhead as the backup species. Eight replicate fish samples are collected and analyzed at each location. A sample consists of the fish muscle tissue only, and excludes the head, skin, fins, and as many bones as possible. HTO, C-14, Co-60, Cs-134, Cs-137, and Potassium-40 (K-40) measurements are performed on each fish sample.

The results for fish are provided in Appendix D, Table D9.

Tritium Oxide

The HTO levels in fish change quickly in response to changes in water HTO levels from waterborne emissions. Thus, HTO concentrations measured in fish tissue reflect the HTO concentration in the water in the few hours before they were sampled. Long-term graphs of fish HTO levels for the PN and DN EMPs are provided in Figures 3-29 and 3-30. In 2025, the HTO in Lake Ontario background fish samples averaged 2.4 Bq/L.

DN – Figure 3-29

The HTO levels in the DNGS diffuser fish samples averaged 3.4 Bq/L. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for HTO in fish, which generally reflects HTO waterborne emissions from DNGS (Figure 2-6).

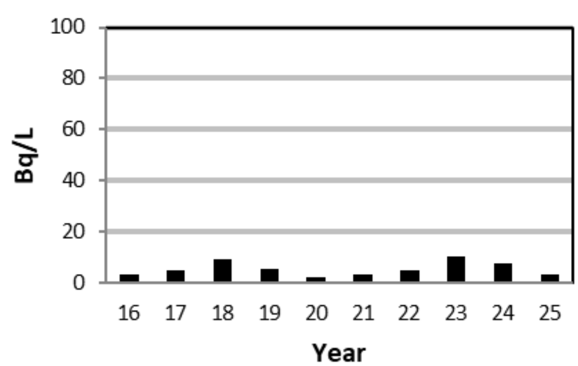

Figure 3-29: DN Annual Average HTO in Fish

PN – Figure 3-30

The HTO concentration in the PNGS outfall fish samples averaged 9.4 Bq/L. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend for HTO in fish, which generally reflects HTO waterborne emissions from PNGS (Figure 2-7).

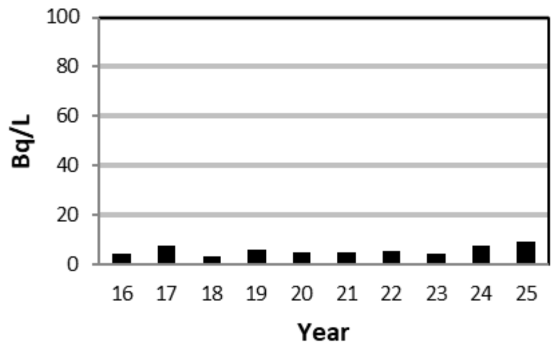

Figure 3-30: PN Annual Average HTO in Fish

Carbon-14

The average C-14 levels in fish measured at the background Lake Ontario location was 221 Bq/kg-C in 2025.

The concentrations of C-14 in fish for both DN and PN EMPs are consistent with past years and comparable to background levels, as shown in Figures 3-31 and 3-32.

DN – Figure 3-31

The 2025 annual average C-14 level in in the DNGS diffuser fish samples was 269 Bq/kg-C. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level indicates a statistically significant upward trend for C-14 in fish. However, the average C-14 level observed in fish over the past 10 years remains low ranging from 233 Bq/kg-C to 269 Bq/kg-C.

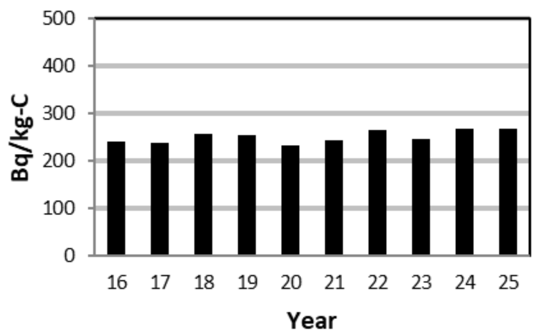

Figure 3-31: DN Annual Average C-14 in Fish

PN – Figure 3-32

The 2025 annual average C-14 level in PNGS outfall fish samples was 285 Bq/kg-C. Based on the past 10 years of data, a Mann-Kendall trend analysis at the 95% confidence level indicates a statistically significant upward trend for C-14 in fish. However, the average C-14 level observed in fish over the past 10 years remains low ranging from 242 Bq/kg-C to 296 Bq/kg-C.

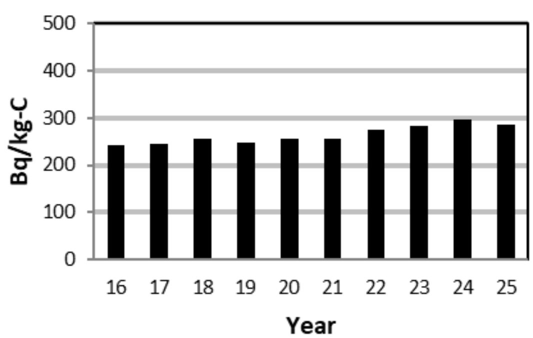

Figure 3-32: PN Annual Average C-14 in Fish

Gamma Spectrometry

The majority of the gamma activity in fish is naturally occurring K-40. A small amount of Cs-137 is usually present, which is primarily due to nuclear weapons testing in the early 1960s and not reactor operation given that Cs-134 and Co-60, which are indicative of reactor operation, were not detected.

The average Cs-137 value for background Lake Ontario fish was 0.2 Bq/kg. The average Cs-134 concentration in Lake Ontario was below the detection limit of 0.1 Bq/kg.

DN – Figure 3-33

Cs-134 and Co-60, which are indicative of reactor operation, were not detected in any DN EMP fish samples in 2025. The average Cs-137 value for fish was 0.1 Bq/kg.

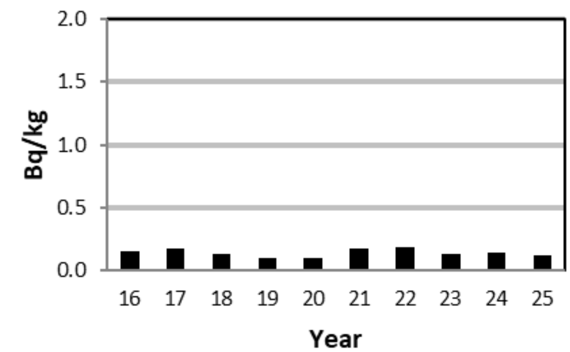

Figure 3-33: DN Annual Average Cs-137 in Fish

PN – Figure 3-34

Cs-134 and Co-60, which are indicative of reactor operation, were not detected in any PN EMP fish samples in 2025. Cs-137 was also not detected in any fish samples in 2025. For the purposes of capturing the trend over the past 10 years, the average Cs-137 value for fish was assigned as the Ld (0.1 Bq/kg).

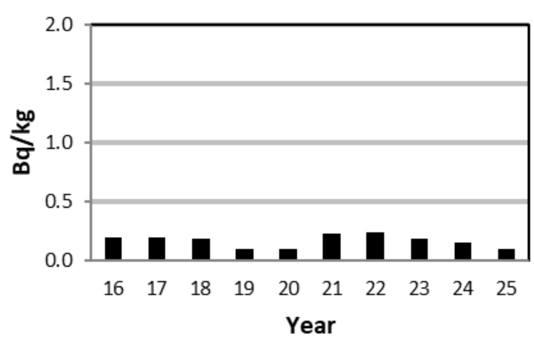

Figure 3-34: PN Annual Average Cs-137 in Fish

3.3.4.5 Beach Sand

Sand from three beaches around DN site and three beaches around PN site is collected annually to represent a potential pathway for external dose. Eight replicates are collected per sampling location. Gamma spectrometry is performed on these samples.

Beach sand samples were collected at Cobourg to determine the Cs-137 concentrations in background sand due to atmospheric weapons test fallout from the early 1960s.

The results for beach sand are provided in Appendix D, Table D10.

Gamma Spectrometry

The majority of the gamma activity in sand is naturally occurring K-40. Background Cs-137 concentrations in beach sand samples measured at Cobourg averaged 0.3 Bq/kg in 2025. All background Cs-134 concentrations in beach sand measured below the detection limit of 0.1 Bq/kg. These values are consistent with values observed over the past ten years.

DN

The average concentration of Cs-137 measured at beaches near DN site ranged from below detection (<0.1) to 0.2 Bq/kg in 2025. There was no Co-60 or Cs-134 detected.

PN

The average concentration of Cs-137 measured at beaches near PN site ranged from 0.3 to 0.4 Bq/kg in 2025. There was no Co-60 or Cs-134 detected.

Wave action continuously moves the beach sand around, disturbing the original deposition patterns. Although Cs-137 was measured above detection in a limited number of instances, this cannot be confirmed to be the result of OPG operations, as Cs-137 is present in the environment as a result of historic weapons testing.

3.3.4.6 Sediment

Lake sediment is sampled every five years to identify possible radionuclide accumulation over time. Lake sediment was last sampled in 2024 and the results are provided in the 2024 Results of the Environmental Monitoring Programs report [R-57]. Station and background sediment sampling in support of the EMPs will be conducted in 2029.

3.4 Supplementary Studies

CSA N288.4:19 specifies that supplementary studies can occasionally be conducted as part of the EMPs to achieve specific, well-defined objectives such as:

- Providing the data required to reduce uncertainty and confounding factors in the risk assessment;
- Increasing knowledge of the behaviour of contaminants and physical stressors in the environment (e.g., refining environmental transfer parameters);
- Investigating specific EMP findings; and
- Follow-up monitoring of mitigation activities implemented following an EA.

Supplementary studies are site-specific, and as such, may vary between nuclear facilities. These studies become part of the EMPs until the objective of the study has been achieved. At that time, the supplementary study is terminated.

In 2025, DNNP EMEAF activities were conducted as project-specific studies that met relevant requirements identified in EMP governance. Results are referenced in the DNNP Annual Report.

In Section 3.1 the supplementary studies that were incorporated into the DN and PN ERA updates are identified.

3.4.1 Supplemental Studies for Effluent Monitoring Program

No supplemental studies for the Effluent Monitoring Program were carried out in 2025.

3.5 Other Studies

3.5.1 Potassium in Lake Water

Concentrations of potassium in lake water around the PN and DN sites are monitored to support validation of the CSA N288.1:20 [R-16] default cesium bioaccumulation factor (Cs BAF) for fish of 3,500 L/kg fw, which is used for the calculation of DRLs. The Cs BAF value is based on an equation recommended by the International Atomic Energy Agency in the Technical Report Series (TRS)-472 report, which considers the relationship of the Cs BAF to lake water concentrations of potassium [R-58]. This study is conducted once every three years and was undertaken in 2025.

Water for low level potassium analysis is collected at three locations near the PN site and three locations near the DN site. The average potassium concentration in 2025 was 1.57 mg/L and 1.67 mg/L at the DN and PN locations, respectively. Using equation 34 from TRS-472 for predatory species in order to be conservative, the Cs BAF for fresh water fish in the vicinity of the DN site was calculated to be 3,108 L/kg fw, and in the vicinity of the PN site was calculated to be 2,927 L/kg fw. As both of these results fall below the CSA N288.1:20 default value of 3,500 L/kg fw, using the default value for the purpose of DRL calculations continues to be valid. This study will next be conducted in 2028.

3.6 Areas of Regulatory Interest and Other Monitoring Programs

While the primary focus of this report is the results of 2025 monitoring conducted in support of the annual public dose calculation, the overall EMPs encompass several other OPG monitoring programs, which are described in Sections 3.6.1 to 3.6.3. Due to differences in reporting requirements and schedules, the information in the following sections is the most recent information available. Some 2025 information is based on preliminary data and/or reports as the finalized reports have not been issued at the time of this report's preparation.

3.6.1 Lake Ontario Thermal Monitoring

Refer to the 2022 EMP Report for a summary of aquatic thermal monitoring studies at DNGS [R-48]. Previous study results at PNGS have been incorporated into the most recent PN PERA which was issued in 2025 [R-55] and are summarized below.

OPG continuously measures the temperatures in the PNGS discharge channels, providing data to assess the thermal impacts on embryonic, larval, and adult stages of fish in the vicinity. Consistent with the methodology applied in the 2022 PN ERA, the rolling 7-day average temperatures from the PNGS Units 5-8 discharge channels were incorporated in the PN PERA from the instantaneous daily maximum effluent temperatures between 2021-2023. These averages were then compared against species-specific Maximum Weekly Average Temperature (MWAT) criteria of two warm-water species, Smallmouth Bass and Emerald Shiner. These criteria represent the upper bound of suitable temperatures for biological processes such as spawning, embryo-larval development, and juvenile growth under chronic exposure conditions.

The results of this comparison for the 2021-2023 period were generally consistent with those reported in previous years and summarized in the 2022 PN ERA. No exceedances of the MWAT criterion for Emerald Shiner (27°C) were observed. In contrast, three exceedances of the Smallmouth Bass MWAT criterion (24.3°C) occurred during the April–May embryo-larval period. Additionally, the duration and degree of these exceedances remained consistent with previous years, with no exceedance persisting for more than 2 consecutive days in late May or exceeding 25.2°C. Thus, these exceedances are likely not detrimental to reproductive performance or embryo/larval development of these species because they occur infrequently, late in the embryo-larval life stages, and are localized to the discharge channel which spans a small area (0.0062 km²).

A similar analysis was conducted for the juvenile life stages of these species. The MWAT criteria applied were 30 °C for Emerald Shiner and 32 °C for Smallmouth Bass. Between 2021 and 2024, the number of occurrences exceeding these MWAT criteria remained generally consistent with previous years, although the average duration of exceedances increased slightly. Despite this, these exceedances are not considered detrimental to fish growth because they are occasional and spatially limited to the discharge channel. Furthermore, unlike embryonic and larval stages, juvenile and adult fish are capable of behavioural thermoregulation and can move in and out of the discharge channel to optimize their exposure to temperature conditions.

For coldwater species such as Round Whitefish, the results of studies conducted between 2018 and 2020 as summarized in the 2022 EMP Report [R-48] remain applicable. Therefore, no chronic adverse effects on Round Whitefish egg survival are expected from the thermal plume.

With the shutdown of PNGS Units 1 and 4 in 2024, flow from the CCW decreased in 2025, resulting in reduced thermal discharge in the vicinity of the PNGS 1-4 outfall.

3.6.2 Fish Impingement Monitoring

Annual reporting of fish impingement is required by DFO to ensure ongoing compliance with conditions of the PN Fisheries Act Authorization issued to OPG in January 2018, and amended in August 2022.

Results of the 2025 impingement monitoring program will be issued in 2026 and included in the subsequent EMP report. The 2024 impingement monitoring program results are discussed here. Results of the 2024 monitoring program are presented in the Pickering Nuclear 2024 Impingement Monitoring Report submitted to both DFO and CNSC [R-18]. The combined biomass of all species and ages impinged in 2024 was 3,159.4 kg, a rate equivalent to 0.65 kg per million cubic metres of station intake volume. The species with the largest all ages biomass impinged were Alewife (2,108.1 kg; 66.7% of total biomass), Round Goby (291.0 kg, 9.2% of total biomass) and Gizzard Shad (103.2 kg, 3.3% of total biomass).

A year-long entrainment monitoring program was conducted at PNGS between 2024 and 2025. Results of this program will be included when available. A comparable program for DNGS is scheduled to be completed between 2027 and 2029.

The residual impingement and entrainment impacts at both PNGS and DNGS are counterbalanced by offset measures approved by DFO in the station specific Authorization. An allocated portion of the OPG Big Island Wetland habitat bank, situated in the Bay of Quinte, is an offset measure for PNGS, DNGS and DNNP. Additional offset measures for PNGS include stocking of Atlantic Salmon into Duffins Creek and the construction and monitoring of the Simcoe Point Wetland at the mouth of Duffins Creek.

3.6.3 Groundwater Monitoring Program

Results of the 2025 groundwater monitoring program will be issued in 2026 and discussed in the 2026 EMP report. The 2024 groundwater monitoring program results are discussed below.

In 2024, annual Groundwater Protection and Monitoring Programs to evaluate groundwater quality and flow were completed at the PN and DN sites to detect any emergent issues [R-49][R-50].

Groundwater monitoring occurs from January 1 to December 31 of each year. In 2024, approximately 145 and 45 groundwater monitoring locations were sampled at the PN and DN sites, respectively. The samples were analyzed for tritium, which is the key parameter of focus. Annual water level measurements were also conducted for each site. Within certain areas, samples were analyzed for Petroleum Hydrocarbon Fractions F1 to F4 and Benzene, Toluene, Ethylbenzene and Total Xylenes (BTEX). Samples were collected within the East and West Landfills at PN and analyzed for dissolved iron.

In general, tritium trends over time show that levels have remained nearly steady or decreased, indicating stable or improved environmental performance. There are isolated cases where tritium concentrations have shown increases. Monitoring wells where unexpected tritium concentrations were identified; investigations were completed to determine the root cause and to implement corrective measures coupled with increased well monitoring. Ongoing results confirm that tritium in groundwater is mainly localized within the protected areas, particularly at the PN site, and the perimeter tritium concentrations continue to remain low below the background criterion.

4.0 ASSESSMENT OF RADIOLOGICAL DOSE TO THE PUBLIC

This section contains an assessment of doses to the public resulting from the operation of OPG’s PN and DN sites. The effective dose limit for members of the public as set out in the Radiation Protection Regulations [R-19] is 1,000 μSv/year. The environmental samples collected and analyzed through the PN and DN EMPs are used to produce realistic estimates of radiation doses to the public resulting from the operation of PN and DN sites, and to demonstrate that these doses remain below the regulatory limit.

The doses are heavily based on environmental concentrations of radionuclides measured at the potential critical group locations and in the surrounding environment. For the radionuclides and pathways where environmental measurements are not available, dose is modeled from emissions.

The dose calculation follows the method described in OPG's Methodology for Data Analysis and Public Dose Determination for the EMP [R-20]. OPG's assumptions, model parameters, and mean intake rates are in accordance with CSA N288.1 [R-16]. Annual average meteorological data are used along with local intake fractions and representative locations for potential critical groups identified in the site-specific survey reviews [R-21][R-22]. Appendix F provides details on how the data are used.

Figure 4-1 represents the model of potential exposure pathways to human receptors used for public dose calculation.

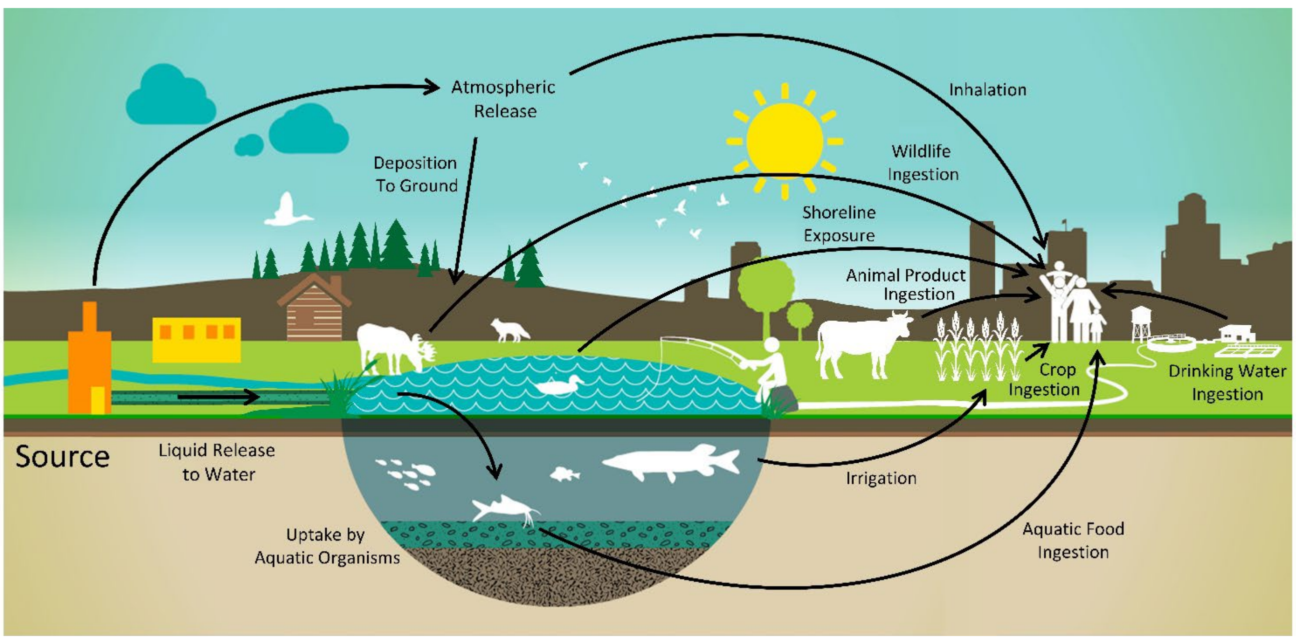

Figure 4-1: Model of Exposure Pathways from Site Emissions

4.1 Modelling

4.1.1 Integrated Model for Probabilistic Assessment of Contaminant Transport (IMPACT)

The IMPACT version 5.5.2 software was used to calculate doses to the potential critical groups using 2025 environmental monitoring data. Where measured environmental data was not available, IMPACT calculated the doses from emissions. IMPACT 5.5.2 is aligned with the CSA N288.1:20 standard [R-23]. Its equations are also consistent with CSA N288.1:14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities.* While a few parameters were updated in the 2020 version of the standard, none of these parameters are involved in PN or DN site dose modelling scenarios.

4.1.2 Calculated Atmospheric Dispersion Factors

Atmospheric dispersion factors (Ka) provide a measure of the dilution of station radiological stack emissions to the atmosphere. Ka values are used to estimate radionuclide concentrations in air at the property boundary monitor locations when local measured values are not available. Details of how and when the Ka values are used are provided in Appendix F, Dose Calculation Procedure and Concentrations.

Factors influencing atmospheric dispersion at a specific location include wind speed and direction, as well as the level of turbulence in the atmosphere.

Ka values are calculated from the measured HTO in air concentrations and HTO emissions using the relationship:

Ka = C/Q (s/m^3)

Where C is the annual average HTO in air concentration (Bq/m^3) above background measured outside the property boundary, and Q is the average annual HTO release rate (Bq/s) measured by stack monitors at the point of release. The release rate is determined by dividing the total annual emission of HTO, as shown in Table 2-1, by 3.16 x 10^7 seconds per year.

Ka values have been calculated using HTO in air concentrations from the active samplers at the property boundary locations. These values are listed in Tables 4-1 and 4-2 for the DN and PN sites, respectively.

Table 4-1: Darlington Nuclear Annual Boundary Dispersion Factors – 2025

INDICATOR SITES	Measured Average Airborne Tritium Concentration (Bq/m^3)	Measured Ka (s/m^3)
D1 – Southeast Fence	0.89	1.4E-07
D2 – East Fence	0.75	1.2E-07
D5 – Knight Road	0.32	4.7E-08
D9- Courtice WPCP	0.36	5.4E-08
D10 – Holt Road	0.13	1.5E-08
Average		**7.6E-08**

NOTE: The measured annual HTO to air emission is used together with the measured levels of HTO in the environment to calculate Ka.

Table 4-2: Pickering Nuclear Annual Boundary Dispersion Factory – 2025

INDICATOR SITES	Measured Average Airborne Tritium Concentration (Bq/m^3)	Measured Ka (s/m^3)
P2 – Montgomery Park Rd.	6.98	6.2E-07
P3 – Sandy Beach Rd.	1.74	1.5E-07
P4 – Liverpool Rd.	0.86	7.3E-08
P6 – East Boundary	4.21	3.7E-07
P10 – Central Maintenance –East	6.32	5.6E-07
P11 – Alex Robertson Park	1.45	1.3E-07
Average		**3.2E-07**

NOTE: The measured annual HTO to air emission is used together with the measured levels of HTO in the environment to calculate Ka.

4.1.3 Meteorological Data

Wind speed, direction and frequency are measured continuously at meteorological towers at each nuclear site. The average annual wind frequencies in 2025 at a 10 m height for the PN site are presented in Table 4-3 for 16 wind sectors. The meteorological data from the PN site was used for both nuclear sites for the 2025 dose calculation.

The meteorological data are used in the IMPACT program to model radionuclide concentrations at the potential critical group locations where measured data are not available (such as pathways for I(mfp), Co-60, Cs-134 and HT). At the DN site, repairs to the meteorological tower are ongoing to address operational issues, as outlined in Station Condition Record (SCR) D-2024-08442 and data for 2025 are not available. At the PN site, the annual wind data unavailability for 2025 was 8.2%. Data unavailability was evaluated by quarter, with 1.3% unavailable in Q1, 0.25% unavailable in Q2, 28% unavailable in Q3 and 2.8% unavailable in Q4. The unavailability of both DN and PN meteorological data in Q3 2025 was documented in SCR N-2026-02831 for trending purposes. The PN meteorological tower exceeded the program’s unavailability limit of 10% for Q3 2025, due to a communications issue that interrupted the PN tower MET feed. Given that the DN meteorological data was unavailable, PN meteorological data from 2024 was used to address this. The substitution process involved replacing the missing data in Q3 with data from the same period from 2024. The substitution approach utilized data from the same site and was considered preferable to utilizing data from a different location.

In 2025, the landward wind sector which the wind predominantly blew towards was the NE sector (wind from SW). Table 4-3 indicates the wind frequencies blowing from each direction.

Table 4-3: Pickering Nuclear – 2025 Annual Average Wind Frequency by Direction (at 10 m height)

Direction Wind Blowing From	Pickering Nuclear Wind Frequency (%)
N	7.11
NNE	10.06
NE	7.15
ENE	3.02
E	3.47
ESE	6.84
SE	5.19
SSE	3.89
S	1.82
SSW	2.70
SW	**8.75**
WSW	7.29
W	5.60
WNW	8.15
NW	8.36
NNW	10.61
Total	100.00

NOTES:

- Shaded fields indicate landward wind sectors.
- Bolded values indicate landward wind sectors with the highest wind frequency.
- PN meteorological data used for DN in 2025 due to unavailability of DN Met Tower.

4.2 Critical Group Dose

The calculation of public dose in this report is intended to be realistic, using the potential critical group lifestyles and attributes collected in the DN and PN site-specific surveys [R-21][R-22]. The site-specific surveys identify the potential critical groups for the DN and PN sites as discussed in Appendix E. Approximately every five years, the site-specific surveys and pathway analyses are reviewed to ensure the public dose accurately represents the public living near the nuclear generating stations.

The current EMPs are based on the 2013 site-specific survey information. Site-specific surveys were most recently reviewed in 2018 and pathway analyses were updated in 2016; however, these did not identify any significant changes with the potential to substantially alter the predictions of the ERAs or the implementation of the EMPs. The recommendations from these studies were incorporated into EMP design reviews undertaken in 2018 [R-41][R-42] and necessary program changes were implemented in 2019. These included minor changes only and mainly affected which potential critical groups are used for reporting purposes as discussed below, and the use of Cs-134 (previously Cs-137) as the surrogate to estimate dose from gross beta/gamma in waterborne releases, as discussed in section 4.2.3.

In public dose assessments, “critical groups” are used to estimate the mean realistic impacts of emissions on the most affected individuals. An individual with the average characteristics of the group is known as the “Representative Person” as described in CSA N288.1 [R-16]. Dose estimates are calculated for a number of potential critical groups for each site, and for three age classes within each potential critical group: adult, child, and infant. The group and age class with the highest dose is reported as the site public dose for the given year.

Doses are reported for each of the top three potential critical groups for the DN and PN EMPs, i.e., the three potential critical groups for each site which yield the highest dose estimates based on the most recent pathway analyses. For the DN site, these groups are the Farm, the West/East Beach Resident, and the Rural Resident. For the PN site, these groups are the Industrial/Commercial Worker, the Urban Resident, and Sport Fisher. Additionally, the annual public dose is also calculated for the PN and DN Dairy Farm potential critical groups as the Dairy Farm group is exposed to the most media types and pathways. Including the Dairy Farm assures that any changes in emissions, environmental transfer factors, exposure factors, dosimetry, and changes in the distribution of radionuclides released will be captured in dose results. The EMP sampling plan is designed to monitor for these potential critical groups. No changes to routine sampling were identified in the 2018 EMP design reviews [R-41][R-42].

For groups that occupy a relatively small geographic area, radionuclide measurements taken at that location are used in the potential critical group calculations. For groups such as the Farm, Dairy Farm or Urban Resident that are spread over much wider geographic areas, air concentrations are determined for a single conservative representative location, and group average values are used for terrestrial samples and water sources.

A small fraction of the adult residents living near the DN or PN site also work within 5 km of the stations, thereby receiving a different dose while at work and at home. Similarly, a small fraction of the Industrial/Commercial potential critical group workers live near the DN or PN site and continue to receive a dose while at home. As a result, the dose estimates for these potential critical groups have been adjusted to account for this portion of the population.

The following sections provide the basis for the dose calculation, results, and interpretation of the public dose for the DN and PN sites. Details on the calculations, how the radionuclide concentrations are determined, background subtractions, and whether data is measured or modeled are provided in Appendix F. Tables of doses calculated for all the potential critical groups are provided in Appendix G, Tables of Public Doses by Radionuclide, Pathway and Age Group for Darlington Nuclear and Pickering Nuclear Potential Critical Groups.

4.2.1 Exposure Pathways

The dose calculations include all pathways of radionuclide uptake or external exposure by humans, as illustrated previously in Figure 4-1. The previous ERAs conclude that the operation of the DN and PN sites do not present any radiological risk to humans or non-human biota. The purpose of the human dose analyses provided in this report is to support the regulatory objective of performing annual public dose assessments. The dose contribution from each pathway was estimated with IMPACT 5.5.2 using inputs from direct measurements in the environment or by modelling from emissions.

4.2.2 Age Classes

In accordance with CSA N288.1 [R-16][R-23], three age classes are used for estimating annual dose to the representative person. The three age classes are 0-5 years (infant), 6-15 years (child), and 16-70 years (adult). The dose estimates to these three age groups are sufficient to characterize doses to the public. For practical implementation in dose calculations, the dose coefficients and characteristics for a one-year-old infant, a 10-year-old child, and an adult are used to represent the three age classes [R-24].

4.2.3 Basic of Dose Calculation

- For each potential critical group, the annual average concentration of each environmental medium sampled from that group is used for the dose calculation with the background subtracted.
- OBT doses from terrestrial animals, plants, and fish are modeled from measured HTO concentrations in terrestrial media and fish.
- Doses from HTO, noble gases, and C-14 in air (where samplers are not at potential critical group locations) are estimated based on measurements at the property boundary and applying a calculated air dispersion ratio for the potential critical group location.
- Doses from gross beta/gamma in airborne releases are estimated using the surrogate Co-60 (as “particulate”) in accordance with DRLs implemented in 2019.
- Doses from gross beta/gamma in waterborne releases are estimated using the surrogate Cs-134 (previously Cs-137) in accordance with DRLs implemented in 2019.
- Doses from the remaining radionuclide pathways for I(mfp), Co-60, and HT, are modeled from emissions applying the Ka dispersion factor as well as the calculated air dispersion ratio for the potential critical group location (see Appendix F).

4.2.4 Uncertainty in Dose Calculation

As described previously, the public dose estimates use a combination of measured and modeled environmental concentrations of radionuclides. A study was completed through Conexus Nuclear Incorporated (Conexus) to quantify the uncertainties associated with public dose estimation. This study concluded that dose estimates which start with concentration measurements in environmental media for the important exposure pathways, such as OPG’s EMP dose estimates, tend to have uncertainties in the order of ±30% [R-25].

4.3 Darlington Nuclear Site Public Dose

4.3.1 Darlington Nuclear Potential Critical Groups

The four potential critical groups for the DN site for which doses are calculated in this report are shown in Figure C1, Appendix C and are described in Appendix E, Potential Critical Group Descriptions. The potential critical groups and their representative locations are primarily based on the DN site-specific survey review [R-21] and modified, if required, if significant changes occur ahead of the next site-specific survey review.

4.3.2 Dose Calculation Results

For 2025, the limiting critical group for the DN site was the Farm adult, with a dose of 0.45 µSv/year, as indicated in Table 4-4.

The Farm critical group represents agricultural farms located within approximately 10 km of the DN site. The representative location of this critical group is the most affected farm which is in the WNW wind sector about 2 km from the site. Members of this group obtain their water supply mostly from wells and use it for drinking, bathing, irrigation, and watering livestock. They also obtain a large fraction of their annual fruit, vegetable and animal product consumption from locally grown products, and are exposed to beach sand at local beaches.

The results of the 2025 DN site public dose calculation are presented in Table 4-4.

Table 4-4: 2025 Annual Darlington Nuclear Critical Group Doses

Potential Critical Group	Dose per Age Class (microsieverts)		
	Adult	Child (10-year old)	Infant (One-year old)
Dairy Farm Residents	0.10	0.09	0.09
West/East Beach Residents	0.21	0.19	0.14
Farm Residents	**0.45**	0.41	0.33
Rural Resident	0.31	0.24	0.18

Table 4-5 illustrates the dose contribution from each radionuclide for the Farm adult and percent contribution to the total dose. C-14, HTO, and noble gases contribute over 98% of the total dose.

Table 4-5: 2025 Darlington Nuclear Public Dose

Radionuclide	Dose (µSv/a)	% Dose Contribution
C-14	8.0E-02	18%
Co-60	4.3E-03	1.0%
Cs-134	3.4E-05	0.008%
HT	2.0E-06	0.0004%
HTO	2.3E-01	51%
Noble Gases	1.3E-01	29%
OBT	3.7E-03	0.8%
I (mfp)	2.9E-04	0.1%
Total	4.5E-01	100%

This distribution of dose by radionuclides reflects the characteristics of the Farm group. C-14 dose is mostly from ingestion of terrestrial plants and animal products. A large portion of the animal products, fruits, and vegetables consumed by the Farm group are from local sources. Dose from HTO is attributed to air inhalation and ingestion of local well water, terrestrial plants and animal products. The public dose trend for the DN site is presented on a logarithmic scale in Figure 4-2. The DN site dose is below 1% of the regulatory limit.

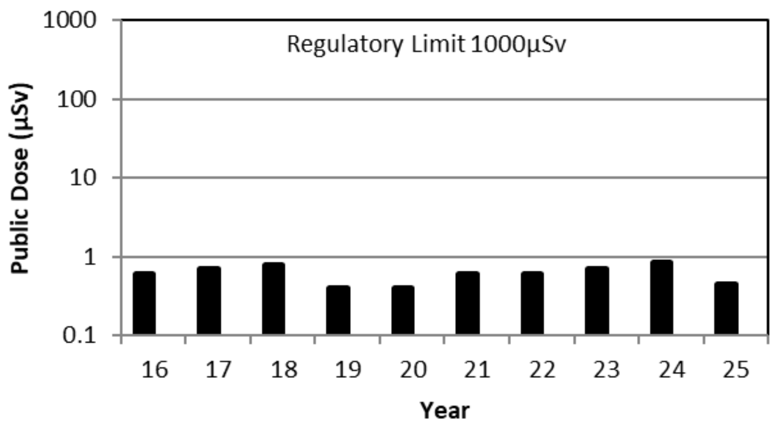

Figure 4-2: Darlington Nuclear Annual Public Dose Trend

4.3.3 Discussion of Results

The 2025 DN site public dose of 0.45 µSv, as represented by the Farm adult, is less than 0.1% of the 1,000 µSv/year regulatory limit for a member of the public. The critical group has remained unchanged from 2023. The public dose in 2025 is lower than in 2024, which was 0.85 µSv.

The DN site dose for 2025 is less than 0.1% of the estimated average background dose in the area of the DN site, from naturally occurring and anthropogenic (man-made) radiation, of about 1,400 µSv/year (excluding medical doses, refer to Section 4.5). Figure 4-3 is a graphical representation of critical group dose compared to background radiation in the area of the DN site. As an additional source of comparison, Table 4-8 provides examples of typical doses from exposure to natural and anthropogenic sources.

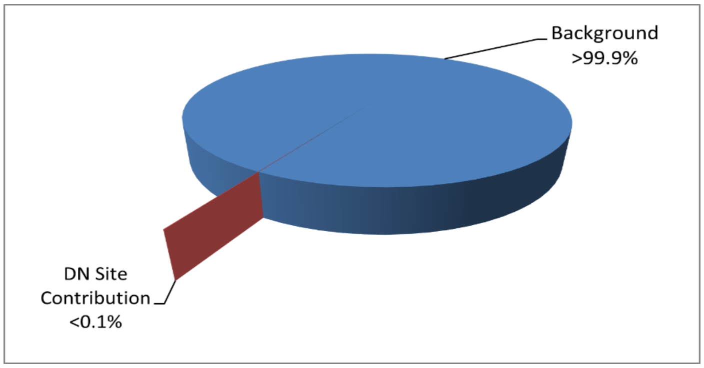

Figure 4-3: Comparison of Darlington Nuclear Public Dose to Background Dose

4.4 Pickering Nuclear Site Public Dose

4.4.1 Pickering Nuclear Potential Critical Groups

The five potential critical groups for PN site for which doses are calculated in this report are shown in Figure C2, Appendix C and are described in Appendix E. The potential critical groups and their representative locations are primarily based on the site-specific survey review [R-22] and modified, if required, if significant changes occur ahead of the next site-specific review cycle.

4.4.2 Dose Calculation Results

For 2025, the limiting critical group for the PN site was the Dairy Farm infant, with a dose of 0.46 μSv/year, as indicated in Table 4-6.

The Dairy Farm critical group consists of residents of dairy farms within a 20 km radius of the PN site. This group obtains most of their water supply from local wells. They also consume locally grown fruit and vegetables and locally produced animal products, including fresh cow's milk. Members of this potential critical group are also externally exposed to beach sand at local beaches (Beachpoint Promenade, Beachfront Park, or Squires Beach).The Dairy Farm infant drinks fresh local cow's milk.

The results of the 2025 PN site public dose calculation are presented in Table 4-6. Though the PN EMP focuses primarily on the Urban Resident, Dairy Farm, Sport Fisher and Industrial Worker potential critical groups, the potential critical groups with the highest calculated doses may vary by year. For this reason, the dose for the C2 Correctional Institution group is also reported in 2025.

Table 4-6: 2025 Annual Pickering Nuclear Critical Group Doses

Potential Critical Group	Dose per Age Class (microsieverts)		
	Adult	Child (10-year old)	Infant (One-year old)
Dairy Farm Residents	0.23	0.32	**0.46**
Urban Residents	0.42	0.34	0.32
Sport Fisher	0.16	0.18	0.13
C2 Correctional Institution	0.16	0.16	
Industrial Workers	0.34		

Table 4-7 illustrates the dose from each radionuclide and percent contribution to the total dose. C-14, HTO, and OBT contribute 99% of the total dose.

Table 4-7: 2025 Pickering Nuclear Public Dose

Radionuclide	Dose (µSv/a)	% Dose Contribution
C-14	2.9E-01	62%
Co-60	2.7E-04	0.1%
Cs-134	1.1E-03	0.2%
HTO	1.6E-01	34%
Noble Gases	2.4E-03	1%
OBT	1.4E-02	3.1%
I (mfp)	7.4E-04	0.2%
Total	4.6E-01	100%

This distribution of dose by radionuclides reflects the characteristics of the Dairy Farm group. C-14 dose is mostly from ingestion of terrestrial plants and animal products. A large portion of the animal products, fruits, and vegetables consumed by the Dairy Farm group are from local sources. Dose from HTO is attributed to air inhalation and ingestion of terrestrial plants and animal products. The public dose trend for PN is presented on a logarithmic scale in Figure 4-4. The PN site dose remains below 1% of the regulatory limit.

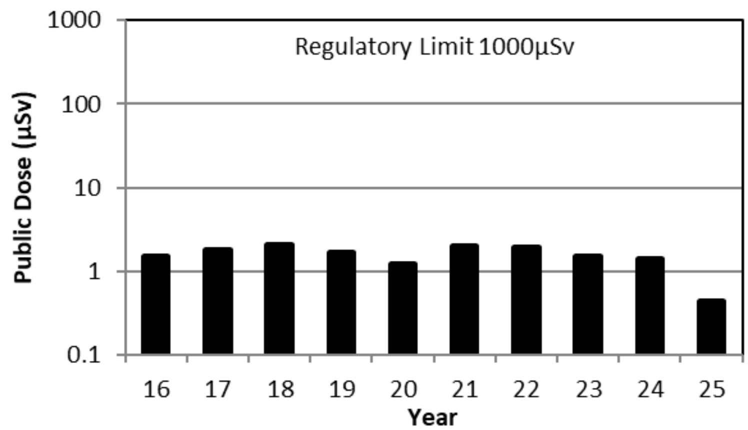

Figure 4-4: Pickering Nuclear Annual Public Dose Trend

4.4.3 Discussion of Results

The 2025 PN site public dose of 0.46 µSv, as represented by the Dairy Farm infant, is less than 0.1% of the 1,000 µSv/year regulatory limit for a member of the public. The critical group has changed from 2024. The reduction in total dose is primarily attributable to the decrease in noble gas emissions, which occurred due to PNGS Units 1 and 4 being shut down at the end of 2024 for safe storage.

The PN site dose for 2025 is less than 0.1% of the estimated background dose in the area of the PN site of 1,400 µSv/year, from naturally occurring and anthropogenic (man-made) radiation (excluding medical doses, refer to Section 4.5). Figure 4-5 is a graphical representation of critical group dose compared to background radiation in the area of the PN site. As an additional source of comparison, Table 4-8 provides examples of typical doses from exposure to natural and anthropogenic sources.

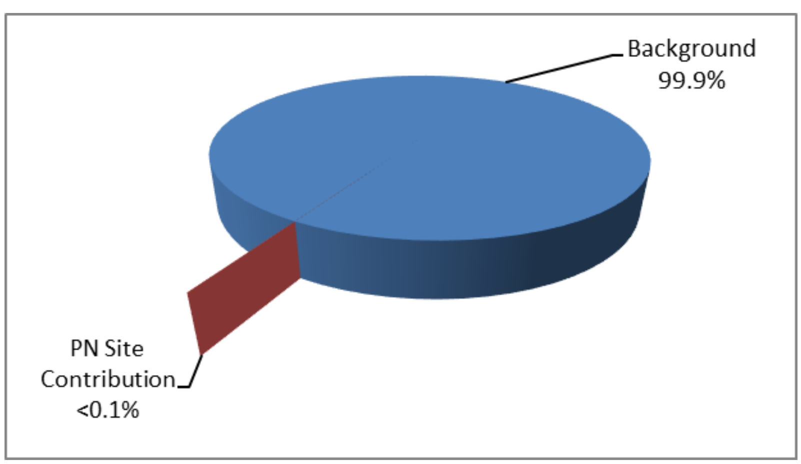

Figure 4-5: Comparison of Pickering Nuclear Public Dose to Background Dose

4.5 Natural and Anthropogenic Data

Table 4-8 provides some typical doses received by members of the public from exposure to natural and anthropogenic sources.

Table 4-8: Typical Doses from Exposure to Natural and Anthropogenic Sources

Source of Exposure	Effective Dose (μSv)
Annual External Exposure during Precipitation Events (Gamma Radiation from Naturally Occurring Radon Gas Decay Products) [R-26]	4
Chest X-Ray (single film) [R-27]	10
Airplane Travel (two hour flight) [R-28]	12

Information on Canadian public doses from naturally occurring sources, including data from ground gamma surveys in four major Canadian cities, was provided in 2002 [R-29][R-30]. Results are summarized in Table 4-9, where it can be seen that most of the variation is due to the inhalation dose from Radon-222 (Rn-222).

Table 4-9: Naturally Occurring Annual Public Effective Doses

Radiation Source	Worldwide Average (μSv)	Canada (μSv)	Toronto (μSv)	Montreal (μSv)	Winnipeg (μSv)	Pickering Nuclear Site (μSv)	Darlington Nuclear Site (μSv)
Cosmic	380	318	313	313	315	313	313
Internal	306	306	306	306	306	306	306
Inhalation(a)	1,256	926	757	667	3,225	565	565
External	480	219	178	278	176	154	154
Total(b)	**2,400**	**1,800**	**1,600**	**1,600**	**4,000**	**1,300**	**1,300**

(a) Mostly from Rn-222.
(b) Total doses have been rounded to two significant figures to reflect the inherent uncertainty. Some components are based on direct measurements and others are estimated from related measurements.

In addition to naturally occurring radiation, the public also receives about 70 μSv/year effective dose from anthropogenic sources such as nuclear weapon test fallout, and exposures from technological processes and consumer products and services, excluding medical sources. Thus, the total background dose in the area of PN and DN sites from naturally occurring and anthropogenic sources is about 1,400 μSv/year. Furthermore, the average Canadian dose from medical sources averages 1,100 μSv/year per person. The regulatory limit of 1,000 μSv per year from licensed industrial practices is over and above the dose the public already receives from the natural environment, anthropogenic sources and medical procedures [R-31].

5.0 QUALITY ASSURANCE AND PERFORMANCE

5.1 Quality Assurance of Environmental Monitoring Program

The Quality Assurance (QA) program for the EMPs encompasses all activities from sample collection, laboratory analysis, laboratory quality control and external laboratory comparison, to program audits, self-assessments, and dose verifications. The objectives include ensuring that EMP samples are representative, and their analytical results are accurate such that best estimates of radiation doses to the public can be provided, as well as complying with procedures and program quality requirements. This section provides an overview of QA activities that are critical to ensuring the quality of the EMP data and processes.

5.1.1 Laboratory Quality Assurance and Quality Control

The OPG Health Physics Laboratory (HPL) is accredited for radioanalysis of drinking water and soil by the Canadian Association for Laboratory Accreditation (CALA). The accreditation is based on demonstrated compliance with ISO 17025, General Requirements for the Competence of Testing and Calibration Laboratories. HPL is also licensed for radioanalysis of drinking water by the Province of Ontario's Ministry of the Environment, Conservation and Parks (MECP). HPL performs laboratory activities in accordance with the OPG Dosimetry and Radiological Environmental Measurement Services Quality Assurance Manual [R-32].

5.1.2 Laboratory Quality Control

Quality Control (QC) samples are used to estimate the precision and accuracy of analytical results and to examine any sources of error introduced by laboratory practices which require corrective actions. Two types of QC samples are used to accompany the analyses of the environmental samples collected for the EMPs:

a) Process control samples are 'dead water' (radiation-free water/blank) samples that go through the same handling process as the real samples.

b) QC standards are samples with predetermined values (usually traceable standards) that go through the same handling process as the real samples. The analysis of the environmental sample is considered valid when the results of the accompanying QC samples are within the expected set limits, depending on the analysis type.

For 2025, the results for the QC samples were all within the required range [R-33]. These results provide confidence in the quality of data for the program and the consistency of laboratory measurements.

5.1.3 Laboratory Proficiency Testing

The main purpose of the laboratory proficiency testing (PT) programs is to provide assurance to OPG and the CNSC of the laboratory's analytical proficiency (i.e., the accuracy of the measurements). The testing programs provide a quality check on laboratory operations including equipment calibration, analytical procedures, data review, and internal QC. These testing programs are a crucial part of the laboratory QA program to demonstrate that the laboratory is performing within the acceptable limits as measured against external unbiased standards.

OPG participated in a laboratory performance testing program that included the measurement of tritium in water, gross beta in water, and gamma emitters in water, soil, and milk.

QA test samples were supplied on a quarterly basis by Eckert and Ziegler Analytics [R-33]. Results of analyses were reported back to Eckert and Ziegler Analytics who then provide performance reports for each of the analytical types. The performance metric used for the environmental QA program for PT samples is a Z-Score. The Z-score is a useful statistical tool to assess proficiency [R-34]. It is defined as:

$$\text{Z-score} = \frac{\text{Relative Bias}}{U_C}$$

where, Relative Bias is:

$$HPL\ Value - \ E\ \&\ Z\ Value$$

U_C is the combined standard uncertainty of the calculated relative bias, a and b are uncertainty at 1σ for the HPL and the E & Z value, respectively.

$$U_C = \sqrt{a^2 + b^2}$$

|Z-score|< 2 is considered Satisfactory

2 ≤ |Z-score| ≤ 3 is acceptable, and reviewed for any trends or anomalies

|Z-score| > 3 is considered Unsatisfactory

All tests met the performance criteria. Detailed PT results can be found in Appendix H.

5.2 Quality Assurance of Effluent Monitoring Program

Chemistry laboratories (which include the DNGS and PNGS labs, and labs external to OPG to provide reference samples and analysis), based on their established Quality Management System, implement QA (program to provide confidence that quality requirements are fulfilled) and QC (operational activities that are used to ensure quality requirements are fulfilled).

As part of QC, the chemistry laboratories perform ongoing checks of their established analytical methods and track performance using QC charts via statistical software. QC check results are measured/assessed against established acceptance criteria and non-conformances are reported within the organization’s internal database where responses to non-conformances are tracked. Summary reports are captured in the QC statistical software. In addition to the ongoing QC checks, the charts undergo periodic, long-term reviews (monthly, quarterly, or annually) to monitor method uncertainty against operational tolerance requirements. There were no non-conformances reported for long-term QC chart reviews for 2025.

As part of QA, the chemistry laboratories participate in inter-laboratory comparisons (performance and evaluation of measurements in comparison to external laboratories) and intra-laboratory comparisons (performance and evaluation of measurements within the same laboratory). Both comparison programs include conventional and radiological parameters, are measures of the laboratory's overall proficiency, and provide opportunities for improvement. OPG performed above target for both inter-laboratory and intra-laboratory comparisons for 2025. An overall performance of 95.3% on the CANDU Owners Group Interlaboratory Study comparison was achieved for the combined DN and PN sites, with 142 out of 149 parameters acceptable and no repeat failures.

5.2.1 Effluent Monitoring Program Statement of Uncertainties

Uncertainty budgets for reporting include elements of laboratory sample analysis, effluent mass flow rate, sampler mass flow rate, sample representativeness, and other/temporal factors. Reported emissions for each radiological parameter are presented as a median value (except as stated). An upper 95% uncertainty bound at 1.64 standard deviations plus median value is calculated for each radiological parameter.

The assessment of overall uncertainty estimates is documented in the site effluent monitoring plan documents [R-46][R-47].

5.3 Environmental Monitoring Program Equipment Calibrations/Maintenance

Equipment calibrations and maintenance are conducted in accordance with the Environmental Monitoring Program Equipment Maintenance Manual [R-35].

In addition, annual sensitivity checks are performed on the noble gas detectors to quantify the deterioration of the sensitivity of the sodium iodide crystal in each detector. In 2025, communication errors caused false values at four detectors due to the sampling rate not changing to the required five minutes for the sensitivity checks. Going forward, steps will be taken to change the sampling rate and confirm that it is set to five minutes before the sensitivity check begins. The majority of the detectors show no degradation of the sodium iodide crystals. Two of the detectors could have potential degradation and next year's results will be used to determine if the sensitivity of the sodium iodide crystals in these two detectors is in fact decreasing [R-36][R-37][R-45].

5.4 Program Quality Assurance

5.4.1 Audits

5.4.1.1 Effluent Monitoring Program Audits

An independent audit, also referred to as a performance-based assessment, of the EMS is conducted at least once every five years. An audit was performed in 2025 by OPG's Nuclear Oversight (NO) department (NO-2025-004). A specific element of the audit scope included Monitoring of Nuclear and Hazardous Substances in Effluents, in accordance with CSA N288.5:22 [R-38]. There were no significant findings related to the Effluent Monitoring Program identified during the audit.

5.4.1.2 Environmental Monitoring Program Audits

An independent audit, also referred to as a performance-based assessment, of the EMPs is conducted once every five years in accordance with CSA N288.4:19 [R-2]. No audits were conducted in 2025. The last audit was conducted in 2024 [R-57].

As part of the CNSC's Compliance and Verification program, the CNSC performs Type II compliance inspections on the EMPs. No inspections were conducted in 2025. The last inspection was conducted in 2024 [R-57].

5.4.1.3 Health Physics Laboratory Audits

The OPG HPL also has a commitment to perform a minimum of one independent audit each year of the quality system used for dosimetry and environmental measurement services. These may not always be related to the EMPs. In 2025, an internal audit was conducted on the accredited Tritium in Water Method within the Environmental sections of the HPL. The audit involved document review, interviews with HPL staff, as well as work performance observations. There were no significant adverse conditions identified through this audit. Five recommendations and one finding will be addressed by updating procedures, performing further assessments and implementing process improvements. The recommendations are being tracked through SCR N-2025-17202 and AR 28279225 [R-33]. Recommendations represent opportunities for improvement or clarifications of areas where further review is warranted.

The MECP conducted a scheduled inspection at the HPL in October 2025. There were 20 observations, with some requiring corrective actions. SCR N-2025-14575 was submitted to document the adverse condition. The Final Inspection Rating was 94.4%.[R-33].

The MECP also conducted an unannounced inspection of the HPL in April 2025. There were 21 observations, with some requiring corrective actions. Two SCRs were submitted to document adverse conditions, N-2025-06717 and N-2025-07602. The Final Inspection Rating was 95.3% [R-33].

5.4.1.4 Implementation of N288.8 Audit

In 2025, NO conducted an audit (NO-2025-018) on the implementation of CSA N288.8-17, *Establishing and implementing action levels for releases to the environment from nuclear facilities* [R-65]. The audit concluded that CSA N288.8 has been effectively implemented, and no findings were identified.

5.4.2 Self Assessments of the Environmental Monitoring Programs

In 2025, two Self Assessments were performed on different elements of the EMPs.

(a) <u>Field Verification of the Environmental Monitoring Programs</u>

The focus of this field verification was on observing and verifying WSP sampling collection and sample preparation. The field verification involved observation of HPL personnel collecting monthly samples from local WSPs and preparing the samples for analysis.

There were no findings. The field verification revealed that HPL's procedural use and adherence to their WSP Monthly Sampling Collection, Environmental Monitoring Program Sampling Sheets and Preparation of Monthly Samples procedures is satisfactory. This Self Assessment is documented as Report No. NO25-000074-SA in OPG's Self-Assessment Database.

(b) Annual Performance Assessment

Self Assessment COE25-000073-SA was completed for the EMP Annual Performance Assessment. The assessment confirmed that the EMPs are effective in meeting their program objectives and QA requirements, and procedures and processes in place were found to be adequate.

5.4.3 Self Assessments of the Effluent Monitoring Program

In August 2025, it was found that the PNGS Water Treatment Plant, which is used to produce demineralized water for steam production and is operated by the contractor Veolia, continues to perform according to the requirements of the Environmental Compliance Approval (ECA) and all referenced regulations. This self-assessment is documented in the MyPi Database under P25-039954-SA.

5.5 Third Party Verification of Annual EMP Report

The 2025 EMP report and dose calculations were prepared by Egis. The verifications of the dose and report were conducted, by two separate parties, internally by Egis, prior to a final review by an OPG qualified EMP Subject Matter Expert. Verification was done on the methodology used, assumptions made, input parameter values and data used. This involved checking the dose calculations and IMPACT scenarios, and performing independent replicate IMPACT model runs and hand calculations to validate the results. Any necessary changes identified by the verification process have been addressed and incorporated in this report.

5.6 Program Performance

5.6.1 EMP Sample Unavailability

A total of 889 laboratory analyses were performed for the 2025 dose calculation. The analyses covered HTO, C-14, and gamma scan. The PN EMP accounted for 36.2% of these sample analyses, while the DN and provincial background programs accounted for 48.9% and 14.9%, respectively. Table 5-2 shows the sample types, number of locations, and number of samples used for the dose calculation, and the unavailability of each sample type.

The unavailability indicator tracks the performance of sample collection and analysis for the EMPs. The sampling portion of the EMPs is designed to collect representative field samples from selected pathways near each nuclear site and from background locations, in order to meet the program objectives as defined in Section 1.1. The sample unavailability percentage is determined by dividing the number of missed or invalid sample analyses by the number of planned sample analyses for each EMP.

An important objective of the EMPs is to estimate the doses to the public based on environmental data measured in the public domain. In accordance with the EMP governing document [R-37], the requirement to meet unavailability limits is specific to the analysis of samples used in the dose calculation. These limits are applied to the PN and DN EMPs, and to provincial background samples separately.

The unavailability limits for samples used in the dose calculation are provided in Table 5-2 and range from 10 to 25%. The unavailability limits were derived based on the relative contributions to total dose, therefore higher dose contributors have a lower unavailability limit. The overall unavailability for PN, DN and provincial background samples was 4%, 5% and 6%, respectively. When a sample is unavailable, an SCR is initiated for trending purposes.

The samples collected were considered representative when compared to historical data and used in the dose calculation.

The unavailability limit of 15% for HTO analysis in DN EMP vegetables was exceeded in 2025. In addition, the 20% unavailability limit for C-14 analysis in DN EMP vegetables was exceeded. Sample availability for vegetables fluctuates from year to year due to garden availability and growing season variability. Two-thirds of the expected samples were collected and considered representative of critical group locations when compared to historical data. Therefore, these samples were used in the dose calculation.

The unavailability limit of 15% for DN EMP fruit (HTO analysis) was exceeded in 2025. Similarly, the unavailability limit of 20% for PN EMP fruit (HTO analysis) was exceeded in 2025. Sample availability for fruits fluctuates from year to year due to garden availability and growing season variability. For both DN and PN EMPs, eighty percent (80%) of the expected samples were collected and considered representative when compared to historical data and used in the dose calculation.

The unavailability limit of 25% for provincial vegetables was exceeded in 2025. Sample availability for vegetables fluctuates from year to year due to garden availability and growing season variability. Half of the expected samples were collected and considered representative when compared to historical data and used in the dose calculation.

New sampling locations will be explored, as needed, through the Site-Specific Survey process, which is currently underway, and the next EMP Design Review.

Table 5-1: Unavailability of EMP Sample Data Used for Dose Calculation Purposes

Sample Types	Collection Frequency	Pickering Nuclear					Darlington Nuclear					Provincial Background				
		Locations	Planned Analyses	Actual Analyses	Unavailability	Unavailability Limit [(d)]	Locations	Planned Analyses	Actual Analyses	Unavailability	Unavailability Limit [(d)]	Locations	Planned Analyses	Actual Analyses	Unavailability	Unavailability Limit [(d)]
Tritium																
Tritium in Air (Molecular Sieve)	Monthly/Quarterly	6	72	72	0%	15%	6	72	71	1%	10%	1	12	12	0%	25%
Water Supply Plants	Weekly Composite	1	48	48	0%	20%	2	96	96	0%	15%					
Residential Wells	Monthly	2	24	24	0%	20%	4	48	48	0%	15%					
Milk	Monthly	1	12	12	0%	15%	2	24	24	0%	20%					
Milk	Quarterly											1	12	12	0%	25%
Lake Water	Monthly [(a)]	3	24	24	0%	25%	2	16	16	0%	25%					
Fruits	Annual	5	15	12	20%	20%	5	15	12	20%	15%	2	4	4	0%	25%
Vegetables	Annual	5	15	13	13%	20%	3	9	6	33%	15%	2	4	2	50%	25%
Animal Feed	Annual	1	8	8	0%	15%	2	8	8	0%	20%	1	8	8	0%	25%
Poultry	Annual						1	8	8	0%	20%	1	8	8	0%	25%
Eggs	Quarterly						1	12	12	0%	20%	1	12	12	0%	25%
Fish	Annual	1	8	8	0%	25%	1	8	8	0%	25%					
Carbon-14																
Carbon-14 in Air	Quarterly	4	16	16	0%	25%	4	16	16	0%	25%	1	4	4	0%	25%
Milk	Monthly	1	12	12	0%	15%	2	24	24	0%	15%					
Milk	Quarterly											1	12	12	0%	25%
Fruits	Annual	5	15	12	20%	25%	5	15	12	20%	20%	2	4	4	0%	25%
Vegetables	Annual	5	15	13	13%	25%	3	9	6	33%	20%	2	4	2	50%	25%
Animal Feed	Annual	1	8	8	0%	15%	2	8	8	0%	15%	1	8	8	0%	25%
Poultry	Annual						1	8	8	0%	15%	1	8	8	0%	25%
Eggs	Quarterly						1	12	12	0%	15%	1	12	12	0%	25%
Fish	Annual	1	8	8	0%	25%	1	8	8	0%	25%	1	8	8	0%	25%
Noble Gases																
External Gamma (Noble Gas Monitors)[(b)]	Continuous	6	NA	NA	3%	25%	5	NA	NA	9%	25%					
Gamma																
Fish	Annual	1	8	8	0%	10%	1	8	8	0%	10%	1	8	8	0%	25%
Beach Sand	Annual	3	24	24	0%	15%	3	24	24	0%	25%	1	8	8	0%	25%
Overall dose sample Unavailability [(c)]			332	322	**4%**			448	435	**5%**			136	132	**6%**	

Notes: NA = Not Applicable.

(a) For safety considerations, samples are not required during the winter months (Dec. - Mar.).

(b) Noble gas detector unavailability is based on an average of actual run time of all monitors for PN and DN.

(c) Unavailability defined as an average of the percent unavailability of all sample types.

(d) Unavailability limit for all Provincial samples types is 25%. Unavailability limits for PN and DN based on pathway analyses.

5.7 Annual Assessment of the EMPs

The annual assessment of OPG's 2025 EMPs is summarized as follows:

- Overall, the EMPs met their objectives as defined in Section 1.1.
- A total of 889 environmental data analyses were completed for samples collected for the DN and PN EMPs and at various Ontario background locations in support of the radiological dose calculations. The overall unavailability was 4%, 5%, and 6% for the PN, DN, and provincial background samples, respectively.
- Two Self Assessments were completed this year for the EMPs. No significant findings were identified.

5.7.1 Summary of Darlington Results

- Site emissions remained at a very small fraction of their respective DRLs.
- Property boundary noble gas detector dose rates remained at or below detection limits.
- The DNGS waterborne HTO emissions remain stable. The DNGS tritium to water emission in 2025 was 2.5 x 10^{14} Bq, which is similar to the 2024 value of 2.7 x 10^{14} Bq.
- Annual average tritium concentrations in drinking water from the nearby WSPs were well below OPG's commitment of 100 Bq/L. The annual average HTO activity in well water for the DN EMP was 14 Bq/L.
- Concentrations of HTO and C-14 in air, vegetation, milk, eggs, poultry and fish, as well as Cs-137 and Cs-134 in fish, were in line with levels seen over the last ten years.
- The 2025 public dose for the DN site was 0.45 µSv and was represented by the adult of the Farm critical group. The 2025 site public dose remains a small fraction of both the annual regulatory dose limit and the annual natural background radiation in the area.

5.7.2 Summary of Pickering Results

- Site emissions remained at a very small fraction of their respective DRLs.
- The PNGS tritium to water emission in 2025 was 3.2 x 10^{14} Bq which was slightly lower than the 2024 value of 3.7 x 10^{14} Bq.
- Annual average tritium concentrations in drinking water from the nearby WSPs were below OPG's commitment of 100 Bq/L. The annual average HTO activity in well water for the PN EMP was 9.5 Bq/L.

- Concentrations of HTO and C-14 in air, vegetation, milk, and fish, and Cs-137 in fish were in line with levels seen over the last ten years.

- In 2025, the Ar-41 dose rate in air fell below the detection limit of 6 nGy/month at PN site, representing a notable decline from levels observed over the past 10 years. This reduction is primarily attributable to PNGS Units 1 and 4 being shut down in October and December 2024, respectively, as they transitioned into a safe-storage state.

- The 2025 public dose for the PN site was 0.46 µSv and was represented by the infant of the Dairy Farm critical group. The 2025 site public dose remains a small fraction of both the annual regulatory dose limit and the annual natural background radiation in the area.

6.0 PROGRAM MODIFICATIONS AND OUTLOOK

In 2025, no major changes to the routine sampling program were identified. Non-intent revisions to EMP documentation were identified through recent inspections and Self Assessments and were implemented in 2024 and 2025.

No supplementary studies are planned in 2026 as part of the EMP. DNNP EMEAF activities will continue in 2026 as project-specific studies which will meet relevant requirements identified under EMP governance.

The updated DN ERA was issued in 2021 (and revised in 2022). An Addendum was issued in 2024. The updated PN ERA was issued in 2022 (and revised in 2023). Changes to the EMPs as a result of the latest ERAs will be identified and captured in the next EMP design reviews.

A Harvester receptor has recently been introduced in the Predictive Environmental Risk Assessments for the DNNP and for the PN site. The Harvester aims to better represent the lifestyle characteristics of an Indigenous person who may work and/or live near the site and also harvests traditional foods in the local area. The pathways for this receptor should be reviewed as part of the next EMP design review to determine whether there should be any changes or additions to the EMPs.

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Appendix A: Radiological Units and Conversions

Absorbed Dose

1 gray (Gy)	=	1 joule/kg

Effective Dose

1 sievert (Sv)	=	100 rem
1 millisievert (mSv)	=	100 millirem (mrem)
1 microsievert (μSv)	=	0.1 millirem (mrem)

Quantity of Radionuclide

1 becquerel (Bq)	=	1 disintegration per second
1 curie (Ci)	=	3.7×10^{10} Bq
1 mCi/(km^2·month)	=	37 Bq/(m^2·month)

Appendix B: Glossary of Acronyms and Symbols

Radionuclides and Units of Measure

Ar-41	Argon-41
C-14	Carbon-14
CO_2	Carbon Dioxide
Co-60	Cobalt-60
Cs-134	Cesium-134
Cs-137	Cesium-137
Cs-137+	Cesium-137 including progeny
HT	Elemental Tritium
HTO	Tritium Oxide
I(mfp)	Mixed Fission Products Radioiodines
I-131	Iodine-131
Ir-192	Iridium-192
K-40	Potassium-40
Rn-222	Radon-222
Xe-133	Xenon-133
Xe-135	Xenon-135
µGy	microgray
µSv	microsievert
Bq	becquerel
Bq/kg-C	becquerels per kilogram carbon
Ci	Curie
Gy	Gray
kg	kilogram
L	Litre
mGy	milligray
mSv	millisievert
nGy	nanogray
Sv	Sievert

Acronyms and Abbreviations

ACU	Air Conditioning Unit
ALARA	As Low As Reasonably Achievable
ALW	Active Liquid Waste
BAF	Bioaccumulation Factor
BTEX	Benzene/Toluene/Ethylbenzene/Xylene
CALA	Canadian Association for Laboratory Accreditation
CANDU	Canada Deuterium Uranium
CCW	Condenser Cooling Water
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DFO	Fisheries and Oceans Canada
DN	Darlington Nuclear
DNGS	Darlington Nuclear Generating Station
DNNP	Darlington New Nuclear Project
DRL	Derived Release Limit

E	East wind sector
EMP	Environmental Monitoring Program
EMEAF	Environmental Monitoring and Environmental Assessment Follow-up
EMS	Environmental Management Systems
ENE	East North East wind sector
ERA	Environmental Risk Assessment
ESE	East South East wind sector
FPS	Fixed Point Surveillance
fw	Fresh Weight
HC	Health Canada
HPL	Health Physics Laboratory
IMPACT	Integrated Model for Probabilistic Assessment of Contaminant Transport
ISO	International Organization for Standardization
Ka	Atmospheric Dispersion Factor (s/m^3)
Kerma	Kinetic Energy Released in Matter
Lc	Critical Level (≈0.5Ld)
Ld	Limit of Detection
L&ILW	Low and Intermediate Level Waste
MECP	Ministry of the Environment, Conservation and Parks
MW	Megawatt
MWAT	Maximum Weekly Average Temperature
N	North wind sector
NE	North East wind sector
NNE	North North East wind sector
NNW	North North West wind sector
NSS-DWMF	Nuclear Sustainability Services Darlington Waste Management Facility
NSS-PWMF	Nuclear Sustainability Services Pickering Waste Management Facility
NW	North West wind sector
OBT	Organically Bound Tritium
ODS	Ozone-Depleting Substances
OPG	Ontario Power Generation
PEA	Predictive Effects Assessment
PERA	Predictive Environmental Risk Assessment
PN	Pickering Nuclear
PNGS	Pickering Nuclear Generating Station
PT	Proficiency Testing
QA	Quality Assurance
QC	Quality Control
ROS	Regression on Order Statistics
S	South wind sector
SCR	Station Condition Record
SE	South East wind sector
SRST	Spent Resin Storage Tank
SSE	South South East wind sector
SSW	South South West wind sector
SW	South West wind sector
TIS	Tritium Immobilization System

TRF	Tritium Removal Facility
TDS	Target Delivery System
TWh	Terawatt Hour
W	West wind sector
WNW	West North West wind sector
WSP	Water Supply Plant

Appendix C: Maps of Environmental Monitoring and Critical Group Locations

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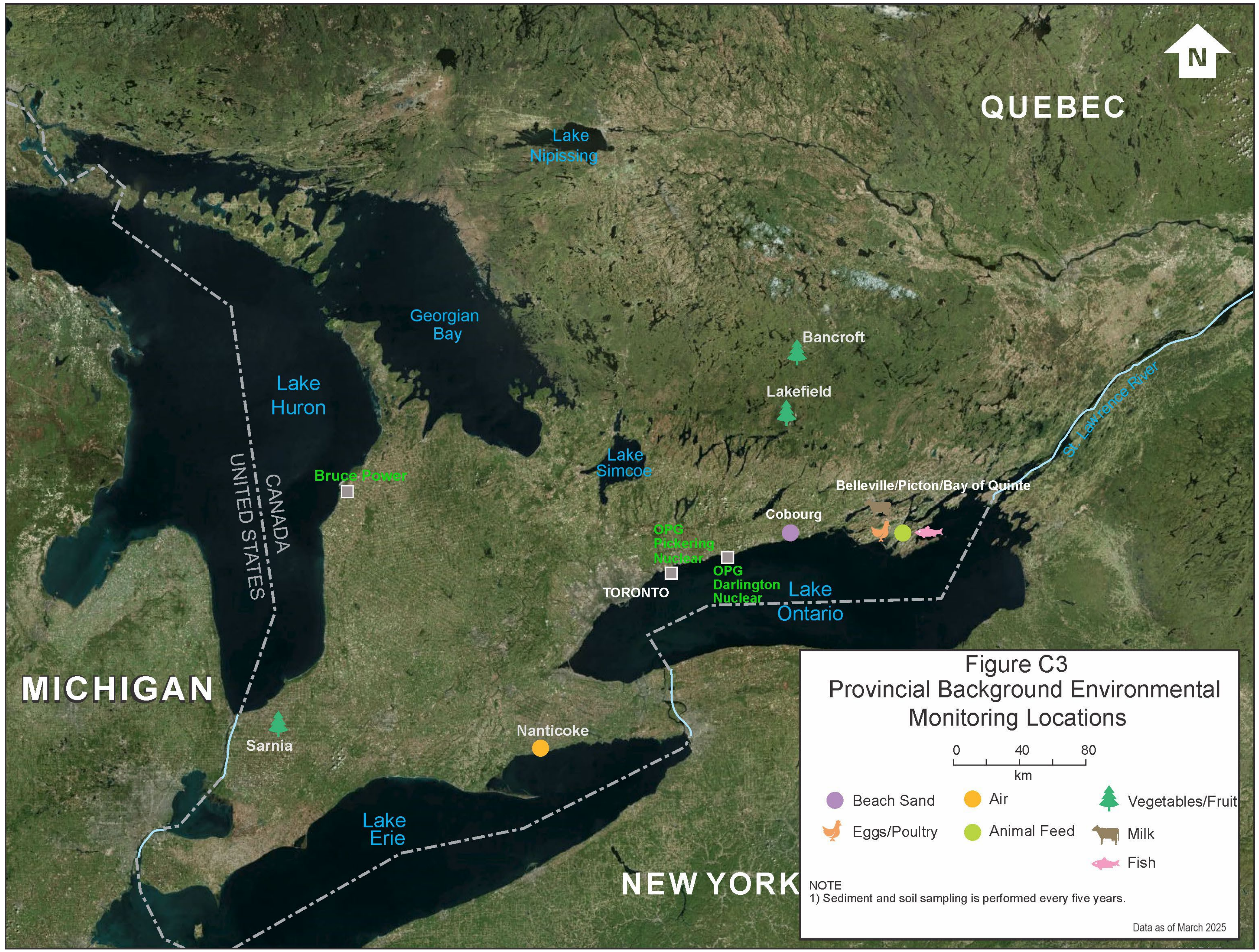
Figure C1 Darlington Nuclear Site Critical Groups and Environmental Monitoring Locations
0 1 2 3 4 km
MILK
FRUIT / VEGETABLES
WELL WATER
LAKE WATER
WATER SUPPLY PLANT
POULTRY/EGGS
PASSIVE C-14 (AIR)
ACTIVE TRITIUM (AIR) / NOBLE GAS
ANIMAL FEED
BEACH SAND
FISH NETTING LOCATIONS
HOSPITAL
TRANSMISSION LINES
RAILROAD LINES
URBAN AREA
LARGE INDUSTRIAL/ COMMERCIAL BUILDINGS
POTENTIAL CRITICAL GROUP
NOTE: 1) Air Monitoring Stations 3 and 8 contain only a Noble Gas monitor
2) Soil sampling performed every five years.
Data as of March 2025
DF18 (13 km NNW of DN site)
10.0 km
5.0 km
5.0 km
NNW
N
NW
NNE
WNW
NE
W
ENE
WSW
SW
SSW
SSE
SE
ESE
E
FARM
RURAL RESIDENT
WEST/EAST BEACH RESIDENTS
DN
D10
Oshawa WSP
Bowmanville WSP
DF9 (13 km ENE of DN site)
Newcastle WSP (13 km ENE of DN Site)

Figure C2 Pickering Nuclear Site Critical Groups and Environmental Monitoring Locations
0 1 2 3 4 km
MILK
FRUIT/VEGETABLES
WELL WATER
LAKE WATER
WATER SUPPLY PLANT
PASSIVE C-14 (AIR)
ACTIVE TRITIUM (AIR) / NOBLE GAS
ANIMAL FEED
BEACH SAND
FISH NETTING LOCATIONS
HOSPITAL
TRANSMISSION LINES
RAILROAD LINES
URBAN AREA
LARGE INDUSTRIAL/ COMMERCIAL BUILDINGS
POTENTIAL CRITICAL GROUP
NOTE: 1) Air Monitoring Stations 7 and 8 contain only a Noble Gas monitor
2) Sediment and Soil sampling performed every five years.
Data as of March 2025
DF3 (18 km NW of PN site)
DF1
DAIRY FARM
DF8
10 km
5.0 km
NW
NNW
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
URBAN RESIDENT
INDUSTRIAL COMMERCIAL
FISHER
PN
SB
F.J. Horgan WSP
Ajax WSP
R.C. Harris WSP (22 km WSW of PN site)
Whitby WSP (12 km ENE of PN site)


N
QUEBEC
Lake Nipissing
Georgian Bay
Lake Huron
Bancroft
Lakefield
Lake Simcoe
Bruce Power
UNITED STATES
CANADA
Belleville/Picton/Bay of Quinte
Cobourg
OPG Pickering Nuclear
OPG Darlington Nuclear
TORONTO
Lake Ontario
St. Lawrence River
MICHIGAN
Sarnia
Nanticoke
Lake Erie
NEW YORK
Figure C3
Provincial Background Environmental Monitoring Locations
0 40 80
km
Beach Sand
Air
Vegetables/Fruit
Eggs/Poultry
Animal Feed
Milk
Fish
NOTE
1) Sediment and soil sampling is performed every five years.
Data as of March 2025

Appendix D: Environmental Monitoring Data

Table D-1: Annual Average Concentrations of Tritium-in-Air – 2025

Molecular Sieve Tritium-in-Air											
DN EMP Locations	N	Location Average (Bq/m^3)[(a)]	Uncertainty (±2σ)[(b)]	PN EMP Locations	N	Location Average (Bq/m^3)[(a)]	Uncertainty (±2σ)[(b)]	Background Locations	N	Location Average (Bq/m^3)[(a)]	Uncertainty (±2σ)[(b)]
D1	12	0.9	1.0	P2	12	7.0	8.9	Nanticoke	12	<0.1	NA
D2	12	0.8	0.8	P3	12	1.7	1.6				
D5	12	0.3	0.4	P4	12	0.9	0.9				
D9	12	0.4	0.5	P6	12	4.2	2.2				
D10	11	0.1	0.1	P10	12	6.3	8.1				
D11	12	0.4	0.5	P11	12	1.4	1.5				
Annual Average[(c)]	71	0.5	0.8	Annual Average[(c)]	72	3.6	6.9				

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples.

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(a) Molecular Sieve Tritium Ld = 0.2 Bq/m^3 and Lc = 0.1 Bq/m^3.

(b) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(c) Annual averages are calculated using the entire dataset.

Table D-2: Annual Average Concentrations of Carbon-14 in Air – 2025

Passive Sampler C-14 in Air											
DN EMP Locations	N	Location Average (Bq/kg-C)[(a)]	Uncertainty (±2σ)[(b)]	PN EMP Locations	N	Location Average (Bq/kg-C)[(a)]	Uncertainty (±2σ)[(b)]	Background Locations	N	Location Average (Bq/kg-C)[(a)]	Uncertainty (±2σ)[(b)]
D1	4	278	33	P3	4	240	97	Nanticoke	4	237	33
D2	4	260	33	P4	4	228	48				
D5	4	241	51	P6	4	315	74				
D10	4	217	38	P10	4	338	67				
Annual Average[(c)]	16	249	59	Annual Average[(c)]	16	280	118				

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples.

(a) Bq/kg-C (Bq per kg of carbon). Ld for C-14 = 40 Bq/kg-C.

(b) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(c) Annual averages are calculated using the entire dataset.

Table D-3: Annual Average Dose Rates of Noble Gases and Ir-192 Skyshine in Air – 2025

DN EMP	N	Air Kerma Rates							
		Ar-41		Ir-192		Xe-133		Xe-135	
		Location Average (nGy/month)	Uncertainty (±2σ)	Location Average (nGy/month)	Uncertainty (±2σ)	Location Average (nGy/month)	Uncertainty (±2σ)	Location Average (nGy/month)	Uncertainty (±2σ)
D1	12	*6.1[e]	0.5[e]	ND	NA	<3	NA	<3	NA
D2	12	<6	NA	ND	NA	<3	NA	<3	NA
D3	12	<6	NA	ND	NA	<3	NA	<3	NA
D5	12	<6	NA	ND	NA	<3	NA	<3	NA
D8	12	<6	NA	ND	NA	<3	NA	<3	NA
D9	12	<6	NA	ND	NA	<3	NA	<3	NA
D10	11	<6	NA	ND	NA	<3	NA	<3	NA
D11	12	<6	NA	ND	NA	<3	NA	<3	NA
Annual Average[b]	95	*6.0[e]	0.2[e]	ND	NA	<3	NA	<3	NA
PN EMP	N	Ar-41		Ir-192		Xe-133		Xe-135	
		Location Average (nGy/month)	Uncertainty (±2σ)[a]	Location Average (nGy/month)	Uncertainty (±2σ)	Location Average (nGy/month)	Uncertainty (±2σ)[a]	Location Average (nGy/month)	Uncertainty (±2σ)[a]
P2	12	<6	NA	ND	NA	*3.1[e]	0.8[e]	<3	NA
P3	12	<6	NA	ND	NA	<3	NA	<3	NA
P4	12	<6	NA	ND	NA	<3	NA	<3	NA
P6	12	<6	NA	ND	NA	*2.0[d]	2.5[d]	<3	NA
P7	12	<6	NA	ND	NA	*3.1[e]	0.5[e]	<3	NA
P8	12	<6	NA	ND	NA	<3	NA	<3	NA
P10	12	<6	NA	ND	NA	*3.2[e]	1.7[e]	<3	NA
P11	12	<6	NA	ND	NA	<3	NA	<3	NA
Annual Average[b]	96	<6	NA	ND	NA	*3.1[e]	0.8[e]	<3	NA

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples.

"<" indicates less than Ld. NA= Not Applicable. ND = Not Detected.

* indicates that dataset contains both detected and censored non-detected values

(a) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(b) Annual averages are calculated using the entire dataset.

(c) For datasets with less than 50% of values censored at the Ld, the Kaplan-Meier (KM) estimation method is used.

(d) For datasets with 50 to 80% of values censored at the Ld, the Regression on Order Statistics (ROS) estimation method was used. This method was selected, consistent with the guidance in Helsel (2012), as it provides more reliable estimates of central tendency than the KM method at this level of censoring. The resulting ROS mean may fall below the detection limit, reflecting that most true concentrations are likely below this threshold.

(e) For datasets with greater than 80% of values censored at the Ld, the arithmetic mean is reported and the associated uncertainty is two times the standard deviation of the dataset. This method was selected as both the KM and ROS estimates become unreliable at this level of censoring. The arithmetic means calculated for these datasets are likely biased upward relative to the true mean due to the high proportion of non-detects and therefore represent a conservative estimate.

Table D-4: Fruits and Vegetables – 2025

Darlington EMP						
Location	Sample Type	N	HTO (Bq/L)[a]		C-14 (Bq/kg-C)[a]	
			Location Average	Uncertainty (±2σ)[c][d]	Location Average	Uncertainty (±2σ)[c][d]
DF9	Fruit	3	8.4	1.2	223	12
F18	Fruit	3	8.3	3.1	247	12
R27	Fruit	3	15	5.3	243	50
R335	Fruit	3	22	1.2	290	20
Annual Average[b]	Fruit	12	14	12	251	56
F16	Vegetables	3	12	4	257	31
R19	Vegetables	3	10	1.8	237	12
Annual Average[b]	Vegetables	6	11	4	247	30

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples. NA= not applicable.

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(a) Ld for tritium = 4.5 Bq/L and Lc = 2.3 Bq/L. Ld for C-14 = 40 Bq/kg-C.

(b) Annual averages are calculated using the entire dataset.

(c) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(d) For datasets of a single measured value, associated uncertainty is the laboratory analytical uncertainty for that sample.

Table D-4: Fruits and Vegetables – 2025 (Continued)

Pickering EMP								
Location	Sample Type	N	HTO (Bq/L)[a]		C-14 (Bq/kg-C)[a]		OBT[e] (Bq/L (w.e.))[d]	
			Location Average	Uncertainty (±2σ)[c]	Result	Uncertainty (±2σ)[c]	Result	Uncertainty (±2σ)[b]
DF3	Fruit	3	11	2.0	210	20		
F10	Fruit	3	14	4.6	240	0	32	2.3
LOC10	Fruit	3	97	49	250	20		
LOC7	Fruit	3	64	14	270	20		
Annual Average[b]	Fruit	12	46	78	243	48	32	2.3
DF1	Vegetables	3	12	2.3	233	42		
DF3	Vegetables	3	9.9	6.2	227	23		
P11	Vegetables	2	43	79	235	14		
P9	Vegetables	2	100	10	230	28		
R144	Vegetables	3	47	43	253	42		
Annual Average[b]	Vegetables	13	38	70	236	34		

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples. NA= not applicable.

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(a) Ld for tritium = 4.5 Bq/L and Lc = 2.3 Bq/L. Ld for C-14 = 40 Bq/kg-C.

(b) Annual averages are calculated using the entire dataset.

(c) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(d) w.e. = water equivalent.

(e) One sample from F10 was analysed for OBT.

Table D-4: Fruits and Vegetables – 2025 (Continued)

Background Locations								
Location	**Sample Type**	**N**	**HTO (Bq/L)[a]**		**C-14 (Bq/kg-C)[a]**		**OBT (Bq/L (w.e.))[d]**	
			Result	**Uncertainty (±2σ)[b]**	**Result**	**Uncertainty (±2σ)[b]**	**Result**	**Uncertainty (±2σ)[b]**
F1 | Bancroft- Sample A	Fruit	1	**2.6**	1.3	**220**	18		
F1 | Bancroft- Sample B	Fruit	1	**4.1**	1.5	**200**	18		
F2 | Lakefield- Sample A	Fruit	1	**3.7**	1.4	**220**	18		
F2 | Lakefield- Sample B	Fruit	1	<2.3	1.1	**220**	18		
Annual Average[c]		2	2.9	1.3	215	18		
F2 | Lakefield- Sample A	Vegetables	1	<2.3	NA	220	18	28.0	2.2
F2 | Lakefield- Sample B	Vegetables	1	**2.5**	2.2	240	18	NR	NR
Annual Average[c]		2	<2.3	2.2	230	18	28.0	2.2

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples. NA= not applicable. NR = not required by program.

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(a) Ld for tritium = 4.5 Bq/L and Lc = 2.3 Bq/L. Ld for C-14 = 40 Bq/kg-C.

(b) Individual analytical results are reported. 2σ denotes the laboratory uncertainty of the individual sample.

(c) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(d) w.e. = water equivalent.

Table D-5: Animal Feed – 2025

Animal Feed[b]						
Location	Sample Type	N	HTO (Bq/L)[a]		C-14 (Bq/kg-C)[a]	
			Location Average	Uncertainty (±2σ)[d]	Location Average	Uncertainty (±2σ)[d]
Darlington EMP						
DF18	Forage	4	11	3.9	217	28
DF9	Forage	4	8.9	4.7	222	44
Annual Average[c]	Forage	8	9.8	4.4	219	35
Pickering EMP						
DF1	Forage	8	19	8.0	223	21
Background Locations						
Belleville	Forage	8	**3.5**	2.1	231	22

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples. NA= not applicable.

Generic Feed = dry feed, Forage = wet feed

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(a) Ld for tritium = 4.5 Bq/L and Lc = 2.3 Bq/L. Ld for C-14 = 40 Bq/kg-C.

(b) Animal feed is collected semi-annually. This table depicts the average of the results for each sampling location.

(c) Annual averages are calculated using the entire dataset.

(d) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset. However, where N < 3, Individual sample results are reported and 2σ denotes the laboratory uncertainty of the individual sample.

Table D-6: Annual Average Concentrations in Milk – 2025

Location	N	HTO (Bq/L)[a]		C-14 (Bq/kg-C)[a]		OBT (Bq/L w.e.)	
		Location Average	Uncertainty (±2σ)[b]	Location Average	Uncertainty (±2σ)[b]	Location Average	Uncertainty (±2σ)[b]
DN EMP							
DF18	12	4.9	3.1	233	38		
DF9	12	**3.1**	20	230	20		
Annual Average[c]	24	**4.0**	3.2	231	30		
PN EMP							
DF1	12	12	5.4	244	36	31	28
Background Locations							
Belleville	12	**2.4**	2.3	234	22	NR	NR

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples. NA = not applicable. NR = not required by program.

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(a) Ld for tritium = 4.5 Bq/L and Lc 2.3 Bq/L. Ld for C-14 = 40 Bq/kg-C.
(b) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.
(c) Annual averages are calculated using the entire dataset.

Table D-7: Annual Average Concentrations in Eggs and Poultry – 2025

Location	Sample Type	N	HTO (Bq/L)[(a)]		C-14 (Bq/kg-C)[(a)]	
			Location Average	Uncertainty (±2σ)[(b)]	Location Average	Uncertainty (±2σ)[(b)]
Darlington EMP						
F16	Poultry	8	8.6	1.4	221	17
D10	Eggs	12	9.3	6.4	227	22
Background						
Picton	Poultry	8	**2.6**	2.0	226	24
Picton	Eggs	12	**3.7**	1.6	226	22

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

Egg and poultry sampling not required for PN EMP.

(a) Ld for tritium = 4.5 Bq/L and Lc = 2.3 Bq/L. Ld for C-14 = 40 Bq/kg-C.

(b) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

Table D-8: Annual Average Drinking Water and Lake Water Concentrations – 2025

DN EMP

Location	Tritium Concentration			Gross Beta Activity Concentration		
	N	Location Average (Bq/L)[b]	Uncertainty (±2σ)[c]	N	Location Average (Bq/L)[a]	Uncertainty (±2σ)[c]
WSP						
Bowmanville WSP	48	5.7	5.1	12	0.13	0.03
Newcastle WSP	48	6.4	6.6	12	0.13	0.02
Oshawa WSP	48	7.0	7.0	12	0.15	0.04
Annual Average[d]	144	6.4	6.6	36	0.14	0.04
Well Water						
DF18	12	**3.6**	2.8			
R2	12	30	3.9			
R316	12	8.9	3.3			
R329	12	13	7.7			
Annual Average[d]	48	14	20			
Lake Water						
Courtice Road Beach	8	6.7	7.1			
McLaughlin Bay	8	25	5.4			
Annual Average[d]	16	16	20			

PN EMP

Location	Tritium Concentration			Gross Beta Activity Concentration		
	N	Location Average (Bq/L)[b]	Uncertainty (±2σ)[c]	N	Location Average (Bq/L)[a]	Uncertainty (±2σ)[c]
WSP						
Ajax WSP	48	5.3	5.5	12	0.15	0.03
F. J. Horgan WSP	48	4.6	3.3	12	0.14	0.02
R. C. Harris WSP	48	**4.2**	2.7	12	0.12	0.02
Whitby WSP	48	5.4	5.6	12	0.13	0.03
Annual Average[d]	192	**4.9**	4.5	48	0.14	0.04
Well Water						
DF1	12	8.3	1.9			
DF8	12	11	2.7			
Annual Average[d]	24	9.5	3.3			
Lake Water						
Beachfront Park	8	32	61			
Frenchman's Bay	8	22	19			
Squire's Beach	8	15	18			
Annual Average[d]	24	23	39			

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples. NR = not required by program.

Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(a) Ld for gross beta = 0.03 Bq/L and Lc = 0.02 Bq/L.

(b) Ld for tritium = 4.5 Bq/L and Lc = 2.3 Bq/L.

(c) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(d) Annual averages are calculated using the entire dataset.

(e) Samples are not required during the winter months.

Table D-9: Lake Fish – 2025

	Sample Type	N	HTO		C-14		Co-60		Cs-134		Cs-137		K-40		OBT composite[d][f]	
			Average (Bq/L)[a]	Uncertainty (±2σ)[c]	Average (Bq/kg-C)[a]	Uncertainty (±2σ)[c]	Average (Bq/kg fw)[b]	Uncertainty (±2σ)[c]	Average (Bq/kg fw)[b]	Uncertainty (±2σ)[c]	Average (Bq/kg fw)[b]	Uncertainty (±2σ)[c]	Average (Bq/kg fw)	Uncertainty (±2σ)[c]	Average (Bq/L) w.e.	Uncertainty (±2σ)[c]
DN EMP - Locations																
Darlington Diffuser	White sucker	8	**3.4**	1.1	269	23	< 0.1	NA	< 0.1	NA	0.1	0.03	124	15	45	3
PN EMP - Locations																
Pickering 5-8 Outfall	White sucker	8	9.4	3.8	285	45	< 0.1	NA	< 0.1	NA	<0.1	NA	127	18	52	3
Background Locations																
Lake Ontario Far Field	White sucker	8	**2.4**	1.3	221	33	< 0.1	NA	< 0.1	NA	0.2	0.1	115	17	23	3

NOTES:

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples

fw = fresh weight

w.e. = water equivalent

NA = not applicable

Bolded values are greater than Lc but less than Ld.

(a) Ld for tritium = 4.5 Bq/L and Lc = 2.3 Bq/L. Ld for C-14 = 40 Bq/kg-C. Bolded values are greater than Lc but less than Ld. "<" indicates less than Lc.

(b) For gamma analysis (Co-60, Cs-134, Cs-137, K-40), "<" indicates less than Ld.

(c) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

(d) Where individual analytical results are reported, 2σ denotes the laboratory uncertainty of the individual sample.

(e) For datasets partially composed of values censored at the Ld, the Kaplan-Meier methodology is used to determine the mean and standard deviation of the dataset. This is indicated by "*".

Table D-10: Beach Sand – 2025

Beach Sand	N	Gamma Analysis (Bq/kg dw)[a]							
		Co-60		Cs-134		Cs-137		K-40	
		Average	Uncertainty (±2σ)[b]	Average	Uncertainty (±2σ)[b]	Average	Uncertainty (±2σ)[b]	Average	Uncertainty (±2σ)[b]
DN EMP - Locations									
Courtice Road Beach	8	< 0.1	NA	< 0.1	NA	< 0.1	NA	330	100
McLaughlin Bay	8	< 0.1	NA	< 0.1	NA	< 0.1	NA	323	23
West/East Beach	8	< 0.1	NA	< 0.1	NA	0.2	0.1	367	54
PN EMP - Locations									
Beachfront Park	8	< 0.1	NA	< 0.1	NA	0.3	0.1	286	55
Squires Beach	8	< 0.1	NA	< 0.1	NA	0.4	0.1	369	52
Beachpoint Promenade	8	< 0.1	NA	< 0.1	NA	0.4	0.1	360	25
Background Locations									
Cobourg	8	< 0.1	NA	< 0.1	NA	0.3	0.06	383	61

Refer to Section 3.3.1 for complete list of reporting conventions.

N = number of samples. NR = not required by program. NA = Not applicable

(a) For gamma analysis "<" indicates less than Ld.

(b) Averages of datasets are reported. 2σ denotes two times the standard deviation of the dataset.

Appendix E: Potential Critical Group Descriptions

E.1.0 DARLINGTON NUCLEAR POTENTIAL CRITICAL GROUPS

Nine potential critical groups are identified for the DN EMP. The annual public dose is routinely reported for the top three potential critical groups, as identified through the pathway analysis. These are the Farm, West/East Beach Resident and the Rural Resident, as shown in Figure C1 (see Appendix C, Maps of Environmental Monitoring and Critical Group Locations). The annual public dose is also calculated for the Dairy Farm potential critical group as the Dairy Farm group is exposed to the most media types and pathways. The EMP sampling plan is structured around monitoring for these four potential critical groups. These groups can change based on the updated pathway analysis results. For informational purposes, descriptions for all nine potential critical groups considered are provided below.

All of the potential critical groups, with the exception of the Industrial/Commercial group, consume some locally caught fish near the DNGS diffuser. All potential critical groups with the exception of the Sport Fisher and Industrial/Commercial groups are assumed to be exposed to local beach sand. The one-year-old infant is assumed to drink cow's milk and water. For all potential critical groups except the Dairy Farm infant, who drinks fresh local cow's milk, the assumption is made that the milk consumed is a composite from dairy farms all over Ontario which are not affected by station operations.

Based on the site-specific survey review [R-21], a small fraction of residents from the Oshawa/Courtice, Bowmanville, West/East Beach, and Rural Resident potential critical groups work within 5 km of DN site. In addition, a small fraction of the Industrial/Commercial potential critical group resides close to DN site. Therefore, for example, the average Adult dose for the Rural Resident potential critical group has been adjusted to account for the exposure this portion of the population receives while at work and at home.

The DN EMP potential critical groups are described as follows:

(a) The Oshawa/Courtice potential critical group consists of urban residents in Oshawa and in the community of Courtice within the Municipality of Clarington located to the W and WNW of the site starting at about 6 km from the site. These residents obtain drinking water from the Oshawa WSP and grow a small percentage of their annual fruits and vegetables in gardens.

(b) The Bowmanville potential critical group consists of urban residents located to the NE and NNE of the site at distances from 4 to 7 km from DN site. These residents obtain drinking water from the Bowmanville WSP and grow a small percentage of their annual fruits and vegetables in gardens. They also purchase a small percentage of their annual meat, poultry and eggs from local farms.

(c) The West/East Beach potential critical group consists of urban residents located to the ENE of the site at distances from 3.5 km to 7 km. These residents obtain their drinking water from both wells and the Bowmanville WSP, and grow a small percentage of their annual fruits and vegetables in gardens. They also purchase a small percentage of their annual poultry and eggs from local farms.

(d) The Farm potential critical group consists of agricultural farms (but not dairy farms) located in all landward wind sectors around the DN site at distances from 1.5 km to 10 km. The closest is in the WNW wind sector. Members of this group obtain their water supply mostly from wells and use it for drinking, bathing, irrigation and watering livestock. They also obtain a large fraction of their annual fruits, vegetables and animal products from locally grown sources.

(e) The Dairy Farm potential critical group consists of dairy farms located in all landward wind sectors around the DN site at distances from 3 km to over 10 km. The closest is in the N wind sector. Members of this group obtain their water supply from wells and use it for drinking, bathing, irrigation, and livestock watering. They also obtain a large fraction of their annual fruits, vegetables and animal products, including fresh cow's milk, from locally grown sources.

(f) The Rural Residents potential critical group consists of residents in rural areas in all landward wind sectors around the site at distances of about 2 km to 5 km. Members of this group obtain about half of their water supply from wells and half from the Bowmanville WSP, and use it for drinking, bathing, and irrigation. They obtain a moderate fraction of their annual fruits, vegetables, poultry and eggs from locally grown sources.

(g) The Industrial/Commercial potential critical group consists of adult workers whose work location is close to the DN site. The closest location for this group is the St. Marys cement plant about 1.8 km NE of the site, however, the most affected location due to updated meteorological data is the Courtice Water Pollution Control Plant about 2 km W of DN site. Members of this group are typically at this location about 23% of the time. They consume water from the Bowmanville WSP. A small fraction of these workers also reside near the station.

(h) The Sport Fisher potential critical group is comprised of non-commercial individuals fishing near the DNGS discharge, about 0.5 km S of the DN site. Members of this group were conservatively assumed to obtain all the fish they consume in a year from the vicinity of the DN site and spend 1% of their time at the discharge location where atmospheric exposure occurs.

(i) The Camper potential critical group consists of campers at the Darlington Provincial Park, located from 4 to 6 km W of the site at the lakeshore, and includes McLaughlin Bay, a shallow water body where some fishing takes place. The campers are assumed to be in the park no more than six months of the year. They consume drinking water from the Oshawa WSP, and purchase a small fraction of their annual fruits, vegetables, meat, poultry, and eggs from locally grown sources.

E.2.0 PICKERING NUCLEAR POTENTIAL CRITICAL GROUPS

Six potential critical groups are identified for the PN EMP. Note that the annual public dose is routinely reported for the top three potential critical groups, as identified through the pathway analysis. These are the Industrial Worker, the Urban Resident, and the Sport Fisher. In addition, PN site dose is calculated for the Dairy Farm potential critical group since it is exposed to the most media/pathways. Including the Dairy Farm group assures that any changes in emissions, environmental transfer factors, exposure factors, and dosimetry, and changes in the distribution of radionuclides released will be captured. Refer to Figure C2 in Appendix C, Maps of Environmental Monitoring and Critical Group Locations.

The annual sampling plan is structured around monitoring for these four potential critical groups. These groups can change based on the updated pathway analysis results. For informational purposes, descriptions for all six potential critical groups considered are provided below.

The one-year old infant is assumed to drink cow's milk and water. For all potential critical groups except the Dairy Farm infant, who drinks fresh local cow's milk, the assumption is made that the milk is a composite from dairy farms all over Ontario which are not affected by station operations.

Based on the site-specific survey [R-22], a small fraction of Industrial/Commercial workers reside close to PN site. Similarly, a fraction of residents from the Urban Resident potential critical group work within 5 km of PN site. Therefore, the average Adult doses for these groups have been adjusted to account for the exposure this portion of the population receives while at work and at home.

The PN EMP potential critical groups are described as follows:

(a) The C2 potential critical group consists of inhabitants at a correctional institute, located approximately 3 km NNE of the PN site. The C2 group obtains drinking water from the Ajax WSP and does not consume locally grown fruits or vegetables. The C2 resident is conservatively assumed to be at this location 100 percent of the time over the full year.

(b) The Industrial/Commercial potential critical group consists of adult workers whose work location is close to the PN site. Members of this group are typically at this location about 23% of the time. They consume water from the Ajax WSP. The closest location for this group is about 1 km NNE of the site. A small fraction of these workers also reside near the station.

(c) The Urban Residents potential critical group consists of Pickering and Ajax area residents which surround the PN site (e.g., Fairport, Fairport Beach, Rosebank, Liverpool, Pickering Village, etc.). The members of this group mostly consume water from the Ajax WSP and also consume a diet composed in part of locally grown produce and some locally caught fish. Members of this potential critical group are also externally exposed to beach sand at local beaches (Beachpoint Promenade, Beachfront Park, or Squires Beach).

(d) The Farm potential critical group consists of residents of agricultural farms (but not dairy farms) within a 10 km radius of the PN site. Members of this group obtain most of their water supply from wells but also a portion from the Ajax WSP. Members of this potential critical group consume locally grown produce and animal products, as well as locally caught fish. They are also externally exposed to beach sand at local beaches (Beachpoint Promenade, Beachfront Park, or Squires Beach).

(e) The Dairy Farm potential critical group consists of residents of dairy farms within a 20 km radius of the PN site. This group obtains most of their water supply from local wells. They also consume locally grown fruit and vegetables and locally produced animal products, including fresh cow's milk. Members of this potential critical group are also externally exposed to beach sand at local beaches (Beachpoint Promenade, Beachfront Park, or Squires Beach).

(f) The Sport Fisher potential critical group is comprised of non-commercial individuals fishing near the PNGS outfall, 0.5 km S of the PN site. Members of this group were conservatively assumed to obtain all the fish they consume in a year from the vicinity of the PN site and spend 1% of their time at the outfall location where atmospheric exposure occurs.

Appendix F: Dose Calculation Procedure and Concentrations

F.1.0 CRITICAL GROUP DOSE CALCULATION PROCEDURE

The dose calculations were performed according to N-INS-03443-00001, Methodology for Data Analysis and Public Dose Determination for the Environmental Monitoring Program [R-20]. Some clarifications of and assumptions from this methodology are listed below.

- IMPACT 5.5.2 is aligned with the 2020 version of the CSA N288.1 standard [R-23]. For OPG exposure scenarios it is also consistent with the 2014 version of the CSA N288.1 standard [R-16]. While a few parameters were updated in the 2020 version, none of these parameters are involved in PN or DN exposure scenarios. OBT doses from terrestrial animals and terrestrial plants were modeled using HTO concentrations measured in terrestrial samples at the potential critical groups. OBT doses from fish were modeled from HTO concentrations in fish.

- HTO and C-14 concentrations in terrestrial animal products other than milk, eggs, and poultry are modeled from measured concentrations of HTO and C-14 in animal feed, forage, air and water. The concentrations are used to calculate the dose from ingestion of animal products. The dose resulting from I(mfp) and particulate is modeled from emissions and empirical Ka values and the ratio of modeled Ka values for the property boundary monitor location and the potential critical group location.

- Location specific measures of each radionuclide were used in the potential critical group calculations where the group occupied a relatively small geographic location. Some groups such as the Farm, Dairy Farm or Urban Resident are spread over much wider geographic areas, and for these groups air concentrations were determined for a single conservative representative location, and group average values were used for terrestrial samples and water sources.

- Only Dairy Farm residents ingest local cow’s milk.

- People are generally assumed to be at the potential critical group location 100% of the time, with certain exceptions detailed in Appendix E. Based on the site-specific surveys, a small fraction of residential potential critical group members for the PN and DN EMPs work within 5 km of the station. In addition, a small fraction of Industrial/Commercial workers for the PN and DN EMPs reside close to the station. Therefore, the average adult doses for these groups have been adjusted for both PN and DN EMPs to account for the exposure this portion of the population receives while at work and at home.

- No local grain products are consumed by humans.

F.2.0 PROVINCIAL BACKGROUND DATA

Treatment of provincial background data for public dose calculation purposes is as follows:

- If the mean (arithmetic, Kaplan-Meier, or Regression on Order Statistics) is below the Lc, a concentration of 0 (zero) is used for the dose calculation in order to be conservative, i.e. no background concentration is subtracted from the concentration measured for the PN or DN EMP.

- If all values in a dataset are below the Ld, a concentration of 0 (zero) is used for the dose calculation in order to be conservative.

- If there are not enough samples collected in a given year to accurately reflect the background dose in a particular sample media, 0 (zero) is used for HTO and gamma in order to be conservative. Previous sampling years may be consulted to arrive at an estimated C-14 concentration in the affected media as background values are not expected to vary significantly from year to year.

F.3.0 POTENTIAL CRITICAL GROUP RADIONUCLIDE CONCENTRATIONS AND BACKGROUND SUBTRACTIONS

The following section details how the radionuclide concentrations are determined, whether they are measured or modeled, and any calculations made to obtain results.

A summary on the radionuclides and pathways measured and modeled in the dose calculation is presented in Table F-1. DRL Guidance document [R-39] provides a description of each pathway.

Table F-1: Radionuclides and Pathways Measured and Modeled in the Dose Calculation

Pathway	Radionuclide	Modeled[(a)]	Measured
Air Inhalation	HTO	√(Fisher)	√[(c)]
	HT	√ [(b)]	
	C-14	√ [(b)]	√
	I(mfp)	√ [(b)]	
	Co-60	√ [(b)]	
Air External Exposure	Noble Gas		√ [(c)]
	C-14	√ [(b)]	√
	I(mfp)	√ [(b)]	
	Co-60	√ [(b)]	
Soil External Exposure	C-14	√	
	I(mfp)	√	
	Cs-134, Co-60	√	
Sand External Exposure	C-14	√	
	Cs-134	√	
Water External Exposure (Lakes, WSPs, Wells)	HTO	√ (wells)	√
	C-14	√	
	I(mfp)	√	
	Cs-134	√	
Terrestrial Animals Ingestion	HTO	√	√ (milk, eggs, poultry)
	C-14	√	√ (milk, eggs, poultry)
	I(mfp)	√	
	Cs-134, Co-60	√	
	OBT	√ [(d)]	
Terrestrial Plants Ingestion	HTO		√
	C-14		√
	I(mfp)	√	
	Cs-134, Co-60	√	
	OBT	√ [(d)]	
Aquatic Animals Ingestion	HTO		√
	C-14		√
	I(mfp)	√	
	Cs-134		√
	OBT	√ [(d)]	
Sand and Soil Incidental Ingestion	HTO	√	
	C-14	√	
	I(mfp)	√ (soil)	
	Cs-134, Co-60	√	√ (sand)
Water Ingestion (WSPs, Wells)	HTO		√
	C-14	√	
	I(mfp)	√	
	Cs-134	√	

"+" indicates that contributions from progeny are included.

a) Modeling is based on emissions or from local air measurements where they are available.
b) Concentrations are modeled from emissions and adjusted using empirical Ka determined for each potential critical group location.
c) Doses are measured directly at the property boundary and adjusted to potential critical group locations using the ratio of modeled air dispersion factors for the property boundary monitor and potential critical group.
d) OBT dose is modeled from HTO concentration in terrestrial plants, terrestrial animals, or fish respectively.

F.3.1 Tritium

For the purpose of estimating the critical group dose, the concentrations used in the corresponding pathways were determined as follows:

- **Air** – Tritium-in-air is measured at property boundary locations with measured background tritium-in-air subtracted, and these values are used to estimate concentrations at each potential critical group location using the ratio of modeled atmospheric dispersion factors for the boundary monitor location and the potential critical group location (except for the Fisher potential critical group where it is modeled from emissions).

  Concentrations of radionuclides in air that are not monitored at property boundary locations or potential critical groups are determined for the potential critical group location as follows:

  The concentrations at the boundary monitor locations are estimated using the station's emissions data and empirical Ka values obtained from HTO emissions and HTO boundary monitor measurements. The concentrations at potential critical group locations are modeled from the empirically estimated boundary location concentration by using the ratio of modeled air dispersion factors for the boundary monitor location and the potential critical group location.

- **Water** – Drinking water is sampled and measured at the local WSPs and also at wells where local residents obtain their water. For the WSPs, the annual average concentration is used with background tritium concentration subtracted. The background tritium concentration is calculated for natural and weapons fallout contributions using the Great Lakes Time-Concentration Tritium Model [R-13]. For wells, the average concentration found at each potential critical group is used and background is assumed to be zero. Tritium concentration in wells used for purposes other than drinking water is modeled. Lake water HTO concentrations are measured monthly and used to calculate the dose from water immersion. Background HTO concentrations from the Great Lakes Time-Concentration Tritium model [R-13], are subtracted.

- **Milk** – Milk from local dairy farms is sampled on a monthly basis. The annual average of all the dairy farms is used for the dose calculation, with background tritium in milk concentration subtracted. Only dairy farm residents drink local milk since it is illegal to sell unprocessed milk.

- **Poultry** – Poultry from a local farm is sampled on an annual basis. The annual average is used for the dose calculation, with background values subtracted. Since the farm where poultry is sampled is located in close proximity to the dairy farm, it is assumed that there is not a large difference in radionuclide concentrations in poultry obtained from the local farm vs. the local dairy farm. Therefore, the poultry samples taken are applied to both the Farm and Dairy Farm potential critical groups.

- **Eggs** – Eggs from a local farm are sampled on a quarterly basis. The annual average is used for the dose calculation, with background values subtracted. Since the farm where eggs are sampled is located in close proximity to the dairy farm, it is assumed that there is not a large difference in radionuclide concentrations in eggs obtained from the local farm vs.

the local dairy farm. Therefore, the egg samples taken are applied to both the Farm and Dairy Farm potential critical groups.

- **Fruits and Vegetables** – Fruit and vegetable tritium concentrations are measured at each potential critical group location and the background tritium concentration is subtracted. The average concentration from all samples measured for each potential critical group is used in the dose calculation.

- **Animal Feed** – The animal feed (wet and dry) is collected from dairy farms bi-annually and is usually from the previous year's harvest. The annual averages of wet and dry feed are used for the dose calculation with background values subtracted.

- **Fish** – The radionuclide concentrations used for locally caught fish are the average measured values in the fish samples, minus background tritium in water. The background tritium in water concentration is for natural and weapons fallout contributions only, as calculated using the Great Lakes Time-Concentration Tritium Model [R-13].

F.3.2 Carbon-14

For the purpose of estimating the critical group dose, the concentrations used in the corresponding pathways were determined as follows:

- **Air** – C-14 via air inhalation is monitored at property boundary locations for about half the landward wind sectors. Where C-14 in air measurements are available, the concentration of C-14 in air is based on the annual average of measurements for each potential critical group location. If more than one sample location is used to represent one potential critical group, then the maximum of the annual averages is taken. Where C-14 in air measurements are not available C-14 in air is modeled from emissions and adjusted using the empirical Ka as described in Section 4.1.2. For all measurements, the average background C-14 concentration in air is subtracted.

- **Water** – Concentrations of C-14 in well water are modeled from measured local air concentrations at each potential critical group location, and concentrations in the WSPs and lake water are modeled from site waterborne emissions.

- **Terrestrial media** – The concentrations of C-14 in terrestrial media (plants, milk, animal feed, eggs, and poultry) are based on the average of the measurements for each sample type for each potential critical group, minus the average C-14 concentration measured in background media. Where average measurements for a sample type are less than average concentrations in background media, C-14 is conservatively modeled.

- **Fish** – For fish, the average C-14 concentration of all samples per site is used, minus the average concentration of C-14 in Lake Ontario fish measured in background locations.

F.3.3 Noble Gases and Skyshine

The noble gas detectors measure the air kerma rate, which is converted to effective dose using appropriate age-specific conversion factors (effective dose/air kerma rate) [R-40] and standard occupancy and shielding factors for air immersion dose as described in CSA N288.1 [R-16][R-23].

Noble gas dose is measured directly in most landward wind sectors around the DN and PN site property boundaries, and adjusted to the potential critical group location using calculated air dispersion ratios.

The air kerma rate from the NSS-PWMF at the PN site was measured in June 2017 over water on Lake Ontario [R-15]. The results showed a rapid drop in the measured air kerma rate with distance, such that it is below the detection limit (0.33 nGy/h) at a distances greater than 400 m from the storage areas. At 1 km distance, the air kerma rate is estimated to be negligible. The skyshine dose from this source is, therefore, not significant for potential critical groups outside the 1 km distance, which are all the potential critical groups except the Fisher which is assumed to be located 500 m south of PN site in Lake Ontario. Skyshine doses from the NSS-PWMF are estimated and included in the total noble gas dose for all potential critical groups. Skyshine doses from the NSS-DWMF are negligible as all potential critical groups are located beyond 1 km from the NSS-DWMF.

Ir-192 skyshine doses from radiography conducted at DNGS and PNGS are estimated and included in the potential critical group noble gas doses. Skyshine doses are found to be negligible for all potential critical groups.

F.3.4 Radioiodines

Radioiodine emissions are assumed to have an equilibrium mixture of radioiodines based on I(mfp). This is to account for short-lived radioiodines which may be emitted along with I-131. Emissions for each short-lived radioiodine are incorporated into the dose model based on its equilibrium ratio to the measured I-131 emission. Doses are modeled for the individual radioiodines and summed for the total I(mfp) dose. Due to the very short half-lives of some of these radioiodines, this calculation may overestimate the doses.

Radioiodines are an airborne emission and concentrations at potential critical group locations are modeled using emissions, the empirical Ka at each potential critical group location and modeled atmospheric dispersion factors.

F.3.5 Particulates and Gross Beta Gamma

Both airborne particulates and waterborne gross-beta emissions represent a mixture of beta and gamma emitting radionuclides. In order to obtain conservative doses for these mixtures, they are represented by the most limiting radionuclides typically found in the mixtures. According to the pathway analyses [R-41][R-42], the most limiting radionuclide for atmospheric particulate emissions is Co-60 and for liquid effluent beta-gamma emissions it is Cs-134. There was no analysis for alpha radioactivity because alpha radionuclide emissions from the stations are extremely low [R-42].

For airborne particulates, concentrations in air are modeled using emissions, the empirical Ka at each potential critical group location and modeled atmospheric dispersion factors.

Concentrations in terrestrial media are subsequently modeled from the airborne concentrations. These concentrations are used to calculate doses to potential critical groups.

For waterborne gross-beta gamma, potential critical group doses are directly modeled from emissions in aquatic media where no local measurements are available. The only pathways used for dose calculation in which gross beta-gamma activity is measured in environmental samples are fish and beach sand. Background values of activity in Lake Ontario fish and beach sand are subtracted from these measurements.

F.3.6 Elemental Tritium

For HT, the inhalation pathway is the only direct pathway to humans resulting in dose. Concentrations in air are modeled using emissions, the empirical Ka at each potential critical group location and modeled atmospheric dispersion factors. HT converts into HTO through interaction with microbes in the soil. The resultant HTO is routinely measured in air and local biota around nuclear sites.

Appendix G: Tables of Public Doses by Radionuclide, Pathway and Age Group for Darlington Nuclear and Pickering Nuclear Potential Critical Groups

Table G-1: Darlington Nuclear – Farm Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	6.38E-05	7.33E-08	9.16E-07	2.63E-11	0.00E+00	0.00E+00	5.81E-11	3.10E-11	0.00E+00	0.00E+00	7.31E-02	7.38E-03	8.05E-02
	Co-60	uSv/a	4.42E-06	1.68E-07	3.76E-07	1.36E-07	1.71E-09	4.31E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-05	4.69E-07	4.32E-03
	Cs-134	uSv/a	0.00E+00	0.00E+00	2.49E-05	9.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.41E-05
	HT	uSv/a	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.95E-06
	HTO	uSv/a	1.03E-01	0.00E+00	1.06E-01	3.67E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.82E-02	3.37E-03	2.34E-01
	NobleGases	uSv/a	0.00E+00	1.32E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-01
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.87E-03	8.12E-04	3.69E-03
	I (mfp)	uSv/a	6.24E-05	4.63E-06	9.89E-07	1.40E-08	1.28E-10	1.38E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.95E-04	1.05E-05	2.87E-04
	Total	uSv/a	1.03E-01	1.32E-01	1.06E-01	3.68E-03	1.84E-09	4.32E-03	5.81E-11	3.10E-11	0.00E+00	0.00E+00	9.43E-02	1.16E-02	4.55E-01
Child-10y	C-14	uSv/a	9.10E-05	7.33E-08	4.69E-07	2.63E-11	0.00E+00	0.00E+00	1.10E-09	3.10E-11	0.00E+00	0.00E+00	6.71E-02	5.33E-03	7.25E-02
	Co-60	uSv/a	6.31E-06	1.68E-07	4.84E-07	1.36E-07	7.61E-08	4.31E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.21E-05	8.06E-07	4.34E-03
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	9.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.25E-06
	HT	uSv/a	2.32E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E-06
	HTO	uSv/a	1.23E-01	0.00E+00	5.14E-02	3.06E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-02	2.27E-03	1.94E-01
	NobleGases	uSv/a	0.00E+00	1.32E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-01
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-03	5.94E-04	3.11E-03
	I (mfp)	uSv/a	1.42E-04	4.63E-06	9.30E-07	1.40E-08	4.15E-09	1.38E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-04	1.30E-05	4.77E-04
	Total	uSv/a	1.23E-01	1.32E-01	5.14E-02	3.07E-03	8.02E-08	4.32E-03	1.10E-09	3.10E-11	0.00E+00	0.00E+00	8.46E-02	8.20E-03	4.07E-01
Infant_1y	C-14	uSv/a	6.21E-05	7.33E-08	0.00E+00	4.19E-12	0.00E+00	0.00E+00	2.45E-09	3.10E-11	0.00E+00	0.00E+00	5.85E-02	3.12E-03	6.16E-02
	Co-60	uSv/a	4.62E-06	2.18E-07	0.00E+00	4.59E-08	2.07E-07	5.60E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E-05	5.16E-07	5.62E-03
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	HT	uSv/a	1.59E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-06
	HTO	uSv/a	8.48E-02	0.00E+00	0.00E+00	9.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.41E-03	1.64E-03	9.68E-02
	NobleGases	uSv/a	0.00E+00	1.62E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-01
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-03	3.86E-04	1.58E-03
	I (mfp)	uSv/a	1.65E-04	6.02E-06	0.00E+00	4.72E-09	1.61E-08	1.80E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E-04	1.24E-05	6.42E-04
	Total	uSv/a	8.50E-02	1.62E-01	0.00E+00	9.65E-04	2.23E-07	5.62E-03	2.45E-09	3.10E-11	0.00E+00	0.00E+00	6.95E-02	5.17E-03	3.28E-01

Table G-2: Darlington Nuclear – Dairy Farm Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	0.00E+00	0.00E+00	2.01E-08	1.42E-11	0.00E+00	0.00E+00	5.81E-11	3.10E-11	0.00E+00	0.00E+00	3.15E-02	5.39E-03	3.68E-02
	Co-60	uSv/a	1.50E-07	5.69E-09	0.00E+00	0.00E+00	4.72E-11	1.19E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.39E-06	4.21E-07	1.24E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	8.09E-06	9.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-05
	HT	uSv/a	6.62E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.62E-08
	HTO	uSv/a	3.50E-03	0.00E+00	2.63E-02	1.38E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-02	7.51E-03	4.99E-02
	NobleGases	uSv/a	0.00E+00	1.37E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-03	1.08E-03	2.84E-03
	I (mfp)	uSv/a	2.08E-06	1.37E-07	7.44E-09	9.02E-11	4.27E-12	4.45E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.31E-05	3.03E-04	3.88E-04
	Total	uSv/a	3.50E-03	1.37E-02	2.63E-02	1.39E-03	5.15E-11	1.19E-04	5.81E-11	3.10E-11	0.00E+00	0.00E+00	4.45E-02	1.43E-02	1.04E-01
Child-10y	C-14	uSv/a	0.00E+00	0.00E+00	1.10E-08	1.42E-11	0.00E+00	0.00E+00	1.10E-09	3.10E-11	0.00E+00	0.00E+00	2.86E-02	5.99E-03	3.46E-02
	Co-60	uSv/a	2.14E-07	5.69E-09	0.00E+00	0.00E+00	2.10E-09	1.19E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.24E-06	1.35E-06	1.30E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	2.37E-06	9.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-05
	HT	uSv/a	7.87E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.87E-08
	HTO	uSv/a	4.16E-03	0.00E+00	1.31E-02	1.15E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.93E-03	1.03E-02	3.77E-02
	NobleGases	uSv/a	0.00E+00	1.37E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-03	1.42E-03	2.96E-03
	I (mfp)	uSv/a	4.73E-06	1.37E-07	7.00E-09	9.02E-11	1.39E-10	4.45E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-04	7.81E-04	9.15E-04
	Total	uSv/a	4.17E-03	1.37E-02	1.31E-02	1.16E-03	2.24E-09	1.19E-04	1.10E-09	3.10E-11	0.00E+00	0.00E+00	3.92E-02	1.85E-02	9.00E-02
Infant_1y	C-14	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-09	3.10E-11	0.00E+00	0.00E+00	3.06E-02	7.10E-03	3.77E-02
	Co-60	uSv/a	1.57E-07	7.39E-09	0.00E+00	0.00E+00	5.72E-09	1.55E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-05	2.33E-06	1.68E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	HT	uSv/a	5.39E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.39E-08
	HTO	uSv/a	2.87E-03	0.00E+00	0.00E+00	1.92E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.17E-03	1.94E-02	3.07E-02
	NobleGases	uSv/a	0.00E+00	1.69E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-03	2.34E-03	3.65E-03
	I (mfp)	uSv/a	5.53E-06	1.78E-07	0.00E+00	3.04E-11	5.39E-10	5.78E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-04	2.16E-03	2.39E-03
	Total	uSv/a	2.88E-03	1.69E-02	0.00E+00	1.92E-04	6.26E-09	1.55E-04	2.45E-09	3.10E-11	0.00E+00	0.00E+00	4.03E-02	3.10E-02	9.14E-02

Table G-3: Darlington Nuclear – Rural Resident Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	1.51E-04	1.73E-07	1.64E-06	3.81E-11	1.83E-13	8.29E-12	5.71E-11	3.04E-11	0.00E+00	0.00E+00	2.88E-02	1.30E-03	3.02E-02
	Co-60	uSv/a	1.09E-06	4.14E-08	1.63E-08	9.37E-09	2.62E-10	6.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.27E-06	4.26E-08	6.64E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	3.15E-05	9.64E-06	2.91E-09	8.43E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-06	8.91E-09	8.86E-04
	HT	uSv/a	4.81E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.81E-07
	HTO	uSv/a	2.55E-02	0.00E+00	1.39E-01	4.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.11E-03	7.41E-04	1.78E-01
	NobleGases	uSv/a	0.00E+00	9.53E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.53E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-03	1.51E-04	1.59E-03
	I (mfp)	uSv/a	1.54E-05	1.12E-06	7.02E-08	1.57E-09	3.08E-11	3.32E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.35E-05	2.43E-05	1.08E-04
	Total	uSv/a	2.56E-02	9.53E-02	1.39E-01	4.03E-03	3.20E-09	1.51E-03	5.71E-11	3.04E-11	0.00E+00	0.00E+00	3.94E-02	2.21E-03	3.07E-01
Child-10y	C-14	uSv/a	2.03E-04	1.63E-07	9.02E-07	3.88E-11	3.54E-12	8.44E-12	1.10E-09	3.10E-11	0.00E+00	0.00E+00	2.66E-02	1.24E-03	2.80E-02
	Co-60	uSv/a	1.49E-06	3.95E-08	2.15E-08	9.54E-09	1.07E-08	6.06E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.98E-06	1.48E-07	6.15E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	6.43E-06	9.82E-06	3.00E-08	8.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.01E-07	3.21E-09	8.76E-04
	HT	uSv/a	5.45E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.45E-07
	HTO	uSv/a	2.89E-02	0.00E+00	7.01E-02	3.42E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.44E-03	5.34E-04	1.10E-01
	NobleGases	uSv/a	0.00E+00	9.52E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.52E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-03	1.21E-04	1.40E-03
	I (mfp)	uSv/a	3.32E-05	1.07E-06	6.73E-08	1.60E-09	9.52E-10	3.16E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-05	6.50E-05	2.02E-04
	Total	uSv/a	2.91E-02	9.52E-02	7.02E-02	3.43E-03	4.17E-08	1.47E-03	1.10E-09	3.10E-11	0.00E+00	0.00E+00	3.54E-02	1.96E-03	2.37E-01
Infant_1y	C-14	uSv/a	1.38E-04	1.63E-07	0.00E+00	9.10E-12	7.85E-12	8.44E-12	2.45E-09	3.10E-11	0.00E+00	0.00E+00	2.77E-02	7.39E-04	2.86E-02
	Co-60	uSv/a	1.09E-06	5.13E-08	0.00E+00	3.22E-09	2.92E-08	7.88E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.12E-06	1.06E-08	7.97E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	1.91E-07	3.81E-08	1.12E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E-07	2.24E-09	1.12E-03
	HT	uSv/a	3.73E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E-07
	HTO	uSv/a	1.99E-02	0.00E+00	0.00E+00	1.34E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.91E-03	5.11E-04	2.87E-02
	NobleGases	uSv/a	0.00E+00	1.17E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-01
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-03	1.09E-04	1.21E-03
	I (mfp)	uSv/a	3.88E-05	1.39E-06	0.00E+00	5.39E-10	3.70E-09	4.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-04	7.27E-07	2.13E-04
	Total	uSv/a	2.01E-02	1.17E-01	0.00E+00	1.34E-03	7.09E-08	1.91E-03	2.45E-09	3.10E-11	0.00E+00	0.00E+00	3.59E-02	1.36E-03	1.78E-01

Table G-4: Darlington Nuclear – West/East Beach Resident – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	3.41E-04	3.92E-07	4.39E-06	8.38E-11	1.84E-13	8.33E-12	5.73E-11	3.05E-11	0.00E+00	1.17E-02	3.79E-02	1.42E-04	5.00E-02
	Co-60	uSv/a	2.48E-06	9.41E-08	9.08E-08	3.90E-08	3.54E-10	8.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.85E-06	1.33E-09	8.97E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	8.82E-06	9.19E-06	2.92E-09	8.47E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.31E-06	0.00E+00	8.74E-04
	HT	uSv/a	1.09E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-06
	HTO	uSv/a	5.79E-02	0.00E+00	5.21E-02	2.59E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-04	1.35E-02	8.91E-05	1.26E-01
	NobleGases	uSv/a	0.00E+00	2.52E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.70E-05	2.13E-03	1.29E-05	2.19E-03
	I (mfp)	uSv/a	3.47E-05	2.17E-06	6.46E-07	1.07E-08	6.91E-11	7.33E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.65E-05	1.94E-07	1.22E-04
	Total	uSv/a	5.83E-02	2.52E-02	5.21E-02	2.60E-03	3.35E-09	1.74E-03	5.73E-11	3.05E-11	0.00E+00	1.18E-02	5.36E-02	2.45E-04	2.06E-01
Child-10y	C-14	uSv/a	4.81E-04	3.88E-07	2.44E-06	8.50E-11	3.54E-12	8.44E-12	1.10E-09	3.10E-11	0.00E+00	2.34E-02	3.44E-02	1.12E-04	5.84E-02
	Co-60	uSv/a	3.51E-06	9.34E-08	1.19E-07	3.96E-08	1.51E-08	8.54E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.20E-06	2.45E-09	8.66E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	4.08E-07	9.32E-06	3.00E-08	8.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.46E-06	0.00E+00	8.73E-04
	HT	uSv/a	1.29E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-06
	HTO	uSv/a	6.83E-02	0.00E+00	2.60E-02	2.19E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-04	1.10E-02	6.33E-05	1.08E-01
	NobleGases	uSv/a	0.00E+00	2.41E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.35E-05	1.89E-03	1.00E-05	1.99E-03
	I (mfp)	uSv/a	7.83E-05	2.15E-06	6.16E-07	1.08E-08	2.22E-09	7.27E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-04	2.60E-07	2.08E-04
	Total	uSv/a	6.89E-02	2.41E-02	2.60E-02	2.20E-03	4.74E-08	1.72E-03	1.10E-09	3.10E-11	0.00E+00	2.37E-02	4.74E-02	1.85E-04	1.94E-01
Infant_1y	C-14	uSv/a	3.28E-04	3.88E-07	0.00E+00	2.28E-11	7.85E-12	8.44E-12	2.45E-09	3.10E-11	0.00E+00	1.63E-02	3.27E-02	8.85E-05	4.95E-02
	Co-60	uSv/a	2.58E-06	1.21E-07	0.00E+00	1.33E-08	4.11E-08	1.11E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.47E-06	2.30E-09	1.12E-03
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	2.15E-08	3.81E-08	1.12E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E-06	0.00E+00	1.12E-03
	HT	uSv/a	8.86E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.86E-07
	HTO	uSv/a	4.71E-02	0.00E+00	0.00E+00	5.53E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-04	9.94E-03	5.35E-05	5.78E-02
	NobleGases	uSv/a	0.00E+00	2.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.73E-05	1.59E-03	8.51E-06	1.67E-03
	I (mfp)	uSv/a	9.15E-05	2.79E-06	0.00E+00	3.64E-09	8.64E-09	9.45E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-04	3.39E-07	3.04E-04
	Total	uSv/a	4.76E-02	2.96E-02	0.00E+00	5.53E-04	8.78E-08	2.24E-03	2.45E-09	3.10E-11	0.00E+00	1.65E-02	4.45E-02	1.51E-04	1.41E-01

Table G-5: Pickering Nuclear – Dairy Farm Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	9.92E-05	1.14E-07	6.74E-07	1.19E-09	0.00E+00	0.00E+00	4.81E-09	2.56E-09	0.00E+00	0.00E+00	2.92E-02	7.24E-02	1.02E-01
	Co-60	uSv/a	3.81E-07	1.44E-08	0.00E+00	3.58E-09	8.22E-11	2.07E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.33E-07	1.83E-07	2.08E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	5.91E-04	0.00E+00	0.00E+00	3.42E-07	8.16E-04	0.00E+00	0.00E+00	8.73E-05	0.00E+00	1.50E-03
	HTO	uSv/a	3.62E-02	0.00E+00	3.29E-02	2.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-02	2.99E-02	1.22E-01
	NobleGases	uSv/a	0.00E+00	1.98E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-03
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-03	3.18E-03	6.06E-03
	I (mfp)	uSv/a	1.13E-06	4.87E-08	0.00E+00	1.31E-10	2.32E-12	2.35E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-06	6.33E-05	6.80E-05
	Total	uSv/a	3.63E-02	1.98E-03	3.29E-02	3.13E-03	8.45E-11	2.07E-04	3.47E-07	8.16E-04	0.00E+00	0.00E+00	5.32E-02	1.05E-01	2.34E-01
Child-10y	C-14	uSv/a	1.42E-04	1.14E-07	3.70E-07	1.19E-09	0.00E+00	0.00E+00	9.11E-08	2.56E-09	0.00E+00	0.00E+00	4.61E-02	1.30E-01	1.76E-01
	Co-60	uSv/a	5.43E-07	1.44E-08	0.00E+00	3.58E-09	3.66E-09	2.07E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E-06	7.41E-07	2.10E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	5.91E-04	0.00E+00	0.00E+00	3.47E-06	8.16E-04	0.00E+00	0.00E+00	9.03E-05	0.00E+00	1.50E-03
	HTO	uSv/a	4.31E-02	0.00E+00	1.64E-02	2.11E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-02	5.01E-02	1.34E-01
	NobleGases	uSv/a	0.00E+00	1.98E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-03
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.26E-03	5.53E-03	8.79E-03
	I (mfp)	uSv/a	2.58E-06	4.87E-08	0.00E+00	1.31E-10	7.54E-11	2.35E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.75E-06	2.06E-04	2.17E-04
	Total	uSv/a	4.32E-02	1.98E-03	1.64E-02	2.70E-03	3.73E-09	2.07E-04	3.56E-06	8.16E-04	0.00E+00	0.00E+00	7.14E-02	1.86E-01	3.22E-01
Infant_1y	C-14	uSv/a	9.67E-05	1.14E-07	0.00E+00	6.35E-12	0.00E+00	0.00E+00	2.02E-07	2.56E-09	0.00E+00	0.00E+00	3.09E-02	2.55E-01	2.86E-01
	Co-60	uSv/a	3.98E-07	1.88E-08	0.00E+00	1.21E-09	9.96E-09	2.69E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-06	1.75E-06	2.73E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.39E-06	1.06E-03	0.00E+00	0.00E+00	2.87E-05	0.00E+00	1.09E-03
	HTO	uSv/a	2.97E-02	0.00E+00	0.00E+00	5.28E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E-02	1.06E-01	1.56E-01
	NobleGases	uSv/a	0.00E+00	2.43E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E-03
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E-03	1.11E-02	1.44E-02
	I (mfp)	uSv/a	3.02E-06	6.33E-08	0.00E+00	4.40E-11	2.93E-10	3.06E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.41E-06	7.24E-04	7.36E-04
	Total	uSv/a	2.98E-02	2.43E-03	0.00E+00	5.28E-04	1.03E-08	2.69E-04	4.59E-06	1.06E-03	0.00E+00	0.00E+00	5.35E-02	3.73E-01	4.61E-01

Table G-6: Pickering Nuclear – Industrial/Commercial Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	3.54E-04	4.07E-07	1.22E-05	1.12E-10	3.60E-13	1.63E-11	2.96E-10	1.58E-10	0.00E+00	3.95E-06	1.13E-03	3.49E-07	1.50E-03
	Co-60	uSv/a	3.13E-06	1.19E-07	0.00E+00	0.00E+00	4.95E-11	1.25E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.75E-08	1.36E-12	1.28E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	3.80E-03	5.65E-05	4.43E-09	1.28E-03	2.11E-08	5.03E-05	0.00E+00	0.00E+00	5.51E-05	4.30E-10	5.25E-03
	HTO	uSv/a	2.99E-01	0.00E+00	9.13E-03	1.26E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E-07	1.53E-03	2.12E-06	3.09E-01
	NobleGases	uSv/a	0.00E+00	1.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.96E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E-08	2.05E-04	4.32E-07	2.06E-04
	I (mfp)	uSv/a	9.58E-06	6.53E-07	0.00E+00	0.00E+00	8.99E-13	9.65E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.39E-07	3.76E-11	1.06E-05
	Total	uSv/a	2.99E-01	1.96E-02	1.29E-02	1.82E-04	4.48E-09	1.41E-03	2.14E-08	5.03E-05	0.00E+00	4.10E-06	2.92E-03	2.90E-06	3.36E-01

Table G-7: Pickering Nuclear – Sport Fisher Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	3.11E-04	3.58E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E-02	0.00E+00	0.00E+00	3.23E-02
	Co-60	uSv/a	1.20E-06	4.53E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-06
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	HTO	uSv/a	1.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.49E-04	0.00E+00	0.00E+00	1.15E-01
	NobleGases	uSv/a	0.00E+00	8.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.16E-03
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.65E-04	0.00E+00	0.00E+00	3.65E-04
	I (mfp)	uSv/a	3.64E-06	2.33E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.88E-06
	Total	uSv/a	1.14E-01	8.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.32E-02	0.00E+00	0.00E+00	1.56E-01
Child-10y	C-14	uSv/a	4.44E-04	3.58E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E-02	0.00E+00	0.00E+00	3.15E-02
	Co-60	uSv/a	1.71E-06	4.53E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-06
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	HTO	uSv/a	1.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.46E-04	0.00E+00	0.00E+00	1.36E-01
	NobleGases	uSv/a	0.00E+00	8.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.16E-03
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E-04	0.00E+00	0.00E+00	3.51E-04
	I (mfp)	uSv/a	8.27E-06	2.33E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.50E-06
	Total	uSv/a	1.36E-01	8.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-02	0.00E+00	0.00E+00	1.76E-01
Infant_1y	C-14	uSv/a	3.03E-04	3.58E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-02	0.00E+00	0.00E+00	2.19E-02
	Co-60	uSv/a	1.25E-06	5.89E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-06
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	HTO	uSv/a	9.35E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.51E-04	0.00E+00	0.00E+00	9.40E-02
	NobleGases	uSv/a	0.00E+00	1.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-04	0.00E+00	0.00E+00	2.52E-04
	I (mfp)	uSv/a	9.66E-06	3.03E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.97E-06
	Total	uSv/a	9.38E-02	1.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.24E-02	0.00E+00	0.00E+00	1.26E-01

Table G-8: Pickering Nuclear – Urban Resident Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	7.91E-05	9.09E-08	4.15E-05	1.78E-09	5.71E-12	2.59E-10	4.70E-09	2.50E-09	0.00E+00	6.26E-05	1.80E-02	5.54E-06	1.82E-02
	Co-60	uSv/a	2.59E-06	9.82E-08	0.00E+00	0.00E+00	7.86E-10	1.98E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.53E-07	2.16E-11	1.98E-03
	Cs-134	uSv/a	0.00E+00	0.00E+00	1.29E-02	8.97E-04	7.02E-08	2.03E-02	3.34E-07	7.97E-04	0.00E+00	0.00E+00	8.74E-04	6.82E-09	3.58E-02
	HTO	uSv/a	2.46E-01	0.00E+00	3.28E-02	1.99E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-06	2.42E-02	3.37E-05	3.06E-01
	NobleGases	uSv/a	5.14E-06	1.38E-08	0.00E+00	0.00E+00	1.36E-11	8.39E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.59E-06	5.21E-10	9.58E-06
	OBT	uSv/a	1.16E-07	1.25E-07	0.00E+00	0.00E+00	3.13E-15	8.83E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.55E-10	0.00E+00	3.31E-07
	I (mfp)	uSv/a	2.11E-06	4.62E-08	0.00E+00	0.00E+00	5.91E-13	3.16E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E-07	6.44E-11	2.66E-06
	Total	uSv/a	2.47E-01	5.48E-02	4.58E-02	2.89E-03	7.10E-08	2.23E-02	3.39E-07	7.97E-04	0.00E+00	6.50E-05	4.63E-02	4.60E-05	4.20E-01
Child-10y	C-14	uSv/a	6.42E-05	5.17E-08	2.28E-05	1.70E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.70E-05
	Co-60	uSv/a	3.35E-06	8.89E-08	0.00E+00	0.00E+00	9.43E-09	5.33E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.37E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	3.78E-03	8.58E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.87E-03
	HTO	uSv/a	2.65E-01	0.00E+00	1.64E-02	2.18E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.82E-01
	NobleGases	uSv/a	0.00E+00	5.45E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.45E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	I (mfp)	uSv/a	1.62E-05	4.94E-07	0.00E+00	0.00E+00	1.65E-10	5.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-05
	Total	uSv/a	2.65E-01	5.45E-02	2.02E-02	3.04E-04	9.59E-09	5.34E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.41E-01
Infant_1y	C-14	uSv/a	4.38E-05	5.17E-08	0.00E+00	1.68E-10	2.46E-10	2.65E-10	2.02E-07	2.56E-09	0.00E+00	7.36E-04	1.78E-02	0.00E+00	1.86E-02
	Co-60	uSv/a	2.45E-06	1.16E-07	0.00E+00	0.00E+00	9.74E-08	2.63E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-06	0.00E+00	2.64E-03
	Cs-134	uSv/a	0.00E+00	0.00E+00	0.00E+00	1.10E-04	9.23E-07	2.71E-02	4.39E-06	1.06E-03	0.00E+00	0.00E+00	2.08E-04	0.00E+00	2.85E-02
	HTO	uSv/a	1.83E-01	0.00E+00	0.00E+00	2.43E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.87E-05	1.85E-02	0.00E+00	2.02E-01
	NobleGases	uSv/a	0.00E+00	6.69E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.69E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.58E-06	2.68E-03	0.00E+00	2.69E-03
	I (mfp)	uSv/a	1.90E-05	6.42E-07	0.00E+00	0.00E+00	1.84E-09	2.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.41E-06	0.00E+00	3.11E-05
	Total	uSv/a	1.83E-01	6.69E-02	0.00E+00	3.53E-04	1.02E-06	2.97E-02	4.59E-06	1.06E-03	0.00E+00	7.63E-04	3.92E-02	0.00E+00	3.21E-01

Table G-9: Pickering Nuclear – C2 Correctional Institution Doses – 2025

HumanType	Radionuclide	Unit	Air (inhalation)	Air (external)	Water (ingestion)	Water (external)	Soil (ingestion)	Soil (external)	Sediment (ingestion)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total
Adult	C-14	uSv/a	2.53E-04	2.91E-07	4.20E-05	1.70E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.95E-04
	Co-60	uSv/a	9.94E-07	3.77E-08	0.00E+00	0.00E+00	2.12E-10	5.33E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	1.31E-02	8.58E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-02
	HTO	uSv/a	1.05E-01	0.00E+00	3.09E-02	2.62E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-01
	NobleGases	uSv/a	0.00E+00	1.17E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	I (mfp)	uSv/a	2.62E-06	1.95E-07	0.00E+00	0.00E+00	5.07E-12	5.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.41E-06
	Total	uSv/a	1.06E-01	1.17E-02	4.40E-02	3.48E-04	2.17E-10	5.34E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-01
Child-10y	C-14	uSv/a	3.61E-04	2.91E-07	2.31E-05	1.70E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.84E-04
	Co-60	uSv/a	1.42E-06	3.77E-08	0.00E+00	0.00E+00	9.43E-09	5.33E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-04
	Cs-134	uSv/a	0.00E+00	0.00E+00	3.84E-03	8.58E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.92E-03
	HTO	uSv/a	1.25E-01	0.00E+00	1.54E-02	2.18E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-01
	NobleGases	uSv/a	0.00E+00	1.17E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-02
	OBT	uSv/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	I (mfp)	uSv/a	5.95E-06	1.95E-07	0.00E+00	0.00E+00	1.65E-10	5.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.73E-06
	Total	uSv/a	1.26E-01	1.17E-02	1.92E-02	3.04E-04	9.59E-09	5.34E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-01

Appendix H: Laboratory Proficiency Testing Program 2025 Results

Table H-1: Proficiency Test Results for Tritium in Water (Bq/L)

Quarter	Analytics Value	HPL Value	Z-Score	RMSE	Notes
Q1/2025	305	289	-1.93	0.06	-
Q2/2025	475	463	-0.94	0.03	
Q3/2025	377	380	0.23	0.03	
Q4/2025	441	443	0.17	0.02	

Table H-2: Proficiency Test Results for Gross Beta in Water (Bq/L)

Quarter	Analytics Value	HPL Value	Z-Score	RMSE	Notes
Q1/2025	10.6	11.3	0.65	0.11	-
Q2/2025	8.41	9.33	1.14	0.14	
Q3/2025	7.45	7.92	0.78	0.10	
Q4/2025	9.50	10.3	0.83	0.12	

Table H-3: Proficiency Test Results for Gamma in Milk (Bq/L)

Quarter	Radionuclide	Analytics Value	HPL Value	Z-Score	RMSE	Notes
Q1/2025	I-131	3.5	3.46	-0.17	0.02	-
	Ce-141	2.8	2.88	0.37	0.04	
	Cr-51	10.8	10.74	-0.07	0.04	
	Cs-134	5.27	4.77	-1.38	0.11	
	Cs-137	6.21	6.64	0.87	0.07	
	Co-58	3.89	4.07	0.59	0.05	
	Mn-54	7	7.34	0.63	0.05	
	Fe-59	4.99	5.43	1.04	0.08	
	Zn-65	9.27	10.08	1.08	0.08	
	Co-60	7.13	7.18	0.1	0.01	
Q2/2025	I-131	2.76	2.66	-0.46	0.03	-
	Ce-141	5.29	5.17	-0.32	0.02	
	Cr-51	10.8	11.1	0.31	0.07	
	Cs-134	7.83	6.71	-2.22	0.11	
	Cs-137	5.7	5.83	0.29	0.05	
	Co-58	6.13	6.06	-0.14	0.04	
	Mn-54	5.73	5.95	0.49	0.08	
	Fe-59	5.15	5.45	0.7	0.12	
	Zn-65	10.8	11.42	0.74	0.1	
	Co-60	8.09	7.95	-0.23	0.01	
Q3/2025	I-131	-	-	-	-	Delayed delivery. SCR#: N-2025-13395, N-2025-12530
	Ce-141	3.31	3.6	1.01	0.09	
	Cr-51	9.6	8.78	-0.87	0.12	
	Cs-134	5.24	4.82	-1.17	0.09	
	Cs-137	4.67	5.1	1.12	0.08	
	Co-58	3.88	4.33	1.36	0.1	
	Mn-54	5.97	6.79	1.63	0.12	
	Fe-59	3.65	4.26	1.68	0.15	
	Zn-65	7.24	8.54	2.03	0.15	
	Co-60	5.57	5.81	0.54	0.04	
Q4/2025	I-131	3.18	2.96	-0.94	0.08	No issues
	Ce-141	5.29	5.23	-0.15	0.02	
	Cr-51	11.1	10.86	-0.26	0.05	
	Cs-134	5.15	4.46	-2.02	0.15	
	Cs-137	6.23	6.08	-0.32	0.03	
	Co-58	6.26	6.07	-0.41	0.03	
	Mn-54	6.93	7.1	0.32	0.03	

Quarter	Radionuclide	Analytics Value	HPL Value	Z-Score	RMSE	Notes
	Fe-59	4.94	5.11	0.41	0.04	
	Zn-65	9.04	9.66	0.86	0.07	
	Co-60	8.04	7.51	-0.94	0.07	

Table H-4: Proficiency Test Results for Gamma in Water (Bq/L)

Quarter	Radionuclide	Analytics Value	HPL Value	Z-Score	RMSE	Notes
Q1/2025	I-131	2.81	3.18	0.28	0.13	-
	Ce-141	2.8	3.47	0.34	0.21	
	Cr-51	10.8	12.59	1.43	0.17	
	Cs-134	5.27	5.66	0.45	0.08	
	Cs-137	6.2	7.3	0.57	0.15	
	Co-58	3.89	4.22	0.36	0.09	
	Mn-54	6.99	7.92	0.61	0.12	
	Fe-59	4.98	6.07	0.56	0.19	
	Zn-65	9.27	10.33	0.81	0.11	
	Co-60	7.13	7.92	0.61	0.1	
Q2/2025	I-131	2.31	2.58	0.28	0.11	-
	Ce-141	5.12	5.18	0.46	0.14	
	Cr-51	10.5	11.48	1.26	0.11	
	Cs-134	7.57	7.17	0.56	0.05	
	Cs-137	5.51	5.56	0.45	0.14	
	Co-58	5.93	5.83	0.47	0.11	
	Mn-54	5.54	5.82	0.46	0.17	
	Fe-59	4.98	5.68	0.52	0.19	
	Zn-65	10.4	11.46	0.89	0.15	
	Co-60	7.82	8.13	0.63	0.14	
Q3/2025	I-131	-		-	-	Delayed delivery. SCR#: N-2025-13395, N-2025-12530
	Ce-141	3.59	4.04	0.85	0.15	
	Cr-51	10.4	10.98	0.21	0.24	
	Cs-134	5.69	5.69	0.01	0.03	
	Cs-137	5.07	5.39	0.73	0.07	
	Co-58	4.21	4.54	0.84	0.09	
	Mn-54	6.47	7.24	1.39	0.11	
	Fe-59	3.96	5.45	2.15	0.29	
	Zn-65	7.85	8.66	1.17	0.1	
	Co-60	6.04	6.71	1.3	0.1	
Q4/2025	I-131	1.67	1.86	0.95	0.13	No issues
	Ce-141	5.28	5.91	1.23	0.12	
	Cr-51	11	12.63	1.28	0.15	
	Cs-134	5.14	5.45	0.68	0.07	
	Cs-137	6.22	6.96	1.35	0.11	
	Co-58	6.25	6.8	1.04	0.09	
	Mn-54	6.91	7.44	0.92	0.08	

Quarter	Radionuclide	Analytics Value	HPL Value	Z-Score	RMSE	Notes
	Fe-59	4.93	6.26	2.42	0.22	
	Zn-65	9.02	10.4	1.69	0.14	
	Co-60	8.02	8.41	0.61	0.05	

Table H-5: Proficiency Test Results for Gamma in Soil (Bq/kg)

Quarter	Radionuclide	Analytics Value	HPL Value	Z-score	RMSE	Notes
Q1/2025	Ce-141	4.76	5.05	-0.76	0.07	No issues
	Cr-51	18.3	19.02	0.15	0.06	
	Cs-134	8.95	9.77	0.53	0.09	
	Cs-137	13	13.7	0.49	0.05	
	Co-58	6.61	6.94	0.02	0.05	
	Mn-54	11.9	13.93	1.08	0.15	
	Fe-59	8.47	10.15	1.24	0.17	
	Zn-65	15.8	17.5	1.41	0.1	
	Co-60	12.1	12.29	0.43	0.02	
Q2/2025	Ce-141	8.68	8.65	-0.04	0.03	No issues
	Cr-51	17.8	18.97	0.65	0.1	
	Cs-134	12.8	12.82	0.02	0.03	
	Cs-137	11.8	12.44	0.69	0.07	
	Co-58	10.1	10	-0.14	0.04	
	Mn-54	9.4	10.76	1.71	0.15	
	Fe-59	8.45	10.43	2.4	0.13	
	Zn-65	17.7	20.36	1.76	0.13	
	Co-60	13.3	13.81	0.5	0.01	
Q3/2025	Ce-141	5.52	6.67	1.96	0.18	No issues
	Cr-51	16	16.46	0.22	0.11	
	Cs-134	8.74	10.94	2.71	0.2	
	Cs-137	10.2	11.85	1.89	0.14	
	Co-58	6.47	7.32	1.55	0.12	
	Mn-54	9.94	11.78	2.11	0.16	
	Fe-59	6.08	8.2	2.75	0.27	
	Zn-65	12.1	14.91	2.53	0.19	
	Co-60	9.28	9.79	0.69	0.05	
Q4/2025	Ce-141	7.41	7.53	0.21	0.03	No issues
	Cr-51	15.5	15.45	-0.04	0.06	
	Cs-134	7.21	8.08	1.43	0.11	
	Cs-137	11.2	11.77	0.66	0.05	
	Co-58	8.76	8.95	0.28	0.03	
	Mn-54	9.69	10.89	1.49	0.11	
	Fe-59	6.92	8.51	2.31	0.19	
	Zn-65	12.6	13.82	1.18	0.09	
	Co-60	11.2	11.09	-0.13	0.02	

Appendix I: Compliance with Regulatory Document REGDOC-3.1.1

The OPG annual EMP report is structured to comply with CNSC Regulatory Document REGDOC-3.1.1 *Reporting Requirements for Nuclear Power Plants* [R-3], which provides requirements for an annual report on environmental protection. OPG is required to meet the requirements in section 3.6 of REGDOC-3.1.1. Corresponding sections are summarized in the table below.

Table I-1: OPG EMP Report Compliance with Regulatory Document 3.1.1, Reporting Requirements for Nuclear Power Plants

REGDOC-3.1.1, version 3 Section 3.6 Requirement	Corresponding Section in OPG's Annual EMP Report
1. A summary of the results of the environmental protection measures identified in section 4 of REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures and an analysis of the significance of the results of the environmental protection program, with respect to the health and safety of persons and the protection of the environment.	Executive Summary
2. A summary of activities conducted in the last calendar year to meet the objectives of the environmental protection measures.	Executive Summary Section 2.0 Section 3.0
3. A summary of any significant updates made to the environmental protection measures, the reason for these changes, and the current timelines for the next planned periodic reviews of the environmental protection measures.	Section 6.0
4. The results of the effluent/emissions monitoring program, including the hazardous substances (i.e., activity concentrations, flow rates and loadings), in SI units. The following shall be reported: a. For releases to air, where applicable: tritium oxide (HTO), elemental tritium (HT), carbon-14, noble gases, radioiodine, gross alpha, and gross beta/gamma; b. For releases to water, where applicable: tritium oxide (HTO), carbon-14, gross alpha, and gross beta/gamma; and c. Hazardous substance to air and/or water as reported to other Authorities Having Jurisdiction (AHJs).	Section 2.1 and Section 2.2
5. A summary of other government-required monitoring and reporting associated with effluent/emissions or environmental performance as specified in the licensing basis – include a web link to the reporting or a specific means of obtaining the formal reporting.	Section 2.2
6. The results of the environmental monitoring program, including nuclear and hazardous substances, in SI units, as well as associated supportive variables required for interpreting the results as identified in the licensee's site specific programs.	Section 3.0 Appendix D
7. The results and calculations of the annual radiation doses to the representative persons and/or critical group or groups, in comparison to the regulatory public dose limit. Include a description of all relevant environmental transfer models and exposure pathways associated with the operation of the NPP.	Section 4.0, Section 3.1.1, Appendix F, Appendix G
8. For each parameter reported, as part of the effluent/emission monitoring and environmental monitoring program, a description of the characteristics of the monitoring results, including, but not limited to, the sample frequency, quantity, type and trend.	Section 2.0 Section 3.0 Appendix D
9. A summary of reportable events and abnormal results that might require corrective action or additional monitoring and their impact on the environmental monitoring program.	Section 2.0 Section 3.0 Section 5.0