ONTARIO POWER GENERATION

Environmental Emissions Data for Pickering Nuclear

Q4 2017

OVERVIEW

This report summarizes Pickering Nuclear's environmental emissions data for Q4 2017. Pickering Nuclear Generating Station has six operating reactor units and a total generation capacity of 3,094 megawatts. The station is located in the City of Pickering in Durham Region.

This report includes:

- Radioactive Effluents: Releases to air and water remained well below the regulatory limits.
- Pickering Waste Management Facility: Monitoring results for air emissions, water, and perimeter dose rate confirmed the integrity of the facility.
- Groundwater Monitoring: OPG continued to analyze groundwater results to examine trends.
- Spills to the Environment: There were no spills to the environment that were reportable to a regulatory authority.

Note: The contents of this report are consistent with environmental data OPG is required to provide to the Canadian Nuclear Safety Commission (CNSC) on a quarterly basis. These reporting requirements are periodically revised.

ENVIRONMENTAL EMISSIONS MANAGEMENT

OPG has an environmental management program to ensure its activities are conducted in a manner that minimizes any adverse impact on the public and the environment. OPG's environmental program conforms to CNSC requirements for environmental protection and the International Organization for Standardization (ISO) standard for environmental management systems. The quality assurance programs for OPG's chemistry and health physics laboratories conform to the requirements of national and international standards.

As part of OPG's environmental management program, OPG has established an effluent monitoring and control program that is based on the "ALARA" principle. That is, measures are in place to ensure emissions to the environment are kept As Low As Reasonably Achievable while taking social and economic factors into account.

MONITORING OF RADIOACTIVE EFFLUENTS

Release Limits & Action Levels

OPG uses radiation dose limits specified in federal legislation to derive Release Limits for the radionuclides that may be released to air and water from its nuclear facilities. Pickering Nuclear must maintain its radiological emissions well below these limits to meet the terms of its operating licence.

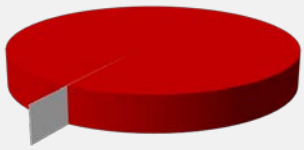
OPG also sets Action Levels that are much lower than the Release Limits to identify and control emissions before a limit can be reached.

Public Radiation Dose Data

The radiation dose to the public resulting from the operation of Pickering Nuclear is a very small fraction of the estimated annual average background radiation dose around the station.

Annual environmental monitoring program results for Pickering Nuclear, including an assessment of radiation dose to the public, are available at: www.opg.com/news-and-media/Pages/reports.aspx

Natural Background Radiation 99.9%



Pickering Nuclear Contribution 0.1%

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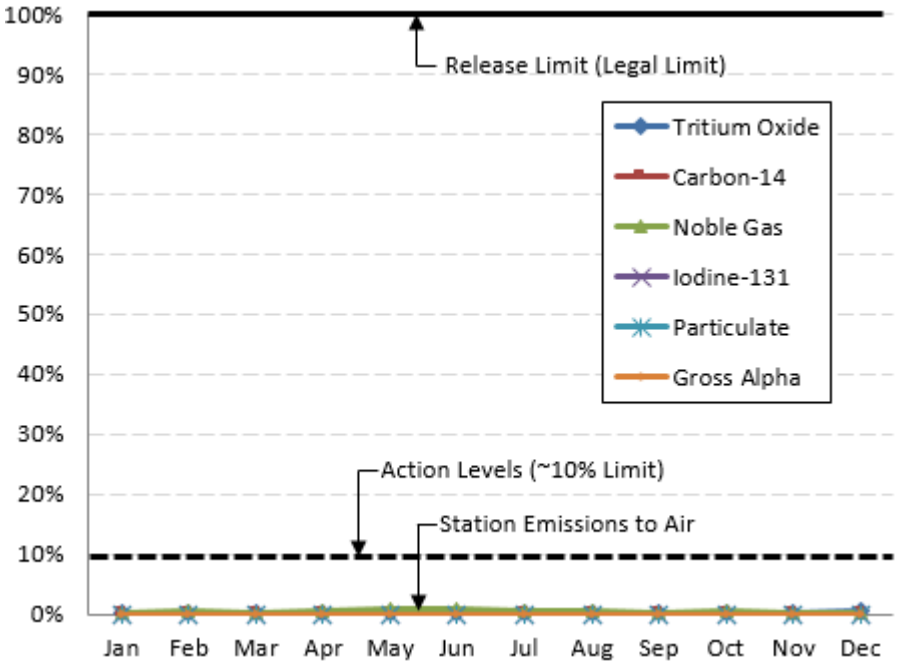
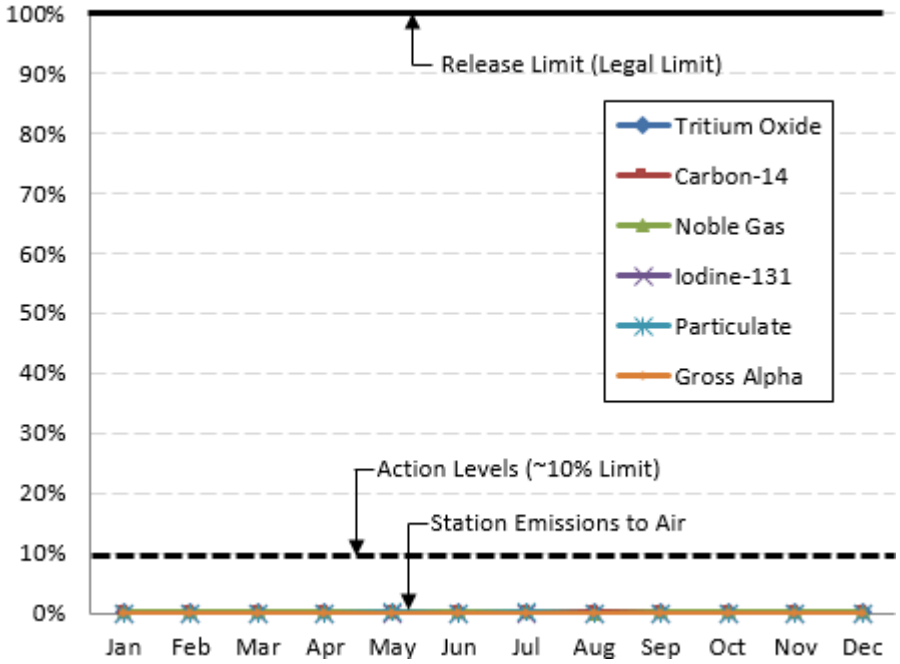
Performance Results

Pickering Nuclear's emissions to the environment are monitored to track performance. For Q4 2017, Pickering Nuclear's radiological emissions to air and water remained well below the Release Limits and no Action Levels were exceeded. (Appendix A, Tables A.1, A.2 and A.3) The following graphs show Pickering Nuclear's radiological emissions for the year to date as a percentage of the Release Limits. Note: Units 2 and 3 are in a safe shutdown state.

Air Emissions as a Per Cent of Release Limits (Units 1-4)



Air Emissions as a Per Cent of Release Limits (Units 5-8)



Environmental Emissions Data for Pickering Nuclear

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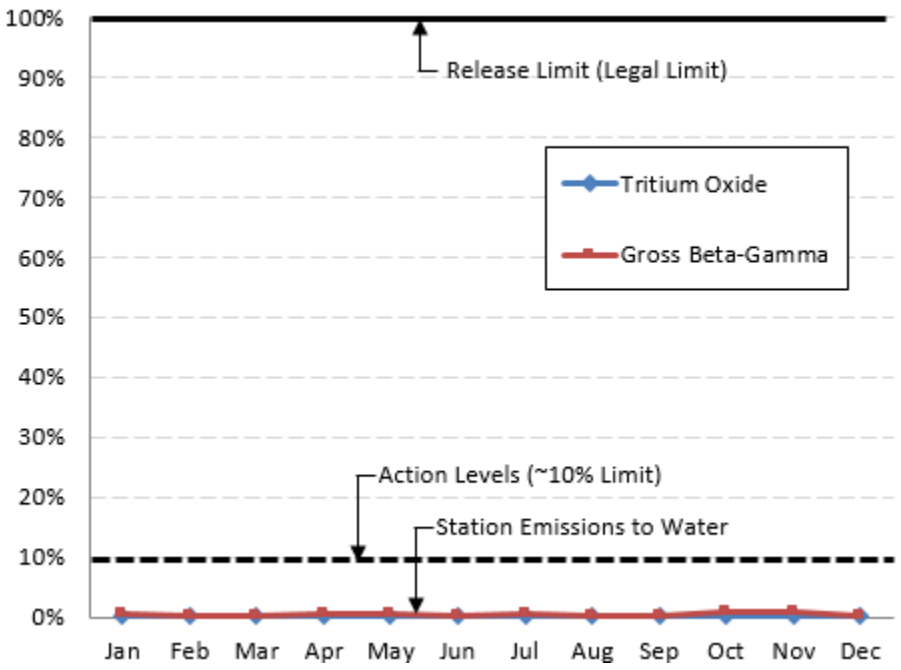
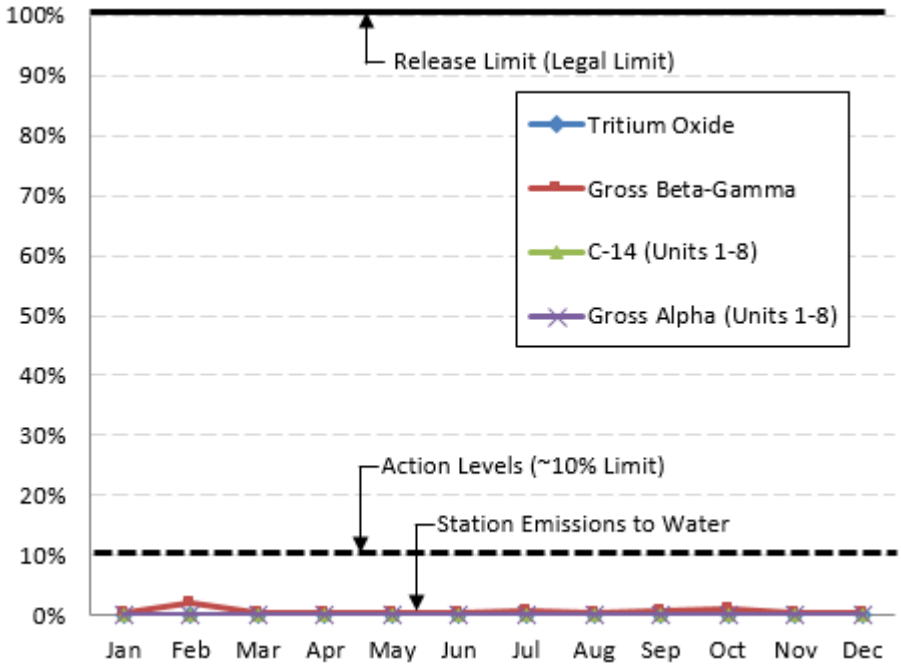
Water Emissions as a Per Cent of Release Limits (Units 1-4)



Water Emissions as a Per Cent of Release Limits (Units 5-8)



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PICKERING WASTE MANAGEMENT FACILITY

Radiological air emissions, water, and radiation dose monitoring requirements for the Pickering Waste Management Facility were met in Q4 2017 and no issues were identified. (Appendix A, Tables A.4, A.5 and A.6)

GROUNDWATER MONITORING

Groundwater monitoring is conducted at monitoring wells around the Pickering site perimeter, including along the Lake Ontario shoreline, to confirm that there are no adverse off-site impacts from tritium in groundwater. (Appendix A, Table A.7)

RELEASES OF HAZARDOUS SUBSTANCES (NON-RADIOACTIVE)

Pickering Nuclear complies with numerous regulatory requirements for controlling and monitoring releases of hazardous substances to the environment. Pickering Nuclear reports releases of hazardous substances to Environment Canada's National Pollutant Release Inventory (NPRI). Tools and resources for accessing, analyzing and interpreting NPRI data are available on the NPRI website. Pickering Nuclear's carbon dioxide emissions are well below the threshold for mandatory reporting to federal and provincial authorities. Greenhouse gas data and information for reporting facilities are available on the Greenhouse Gas Emissions Reporting Program (GHGRP) website.

SPILLS TO THE ENVIRONMENT

OPG has extensive programs to ensure the risk of spills to the environment is effectively assessed and managed. All spills are reported by OPG to the appropriate federal, provincial and municipal authorities as required.

OPG classifies its reportable spills as Category A, B or C spills based on the actual or potential impacts. Category A spills are considered very serious due to the scale of injury or damage, health effects, or safety impairment. Category B spills are considered serious due to localized injury or impacts to property. Category C spills are all other reportable spills that are less serious than Category A and B spills.

There were no reportable spills at Pickering Nuclear in Q4 2017.

APPENDIX A

ENVIRONMENTAL EMISSIONS DATA

Environmental Emissions Data for Pickering Nuclear

Q4 2017

Table A.1: Airborne Radionuclide Releases for Units 1-4

		Tritium (Bq)	Carbon-14 (Bq)	Noble Gas (Bq-MeV)	Iodine-131 (Bq)	Particulate (Bq)	Gross Alpha (Bq)
SUMMARY: ANNUAL							
Release Limit (Bq/year)[a]		1.2×10^{17}	2.2×10^{15}	3.2×10^{16}	9.8×10^{12}	4.9×10^{11}	8.7×10^{10}
Total Releases as of Q4 2017		3.1×10^{14}	1.3×10^{12}	$< 1.5 \times 10^{14}$	$< 9.6 \times 10^{6}$	$< 6.9 \times 10^{6}$	$< 4.8 \times 10^{5}$
DETAILS: WEEKLY[b]							
Action Level (Bq/week)[c]		2.5×10^{14}	4.4×10^{12}	6.3×10^{13}	2.0×10^{10}	9.8×10^{8}	Not specified[d]
Jan.	Week 1	2.1×10^{12}	1.7×10^{10}	$<2.2 \times 10^{12}$	$<1.9 \times 10^{5}$	$<7.1 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 2	2.7×10^{12}	1.4×10^{10}	$<7.3 \times 10^{11}$	$<1.9 \times 10^{5}$	$<6.7 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 3	2.5×10^{12}	1.1×10^{10}	$<7.0 \times 10^{11}$	$<1.8 \times 10^{5}$	$<7.0 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 4	3.9×10^{12}	1.6×10^{10}	$<8.4 \times 10^{11}$	$<1.8 \times 10^{5}$	$<6.5 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 5	7.8×10^{12}	1.8×10^{10}	$<8.4 \times 10^{11}$	$<1.8 \times 10^{5}$	$<6.7 \times 10^{4}$	$<8.5 \times 10^{3}$
Feb.[e]	Week 6	4.8×10^{12}	1.8×10^{10}	$<3.4 \times 10^{12}$	$<1.7 \times 10^{5}$	$<1.2 \times 10^{5}$	$<8.5 \times 10^{3}$
	Week 7	4.1×10^{12}	1.2×10^{10}	$<4.3 \times 10^{12}$	$<1.9 \times 10^{5}$	$<6.7 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 8	2.7×10^{12}	2.4×10^{10}	$<2.1 \times 10^{12}$	$<1.8 \times 10^{5}$	$<7.2 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 9	5.6×10^{12}	2.9×10^{10}	$<4.7 \times 10^{12}$	$<1.6 \times 10^{5}$	$<1.1 \times 10^{5}$	$<8.5 \times 10^{3}$
Mar.	Week 10	2.9×10^{12}	4.7×10^{10}	$<2.1 \times 10^{12}$	$<1.6 \times 10^{5}$	$<6.6 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 11	3.4×10^{12}	4.1×10^{10}	$<2.5 \times 10^{12}$	$<1.6 \times 10^{5}$	$<9.1 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 12	5.4×10^{12}	3.3×10^{10}	$<1.2 \times 10^{12}$	$<1.9 \times 10^{5}$	$<1.0 \times 10^{5}$	$<8.5 \times 10^{3}$
	Week 13	6.8×10^{12}	3.8×10^{10}	$<1.0 \times 10^{12}$	$<1.6 \times 10^{5}$	$<5.6 \times 10^{4}$	$<8.5 \times 10^{3}$
Apr.[e]	Week 14	2.8×10^{12}	3.1×10^{10}	$<2.2 \times 10^{12}$	$<1.8 \times 10^{5}$	$<6.8 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 15	2.8×10^{12}	3.7×10^{10}	$<2.7 \times 10^{12}$	$<1.7 \times 10^{5}$	$<9.0 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 16	3.1×10^{12}	3.3×10^{10}	$<4.0 \times 10^{12}$	$<1.8 \times 10^{5}$	$<1.1 \times 10^{5}$	$<8.5 \times 10^{3}$
	Week 17	2.8×10^{12}	3.5×10^{10}	$<5.8 \times 10^{12}$	$<1.7 \times 10^{5}$	$<5.6 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 18	7.2×10^{12}	2.3×10^{10}	$<3.2 \times 10^{12}$	$<1.7 \times 10^{5}$	$<6.4 \times 10^{4}$	$<8.5 \times 10^{3}$
May[e]	Week 19	3.9×10^{12}	4.4×10^{10}	$<5.6 \times 10^{12}$	$<1.8 \times 10^{5}$	$<1.6 \times 10^{5}$	$<8.5 \times 10^{3}$
	Week 20	3.1×10^{12}	2.5×10^{10}	$<5.2 \times 10^{12}$	$<2.0 \times 10^{5}$	$<8.4 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 21	3.0×10^{12}	3.3×10^{10}	$<6.1 \times 10^{12}$	$<2.3 \times 10^{5}$	$<6.6 \times 10^{4}$	$<8.5 \times 10^{3}$
	Week 22	5.7×10^{12}	2.3×10^{10}	$<6.6 \times 10^{12}$	$<1.7 \times 10^{5}$	$<9.8 \times 10^{4}$	$<8.5 \times 10^{3}$
Jun.[e]	Week 23	3.3×10^{12}	4.0×10^{10}	$<6.8 \times 10^{12}$	$<2.0 \times 10^{5}$	$<1.5 \times 10^{5}$	$<8.5 \times 10^{3}$
	Week 24	3.5×10^{12}	2.1×10^{10}	$<5.9 \times 10^{12}$	$<1.8 \times 10^{5}$	$<1.9 \times 10^{5}$	$<8.5 \times 10^{3}$
	Week 25	3.8×10^{12}	4.6×10^{10}	$<3.8 \times 10^{12}$	$<1.7 \times 10^{5}$	$<1.6 \times 10^{5}$	$<8.5 \times 10^{3}$
	Week 26	6.3×10^{12}	2.1×10^{10}	$<5.7 \times 10^{12}$	$<2.7 \times 10^{5}$	$<1.5 \times 10^{5}$	$<8.5 \times 10^{3}$
Jul.[e]	Week 27	2.5×10^{12}	2.2×10^{10}	$<7.3 \times 10^{12}$	$<2.4 \times 10^{5}$	$<2.1 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 28	3.3×10^{12}	1.7×10^{10}	$<2.6 \times 10^{12}$	$<2.0 \times 10^{5}$	$<2.5 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 29	4.8×10^{12}	2.3×10^{10}	$<4.1 \times 10^{12}$	$<1.8 \times 10^{5}$	$<2.0 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 30	4.4×10^{12}	1.3×10^{10}	$<1.5 \times 10^{12}$	$<1.8 \times 10^{5}$	$<1.8 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 31	9.3×10^{12}	2.5×10^{10}	$<3.6 \times 10^{12}$	$<1.8 \times 10^{5}$	$<2.5 \times 10^{5}$	$<8.9 \times 10^{3}$

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		Tritium (Bq)	Carbon-14 (Bq)	Noble Gas (Bq-MeV)	Iodine-131 (Bq)	Particulate (Bq)	Gross Alpha (Bq)
Aug.[f]	Week 32	5.1×10^{12}	3.5×10^{10}	$<1.5 \times 10^{12}$	$<1.7 \times 10^{5}$	$<1.0 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 33	4.4×10^{12}	2.4×10^{10}	$<2.3 \times 10^{12}$	$<2.0 \times 10^{5}$	$<2.2 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 34	4.6×10^{12}	5.0×10^{10}	$<3.6 \times 10^{12}$	$<2.0 \times 10^{5}$	$<1.7 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 35	9.8×10^{12}	1.3×10^{10}	$<1.7 \times 10^{12}$	$<1.8 \times 10^{5}$	$<2.3 \times 10^{5}$	$<8.9 \times 10^{3}$
Sep.[f]	Week 36	6.2×10^{12}	1.4×10^{10}	$<1.0 \times 10^{12}$	$<1.7 \times 10^{5}$	$<1.7 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 37	5.5×10^{12}	1.8×10^{10}	$<2.5 \times 10^{12}$	$<1.8 \times 10^{5}$	$<2.2 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 38	5.6×10^{12}	4.5×10^{9}	$<2.0 \times 10^{11}$	$<1.7 \times 10^{5}$	$<3.3 \times 10^{5}$	$<8.9 \times 10^{3}$
	Week 39	9.8×10^{12}	1.3×10^{10}	$<4.8 \times 10^{11}$	$<2.2 \times 10^{5}$	$<2.3 \times 10^{5}$	$<8.9 \times 10^{3}$
Oct.[g][h]	Week 40	4.9×10^{12}	1.0×10^{10}	$<2.6 \times 10^{12}$	$<2.0 \times 10^{5}$	$<1.8 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 41	5.0×10^{12}	9.9×10^{9}	$<4.6 \times 10^{12}$	$<2.0 \times 10^{5}$	$<1.0 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 42	6.0×10^{12}	9.6×10^{9}	$<5.7 \times 10^{12}$	$<1.7 \times 10^{5}$	$<1.3 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 43	4.4×10^{12}	1.5×10^{10}	$<1.4 \times 10^{12}$	$<1.7 \times 10^{5}$	$<1.2 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 44	1.1×10^{13}	9.1×10^{9}	$<1.6 \times 10^{12}$	$<1.5 \times 10^{5}$	$<8.9 \times 10^{4}$	$<1.0 \times 10^{4}$
Nov.[h]	Week 45	3.8×10^{12}	6.8×10^{9}	$<1.6 \times 10^{12}$	$<1.6 \times 10^{5}$	$<1.0 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 46	7.3×10^{12}	1.6×10^{10}	$<1.5 \times 10^{12}$	$<1.5 \times 10^{5}$	$<1.2 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 47	3.8×10^{12}	7.7×10^{9}	$<1.6 \times 10^{12}$	$<1.5 \times 10^{5}$	$<8.0 \times 10^{4}$	$<1.0 \times 10^{4}$
	Week 48	1.6×10^{13}	1.7×10^{10}	$<1.3 \times 10^{12}$	$<2.9 \times 10^{5}$	$<2.0 \times 10^{5}$	$<1.0 \times 10^{4}$
Dec.[h]	Week 49	7.5×10^{12}	1.4×10^{10}	$<1.6 \times 10^{12}$	$<1.9 \times 10^{5}$	$<2.0 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 50	2.3×10^{13}	2.4×10^{10}	$<1.6 \times 10^{12}$	$<1.4 \times 10^{5}$	$<8.9 \times 10^{4}$	$<1.0 \times 10^{4}$
	Week 51	1.9×10^{13}	8.9×10^{10}	$<1.5 \times 10^{12}$	$<1.5 \times 10^{5}$	$<1.3 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 52	8.2×10^{12}	4.9×10^{10}	$<1.1 \times 10^{12}$	$<1.7 \times 10^{5}$	$<1.0 \times 10^{5}$	$<1.0 \times 10^{4}$
	Week 53	7.8×10^{12}	2.7×10^{10}	$<1.5 \times 10^{12}$	$<1.4 \times 10^{5}$	$<7.1 \times 10^{4}$	$<1.0 \times 10^{4}$

(a) The derived Release Limit for a given radionuclide is the release rate of that radionuclide to air or surface water during normal operation of a nuclear facility over the period of a calendar year, which would result in an individual receiving a dose equal to the regulatory annual dose limit for a member of the public.

(b) Analysis of air emissions is conducted weekly to monitor against internal performance targets. Emissions are reported using the fiscal calendar and months contain either four or five weeks. Values prefixed by an "<" indicate that reported results were less than the instrument detection limits.

(c) Exceedances of Action Levels must be reported by OPG to the CNSC. To prevent an Action Level from being reached, OPG has set Internal Investigation Levels that require emissions to be reviewed when they reach the high end of the normal range. Corrective actions are taken if necessary. There were no CNSC Action Level exceedance events in the fourth quarter of 2017.

(d) Action Level for gross alpha is not specified because it is not a routinely monitored radionuclide group at Pickering Nuclear as the activity is below the threshold value for monitoring.

(e) The increase in noble gas releases in February and April to July was primarily due to leakage on Unit 4 calandria vault dryers. A team is in place to identify and repair the minor leaks; additional leak repairs are planned for the next outage.

(f) The increase in tritium releases in August (week 35) was primarily due to Unit 1 outage work. The increase in tritium releases in September (week 39) was primarily due to dryer performance issues in Unit 4.

(g) The increase in noble gas releases in October (weeks 41 and 42) were primarily due to air in-leakage when the calandria vault dryers were in service.

(h) The increase in tritium releases in October (week 44), November (week 48) and December (weeks 50 and 51) were primarily due to leaks occurred in various equipment and locations. The water were cleaned up promptly, and corrective actions have been taken for any required repair.

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Table A.2: Airborne Radionuclide Releases for Units 5-8

		Tritium (Bq)	Carbon-14 (Bq)	Noble Gas (Bq-MeV)	Iodine-131 (Bq)	Particulate (Bq)	Gross Alpha (Bq)
SUMMARY: ANNUAL							
Release Limit (Bq/year)[a]		1.9×10^{17}	2.0×10^{15}	4.7×10^{16}	8.9×10^{12}	7.2×10^{11}	1.2×10^{11}
Total Releases as of Q4 2017		3.8×10^{14}	1.3×10^{12}	$< 3.5 \times 10^{12}$	$< 4.3 \times 10^{6}$	$< 2.0 \times 10^{8}$	$< 8.1 \times 10^{5}$
DETAILS: WEEKLY[b]							
Action Level (Bq/week)[c]		3.7×10^{14}	4.0×10^{12}	9.4×10^{13}	1.8×10^{10}	1.4×10^{9}	Not specified[d]
Jan.	Week 1	7.1×10^{12}	1.4×10^{10}	1.1×10^{11}	$<7.0 \times 10^{4}$	$<6.7 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 2	4.9×10^{12}	1.4×10^{10}	9.4×10^{10}	$<7.2 \times 10^{4}$	$<4.2 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 3	5.2×10^{12}	2.0×10^{10}	8.7×10^{10}	$<7.0 \times 10^{4}$	$<4.1 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 4	3.8×10^{12}	1.9×10^{10}	1.1×10^{11}	$<7.0 \times 10^{4}$	$<1.0 \times 10^{5}$	$<1.5 \times 10^{4}$
	Week 5	9.3×10^{12}	2.0×10^{10}	8.6×10^{10}	$<7.0 \times 10^{4}$	$<1.0 \times 10^{5}$	$<1.5 \times 10^{4}$
Feb.[e]	Week 6	6.8×10^{12}	3.0×10^{10}	7.0×10^{10}	$<7.0 \times 10^{4}$	$<7.4 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 7	6.5×10^{12}	2.7×10^{10}	6.3×10^{10}	$<7.0 \times 10^{4}$	$<3.9 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 8	6.5×10^{12}	3.4×10^{10}	$<2.8 \times 10^{10}$	$<7.0 \times 10^{4}$	$<6.9 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 9	1.1×10^{13}	1.8×10^{10}	5.0×10^{10}	$<7.3 \times 10^{4}$	$<5.0 \times 10^{4}$	$<1.5 \times 10^{4}$
Mar.[e]	Week 10	1.9×10^{13}	2.3×10^{10}	$<5.3 \times 10^{10}$	$<7.0 \times 10^{4}$	$<4.7 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 11	7.1×10^{12}	3.2×10^{10}	3.3×10^{10}	$<7.0 \times 10^{4}$	$<1.2 \times 10^{5}$	$<1.5 \times 10^{4}$
	Week 12	6.2×10^{12}	3.3×10^{10}	6.2×10^{10}	$<7.0 \times 10^{4}$	$<3.8 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 13	7.3×10^{12}	3.0×10^{10}	5.6×10^{10}	$<8.4 \times 10^{4}$	$<6.9 \times 10^{4}$	$<1.5 \times 10^{4}$
Apr.[f]	Week 14	8.3×10^{12}	2.0×10^{10}	5.0×10^{10}	$<7.0 \times 10^{4}$	$<4.5 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 15	7.1×10^{12}	2.2×10^{10}	6.4×10^{10}	$<7.0 \times 10^{4}$	$<7.2 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 16	1.4×10^{13}	1.8×10^{10}	5.0×10^{10}	$<8.1 \times 10^{4}$	$<4.9 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 17	7.3×10^{12}	1.8×10^{10}	$<6.5 \times 10^{10}$	$<7.1 \times 10^{4}$	$<4.1 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 18	8.1×10^{12}	2.2×10^{10}	$<4.3 \times 10^{10}$	$<7.0 \times 10^{4}$	$<6.0 \times 10^{4}$	$<1.5 \times 10^{4}$
May[g]	Week 19	4.3×10^{12}	3.3×10^{10}	$<7.6 \times 10^{10}$	$<9.6 \times 10^{4}$	$<5.9 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 20	7.3×10^{12}	2.2×10^{10}	$<6.7 \times 10^{10}$	$<2.4 \times 10^{5}$	$<7.9 \times 10^{7}$	$<1.5 \times 10^{4}$
	Week 21	5.4×10^{12}	1.8×10^{10}	6.5×10^{10}	$<8.1 \times 10^{4}$	$<4.9 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 22	7.0×10^{12}	1.5×10^{10}	7.0×10^{10}	$<7.0 \times 10^{4}$	$<7.7 \times 10^{4}$	$<1.5 \times 10^{4}$
Jun.[f]	Week 23	4.8×10^{12}	1.8×10^{10}	7.8×10^{10}	$<7.1 \times 10^{4}$	$<5.3 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 24	4.7×10^{12}	2.0×10^{10}	$<6.0 \times 10^{10}$	$<7.1 \times 10^{4}$	$<5.0 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 25	5.9×10^{12}	1.9×10^{10}	8.9×10^{10}	$<7.0 \times 10^{4}$	$<7.8 \times 10^{4}$	$<1.5 \times 10^{4}$
	Week 26	1.2×10^{13}	1.7×10^{10}	6.9×10^{10}	$<7.1 \times 10^{4}$	$<1.6 \times 10^{5}$	$<1.5 \times 10^{4}$
Jul.[g] [h]	Week 27	9.8×10^{12}	2.0×10^{10}	7.1×10^{10}	$<3.4 \times 10^{5}$	$<1.1 \times 10^{8}$	$<1.6 \times 10^{4}$
	Week 28	7.0×10^{12}	2.3×10^{10}	7.4×10^{10}	$<7.3 \times 10^{4}$	$<1.1 \times 10^{5}$	$<1.6 \times 10^{4}$
	Week 29	6.3×10^{12}	2.7×10^{10}	4.8×10^{10}	$<7.1 \times 10^{4}$	$<6.6 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 30	7.6×10^{12}	1.8×10^{10}	1.0×10^{11}	$<7.0 \times 10^{4}$	$<6.7 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 31	1.1×10^{13}	3.6×10^{10}	1.0×10^{11}	$<7.0 \times 10^{4}$	$<1.6 \times 10^{5}$	$<1.6 \times 10^{4}$

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		Tritium (Bq)	Carbon-14 (Bq)	Noble Gas (Bq-MeV)	Iodine-131 (Bq)	Particulate (Bq)	Gross Alpha (Bq)
Aug.	Week 32	4.9×10^{12}	2.6×10^{10}	$<1.1 \times 10^{10}$	$<7.0 \times 10^{4}$	$<8.1 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 33	5.4×10^{12}	2.0×10^{10}	$<5.3 \times 10^{10}$	$<7.0 \times 10^{4}$	$<1.1 \times 10^{5}$	$<1.6 \times 10^{4}$
	Week 34	6.0×10^{12}	1.6×10^{10}	6.5×10^{10}	$<7.1 \times 10^{4}$	$<4.9 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 35	8.0×10^{12}	1.7×10^{10}	6.9×10^{10}	$<7.0 \times 10^{4}$	$<1.5 \times 10^{5}$	$<1.6 \times 10^{4}$
Sep.[h]	Week 36	6.1×10^{12}	2.5×10^{10}	6.5×10^{10}	$<7.3 \times 10^{4}$	$<5.3 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 37	4.8×10^{12}	1.6×10^{10}	6.9×10^{10}	$<7.0 \times 10^{4}$	$<3.9 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 38	6.1×10^{12}	2.3×10^{10}	7.8×10^{10}	$<7.0 \times 10^{4}$	$<9.9 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 39	1.1×10^{13}	1.9×10^{10}	8.0×10^{10}	$<9.2 \times 10^{4}$	$<7.7 \times 10^{4}$	$<1.6 \times 10^{4}$
Oct.	Week 40	7.5×10^{12}	2.4×10^{10}	7.6×10^{10}	$<8.0 \times 10^{4}$	$<6.2 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 41	8.4×10^{12}	8.1×10^{10}	$<5.4 \times 10^{10}$	$<7.0 \times 10^{4}$	$<8.9 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 42	8.1×10^{12}	4.5×10^{10}	7.3×10^{10}	$<7.0 \times 10^{4}$	$<9.2 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 43	7.8×10^{12}	1.5×10^{10}	$<5.6 \times 10^{10}$	$<7.0 \times 10^{4}$	$<4.8 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 44	8.9×10^{12}	1.4×10^{10}	$<5.4 \times 10^{10}$	$<7.0 \times 10^{4}$	$<4.8 \times 10^{4}$	$<1.6 \times 10^{4}$
Nov.	Week 45	5.6×10^{12}	1.6×10^{10}	5.8×10^{10}	$<7.0 \times 10^{4}$	$<6.7 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 46	4.1×10^{12}	1.7×10^{10}	$<4.6 \times 10^{10}$	$<7.0 \times 10^{4}$	$<7.1 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 47	5.8×10^{12}	1.9×10^{10}	6.3×10^{10}	$<7.0 \times 10^{4}$	$<4.3 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 48	5.8×10^{12}	3.0×10^{10}	5.8×10^{10}	$<7.0 \times 10^{4}$	$<8.3 \times 10^{4}$	$<1.6 \times 10^{4}$
Dec.	Week 49	4.9×10^{12}	3.0×10^{10}	7.0×10^{10}	$<7.0 \times 10^{4}$	$<1.1 \times 10^{5}$	$<1.6 \times 10^{4}$
	Week 50	4.9×10^{12}	2.1×10^{10}	$<5.1 \times 10^{10}$	$<7.0 \times 10^{4}$	$<4.3 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 51	5.7×10^{12}	3.1×10^{10}	$<7.3 \times 10^{10}$	$<1.4 \times 10^{5}$	$<5.5 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 52	4.5×10^{12}	2.4×10^{10}	7.8×10^{10}	$<9.4 \times 10^{4}$	$<5.4 \times 10^{4}$	$<1.6 \times 10^{4}$
	Week 53	7.4×10^{12}	4.0×10^{10}	8.1×10^{10}	$<7.0 \times 10^{4}$	$<4.9 \times 10^{4}$	$<1.6 \times 10^{4}$

(a) The derived Release Limit for a given radionuclide is the release rate of that radionuclide to air or surface water during normal operation of a nuclear facility over the period of a calendar year, which would result in an individual receiving a dose equal to the regulatory annual dose limit for a member of the public.

(b) Analysis of air emissions is conducted weekly to monitor against internal performance targets. Emissions are reported using the fiscal calendar and months contain either four or five weeks. Values prefixed by an "<" indicate that reported results were less than the instrument detection limits.

(c) Exceedances of Action Levels must be reported by OPG to the CNSC. To prevent an Action Level from being reached, OPG has set Internal Investigation Levels that require emissions to be reviewed when they reach the high end of the normal range. Corrective actions are taken if necessary. There were no CNSC Action Level exceedance events in the fourth quarter of 2017.

(d) Action Level for gross alpha is not specified because it is not a routinely monitored radionuclide group at Pickering Nuclear as the activity is below the threshold value for monitoring.

(e) The increase in tritium releases in weeks 9 and 10 was primarily due to dryer performance issues in Unit 6, and a change in the operating conditions of the ventilation system in Unit 5 respectively.

(f) The increase in tritium releases in April and June (weeks 16 and 26 respectively) was primarily due to dryer performance issues in Unit 7. The releases returned to normal levels the following weeks.

(g) The increase in particulate releases in May and July (weeks 20 and 27 respectively) was primarily due to maintenance performed on the ventilation duct of the service wing chemistry laboratory.

(h) The increase in tritium releases in July (week 31) was primarily due to clogging of a strainer in Unit 7 resulting in water backed up into the service rooms. The increase in tritium releases in September (week 39) was primarily due to dryer performance issues in Unit 8.

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Table A.3: Waterborne Radionuclide Releases to Lake Ontario

	UNITS 1-4		UNITS 5-8			
	Tritium (Bq)	**Gross Beta-Gamma (Bq)**	**Tritium (Bq)**	**Gross Beta-Gamma (Bq)**	**Carbon-14 (Bq)[a]**	**Gross Alpha (Bq)[a]**
SUMMARY: ANNUAL						
Release Limit (Bq/year)[b]	3.7×10^{17}	1.7×10^{12}	7.0×10^{17}	3.2×10^{12}	6.0×10^{13}	2.6×10^{13}
Total Releases as of Q4 2017	1.1×10^{14}	6.5×10^{9}	2.7×10^{14}	2.0×10^{10}	1.9×10^{9}	$<2.5 \times 10^{6}$
DETAILS: MONTHLY[c]						
Action Level (Bq/month)[d]	3.0×10^{15}	1.4×10^{10}	5.6×10^{15}	2.5×10^{10}	4.8×10^{11}	Not specified[e]
January	1.0×10^{13}	4.7×10^{8}	3.0×10^{13}	1.1×10^{9}	1.0×10^{8}	$<2.6 \times 10^{5}$
February[f]	1.0×10^{13}	4.3×10^{8}	3.2×10^{13}	5.4×10^{9}	5.9×10^{7}	$<1.9 \times 10^{5}$
March	9.1×10^{12}	2.8×10^{8}	2.7×10^{13}	1.0×10^{9}	8.7×10^{7}	$<2.0 \times 10^{5}$
April	1.2×10^{13}	5.2×10^{8}	3.3×10^{13}	1.1×10^{9}	2.2×10^{8}	$<2.6 \times 10^{5}$
May	1.0×10^{13}	7.8×10^{8}	1.9×10^{13}	1.1×10^{9}	2.5×10^{7}	$<2.0 \times 10^{5}$
June	9.5×10^{12}	4.1×10^{8}	1.7×10^{13}	1.2×10^{9}	2.5×10^{8}	$<1.8 \times 10^{5}$
July	1.2×10^{13}	4.8×10^{8}	2.3×10^{13}	1.5×10^{9}	1.0×10^{8}	$<2.4 \times 10^{5}$
August	6.3×10^{12}	3.3×10^{8}	1.7×10^{13}	1.3×10^{9}	7.5×10^{7}	$<2.0 \times 10^{5}$
September[g]	4.9×10^{12}	3.8×10^{8}	1.5×10^{13}	1.5×10^{9}	6.8×10^{8}	$<1.9 \times 10^{5}$
October[h]	6.2×10^{12}	1.1×10^{9}	1.5×10^{13}	2.7×10^{9}	6.0×10^{7}	$<2.3 \times 10^{5}$
November	6.3×10^{12}	1.1×10^{9}	2.5×10^{13}	1.1×10^{9}	3.1×10^{7}	$<1.8 \times 10^{5}$
December	9.2×10^{12}	2.9×10^{8}	2.1×10^{13}	1.2×10^{9}	1.6×10^{8}	$<2.1 \times 10^{5}$

(a) Includes emissions from both Units 1-4 and Units 5-8. These emissions are reported under Units 5-8 because Pickering Nuclear's Radioactive Liquid Waste Management System is routinely discharged through the outfall for Units 5-8.

(b) The derived Release Limit for a given radionuclide is the release rate of that radionuclide to air or surface water during normal operation of a nuclear facility over the period of a calendar year, which would result in an individual receiving a dose equal to the regulatory annual dose limit for a member of the public.

(c) Analysis of water emissions is conducted monthly to monitor against internal performance targets. Monthly emissions are reported using the fiscal calendar and months contain either four or five weeks. Months with five weeks typically report higher releases relative to months with four weeks. For 2017, January, April, July, October and December have five weeks.

(d) Exceedances of Action Levels must be reported by OPG to the CNSC. To prevent an Action Level from being reached, OPG has set Internal Investigation Levels that require emissions to be reviewed when they reach the high end of the normal range. Corrective actions are taken if necessary. There were no CNSC Action Level exceedance events in the fourth quarter of 2017.

(e) Action Level for gross alpha is not specified since it is not a routinely monitored radionuclide group because its activity is below the threshold value for monitoring.

(f) The increase in Units 5-8 gross beta-gamma releases in February was primarily due to an operational test performed in the Unit 5 outage. The subsequent analysis result was returned to a normal level.

(g) The increase in Units 5-8 Carbon-14 releases in September was primarily due to the processing of resin storage tank water.

(h) The increase in Units 5-8 gross beta-gamma releases in October was primarily due to the processing of Irradiated Fuel bay water.

A becquerel (Bq) is the standard international unit for measuring radioactive decay or radioactivity. One becquerel is the decay of one atom of a radioisotope per second, and is an extremely small amount of radioactivity. Becquerel is a measure of the rate (not energy) of radiation emission from a source.

Another unit of measuring radioactivity is the curie (Ci). 1 Ci = 3.7 x 10^{10} Bq.

While station emissions typically remain at consistently low levels, small fluctuations do occur because of changing operating conditions (e.g. unit outages), work activities, and equipment issues.

Table A.4: Pickering Waste Management Facility Air Sample Results

	Particulate (weekly average Bq)[(a)]
October	< 3.3 x 10^3 (all weeks)
November	< 3.3 x 10^3 (all weeks)
December	< 3.3 x 10^3 (all weeks)

(a) Values prefixed by an "<" indicate that reported results were less than the instrument detection limits. Pickering Waste Management Facility particulate results are included in Pickering Nuclear's airborne radionuclide release data.

Table A.5: Pickering Waste Management Facility Water Sample Results

		Gross Beta-Gamma (Bq/mL)[(a)]
Sample Point		**Q4**
Retube Component Storage Facility	Catch Basin 111	< 1.51 x 10^{-2}
	Catch Basin 112	< 1.51 x 10^{-2}
	Catch Basin 77	< 1.51 x 10^{-2}
	Catch Basin 78	< 1.51 x 10^{-2}
	Catch Basin 82	< 1.51 x 10^{-2}
	Catch Basin 83	< 1.51 x 10^{-2}
Storage Building #3	Sample Station 01	< 1.51 x 10^{-2}
	Sample Station 02[(b)]	No sample

(a) Values prefixed by an "<" indicate that reported results were less than the instrument detection limits.
(b) Sample Station 02 consists of weeping tiles and is normally dry.

Table A.6: Pickering Waste Management Facility Perimeter Fence Dose Rates

		Average Air Kerma Rate (µGy/hour)[a]
Location		**Q4**
Retube Component Storage Facility (RCSF)	Pi2, RCSF South	0.075
	Pi3, RCSF East	0.076
Storage Building #3[b]	PW1, North - West	0.065
	PW2, North - Middle	0.090
	PW3, North - East	0.072
	PW4, East - North	0.070
	PW5, East - Middle	0.072
	PW6, East - South	0.073
	PW7, South - East	0.067
	PW8, South - West	0.070
	PW9, West - South	0.073
	PW10, West - Middle	0.067
	PW11, West - North	0.070
Used Fuel Dry Storage Facility (UFDSF)[c]	Pu3, UFDSF East Outside	0.264
	Pu4, UFDSF Stage II East1	0.197
	Pu5, UFDSF Stage II East2	0.132

(a) Average ambient dose rates are measured at perimeter fences by Thermoluminescent Dosimeters to demonstrate that potential doses due to radiation fields from waste management facility operations are well within allowable limits and pose a negligible risk for the public, the workers and the environment. Dose rate monitoring results are compared to an internal target dose rate standard of 0.5 µGy/hour. This target is derived from the 1 mSv/year dose limit specified in federal legislation for a member of the public and assumes exposure for a working year (2,000 hours).

(b) PW6, PW7, PW 8 and PW9 were relocated as part of the PWMF Storage Building #4 project.

(c) The dosimeters for the Used Fuel Dry Storage Facility are located on facility perimeter wall and have target dose rate of <1.75 µGy/hour. This rate was derived from the target standard of 0.5 µGy/hour for the perimeter fence, taking into account the location of the dosimeters.

Table A.7: Results for Tritium in Groundwater at Pickering Site Perimeter Monitoring Locations

	Tritium (Bq/L)[a]
	2017[b]
MW-156-20	211
MW-164-13[c]	2,753
MW-165-24	403
MW-176-23	<70.3
MW-177-35	<70.3
MW-183-10	274
MW-184-27	141
MW-185-39	<70.3

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		Tritium (Bq/L)[a]
		2017[b]
MW-192-18		366
MW-193-37		266
MW-194-57		<70.3
MW-195-73		<70.3
MW-197-15		533
MW-198-20		163
MW-199-38		<70.3
MW-200-22		204
MW-201-39		<70.3
MW-204-24		163
MW-205-35		137
MW-206-65		<70.3
MW-207-87		<70.3
MW-216-15		270
MW-217-32		<70.3
MW-222-10		692
MW-223-32		644
MW-224-42		555
MW-225-12		1,040
MW-226-22[d]	Q1	4,070
	Q2	5,550
	Q3	5,180
	Q4	5,180
MW-227-40		<70.3
MW-228-57		<70.3
MW-229-70		133

(a) Values prefixed by an "<" indicate that reported results were less than the instrument detection limits.
(b) In 2017, monitoring wells were sampled on an annual basis, except for MW-226-22 which was sampled quarterly. The wells are labelled as "MW-XXX-YY": the first number (XXX) identifies the well and the second number (YY) is the depth of the well in feet.
(c) The result for MW-164-13 is below 37,000 Bq/L, which can be considered an upper limit of expected tritium concentration for some areas within the immediate influence of the station.
(d) Tritium observed at MW-226-22 was determined to be from legacy spills, and is expected to decrease over time as the source term diminishes.