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Written Submission from the Radiation Safety Institute of Canada

Mémoire de l’ Institut de radioprotection du Canada

In the matter of the

À l’égard de la

Mid-term update from BWXT Nuclear Energy Canada Inc. on licensed activities at its Toronto and Peterborough facilities

Mise à jour de mi-parcours sur les activités autorisées de BWXT Nuclear Energy Canada Inc. à ses installations de Toronto et de Peterborough

Commission Meeting

Réunion de la Commission

May 2026

Mai 2026

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Canada

Radiation Safety Institute of Canada
Institut de radioprotection du Canada

GOOD SCIENCE IN PLAIN LANGUAGE®

Review of the BWXT Nuclear Energy Canada Inc. mid-term update on licensed activities at its Toronto and Peterborough facilities

for

Canadian Nuclear Safety Commission

(Reference: Form number: *PFP2025 BWXT-06*)

by

Radiation Safety Institute of Canada

Radiation Safety Institute of Canada
Institut de radioprotection du Canada

Report Due Date: 17 April 2026

Submitted to:

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1 Introduction

1.1 About the Radiation Safety Institute of Canada

Founded in 1980, the Radiation Safety Institute of Canada (RSIC) is an independent, national organization dedicated to promoting and advancing radiation safety in the workplace, in the environment, and in the community. Our commitment to the principle of "good science in plain language"® underpins everything we do. The Radiation Safety Institute of Canada is incorporated under federal statute as a not-for-profit corporation and is also a registered charity (number: 106861511RR001).

The Radiation Safety Institute of Canada offers a broad range of educational, technical, and scientific services to businesses, government organizations, health care providers, communities, and individuals across Canada and around the world. The Institute is known for the high quality and scientific integrity of its work, and the practical and helpful assistance of its staff. The Institute's independent information service receives hundreds of calls and e-mails every year, for information and assistance on workplace radiation questions.

1.2 Project

The *Radiation Safety Institute of Canada* (Institute) applied for and is to receive funding through CNSC's Participant Funding Program (PFP). This Institute is to provide a review of BWXT Nuclear Energy Canada Inc.'s (BWXT) mid-term update and related documentation, including CNSC staff's and BWXT's Commission members documents, and to conduct a technical review.

This document summarizes the Institute's findings and recommendations for the Commission.

1.3 Background:

BWXT holds two separate Class IB licenses, both of which expire on December 31, 2030. The mid-term update will cover the first five years of the 10-year licensing period for both facilities. BWXT provides information on its Canadian operations on the Canada section of its corporate website (www.bwxt.com/who-we-are/locations/bwxt-canada/). Of particular interest in this case is the description of BWXT's work in producing fuel for Canadian CANDU reactors. Videos providing virtual tours of the Toronto and Peterborough facilities are useful to visualize the types of radioactive material work done at these sites, as well as other potential hazardous work (e.g., work with beryllium in the Peterborough location).

The work in Toronto focuses on production of nuclear fuel pellets from uranium. In Peterborough, fuel rod assembles are fabricated and filled with fuel pellets.

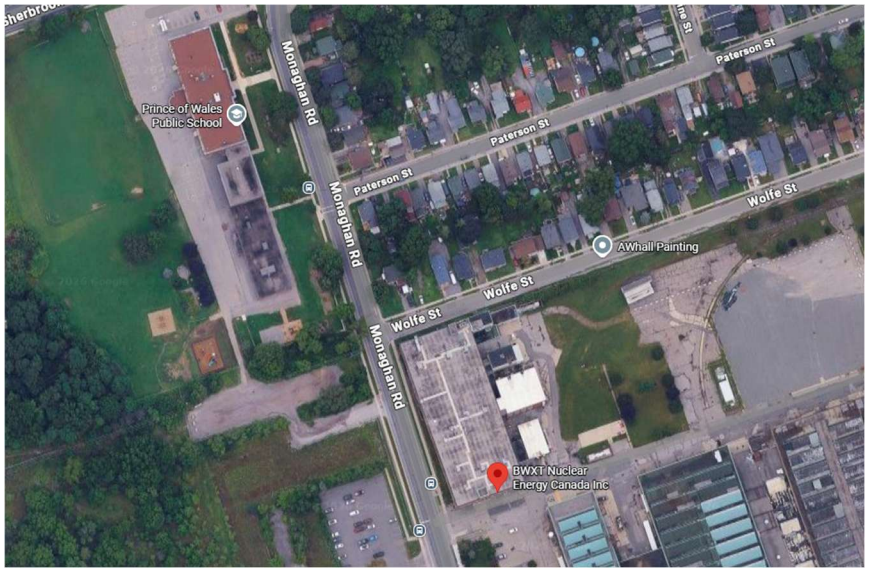

Figure 1 BWXT Peterborough location. The presence of this facility near a residential area and a public school has been a concern to some residents.

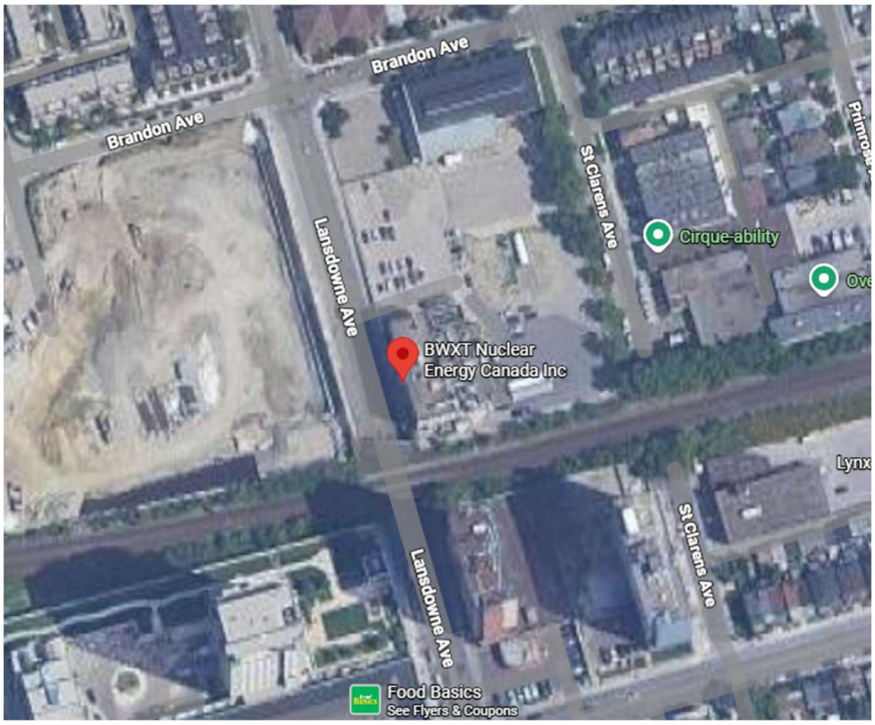

Figure 2 BWXT's Toronto location. Some residents have expressed concern about having a nuclear facility in Toronto. Concern has also been raised regarding the large liquid hydrogen tank located on the property.

2 Review of Documentation Related to Mid-term Update

The Institute downloaded the following files specifically related to the mid-term update from the BWXT website (www.bwxt.com/bwxt-nec/environment-safety/cnsc-mid-term-review/) on 28 March 2026:

- CNSC Notice of Mid-Term Review Meeting
- BWXT NEC Mid-Term Review Briefing Guide
- BWXT NEC Toronto Commission Member Document (CMD) Submission
- BWXT NEC Peterborough Commission Member Document (CMD) Submission
- CNSC Environmental Protection Review
- CNSC Presentation (CMD)

In addition to these files, RSIC also reviewed the final report for the Annual 2025 Surface Soil Sampling Program at BWXT's Peterborough site (prepared for BWXT by Englobe), as well as summary documents for two safety analysis reports for the two BWXT sites.

2.1 Mid-term update overview

2.1.1 CNSC staff inspection results

CNSC staff have provided a draft presentation document providing a summary of inspection results for the BWXT facilities during the licensing period. CNSC staff have found "*BWXT NEC's performance consistently rated as satisfactory in all 14 SCAs (Safety and Control Areas) throughout the first half of the licence period.*" There have been, however, 35 "notices of non-compliance" issued to BWXT following inspections during the licensing period. The CNSC notes that "*inspection findings were of low safety significance and CNSC staff did not identify any risk to the environment or to the health or safety of persons*."

2.1.2 Peterborough site

BWXT's mid-term briefing guide for its Peterborough location describes its CNSC licenced activity in Peterborough as follows "*The Peterborough facility operates under a ten-year Class IB Nuclear Fuel Facility Licence (FFL-3620.00/2030) issued by the Canadian Nuclear Safety Commission (CNSC) and effective January 1, 2021. This licence authorizes BWXT NEC to operate and modify its nuclear fuel facility to produce natural and depleted uranium dioxide (UO2) pellets and to produce and test fuel bundles in Peterborough at 1160 Monaghan Rd. The facility is additionally authorized to receive, repair, modify and return contaminated equipment from off-site nuclear facilities*." Additional background information is available in the "Safety Analysis" report for Peterborough: "*The Peterborough operation is licenced to process a maximum of 150 Megagrams (150 tonnes) of uranium monthly under Nuclear Fuel Facility Operating Licence FFL3620.00/2030.* "This safety analysis report considered a series of hazards, including:

- Radioactive material;
    - o UO_2 pellets and powder;
    - o Contaminated equipment from reactor sites;
- Beryllium;
- Hydrochloric Acid;
- Isopropyl Alcohol;
- Zirconium;
- Compressed gas cylinders;
- High pressure hot water;
- Fire.

Note that the safety analysis concluded "*that engineering and administrative controls and safeguards implemented by the BXWT NEC Peterborough operations provide an adequate level of protection over a broad range of operating conditions*".

On page 10 of the Mid-term licence update document for the Peterborough site, Figure 3 shows the "Senior Management Team" for BWXT NEC. It would have been beneficial to show the "Radiation Safety Management Team" structure. The "Senior Management Team" would have other goals (e.g., maximizing production of CANDU fuel) which could potentially conflict with radiation safety management. Ideally, BWXT should demonstrate that *radiation safety* has a clear management structure *independent* of commercial goals.

Internal licensed activity audits and self-assessments are performed routinely and have not found any significant issues. Note that it might be reasonable to engage an experienced external radiation safety program auditor on a periodic basis to supplement internal audits. A fresh perspective can aid in improving radiation safety performance. CNSC inspections serve a somewhat similar function, but CNSC inspectors are constrained in the advice they can provide.

At the Peterborough facility, both external dosimetry (using TLDs) and internal dosimetry (based on urine samples) are used to assess radiation dose to workers.

BWXT performs environmental monitoring to assess radiological emissions and dose rates from facility operations. This includes sampling in community locations, dose monitoring, and continuous boundary monitoring at the facility perimeter.

Based on Table 2 of the mid-term licence update, BWXT Peterborough has the following internal control levels for surface contamination (assumed to be uranium).

Table 1 BWXT Peterborough internal control levels for surface contamination

Area Classification	Internal control level* (dpm/100 cm^2)	Internal control level** (Bq/100 cm^2)	#samples exceeding internal cntrl level* 2021-2025 (%)
R2	2200	36.7	37 (1.1%)
R1	220	3.67	0 (0.0%)
Active	220	3.67	4 (0.9%)
Unclassified	220	3.67	5 (0.2%)

* From BWXT's report
**Calculated from BWXT report's numbers

CNSC's website (www.cnsc-ccsn.gc.ca/eng/nuclear-substances/classes-of-nuclear-substances/#wb-auto-3) lists both U-238 and U-235 as "Class A" substances with a suggested contamination limit in public areas of 0.3 Bq/cm^2 (30 Bq/100 cm^2) and a suggested contamination limit in controlled areas of 3 Bq/cm^2 (300 Bq/100 cm^2). The internal control limits for R2, R1, Active and Unclassified areas are well below the CNSC's suggested values.

Air monitoring is performed at workstations on site. Air monitoring results can be compared to a calculated Derived Air Concentration (DAC) value, that is determined based on the dose conversion factor for the airborne isotope and a default breathing rate for workers at light activity (1.2 m^3 per hour or 2400 m^3 per year). The DAC is the concentration that, if breathed for a worker for 2000 hours (a full work year), would result in a committed effective dose of 20 mSv. Different chemical forms of the same airborne radioactive material results in different DACs, due to the varying solubility of the compounds and the resulting differences in lung clearance and change to the committed effective dose.

From the most recent publication of the CNSC's Radionuclide Information Booklet (2026 January) (https://www.cnsc-ccsn.gc.ca/eng/resources/radiation/radionuclide-information/), one can obtain data for uranium of a natural isotopic distribution, which is appropriate for the BWXT facilities as they produce fuel for CANDU reactors which do not use enriched fuel. According to this document, the dose conversion factor for inhalation of S-type uranium is 1.25E-5 Sv/Bq. From this, one can calculate that a person would receive 20 mSv of dose if they inhale 1600 Bq (known as the inhalation Annual Limit of Intake (ALI) – the activity that would result in 20 mSv of dose if inhaled. The DAC is then calculated using the formula

$$DAC\ (Bq/m^3) = \frac{ALI\ (Bq)}{2400\ m^3}$$

Therefore, for processed natural uranium, the DAC is 0.67 Bq/m^3.

From the BWXT submission, the maximum airborne concentration recorded at the Peterborough facility over the 5-year period (2021-2025) was 8.52 dpm/m^3 which is equivalent to 0.142 Bq/m^3. This is approximately 21% of the above-calculated DAC. The report also provided that the maximum of the annual "average" concentrations measured in the 5-year timeframe of 2021-2025 was 0.52 dpm/m^3 (measured in 2025) which corresponds to 0.0087 Bq/m^3, just slightly over 1% of the DAC. A worker breathing in air with airborne radioactive material at 1% of the DAC for an entire work year (2000 hours) would receive 1% of the ALI dose, or 0.2 mSv per year, which is not a significant dose when compared to the 50 mSv/y dose limit for Nuclear Energy Workers.

It was noted that the average airborne radioactivity concentration has increased steadily over the 5-year period of this licence, from 0.09 dpm/m^3 (or approximately 0.0015 Bq/m^3) in 2021 to 0.52 dpm/m^3 (0.0087 Bq/m^3) in 2025. The average concentration has increased more than 5 times in this 5-year period. This is shown in

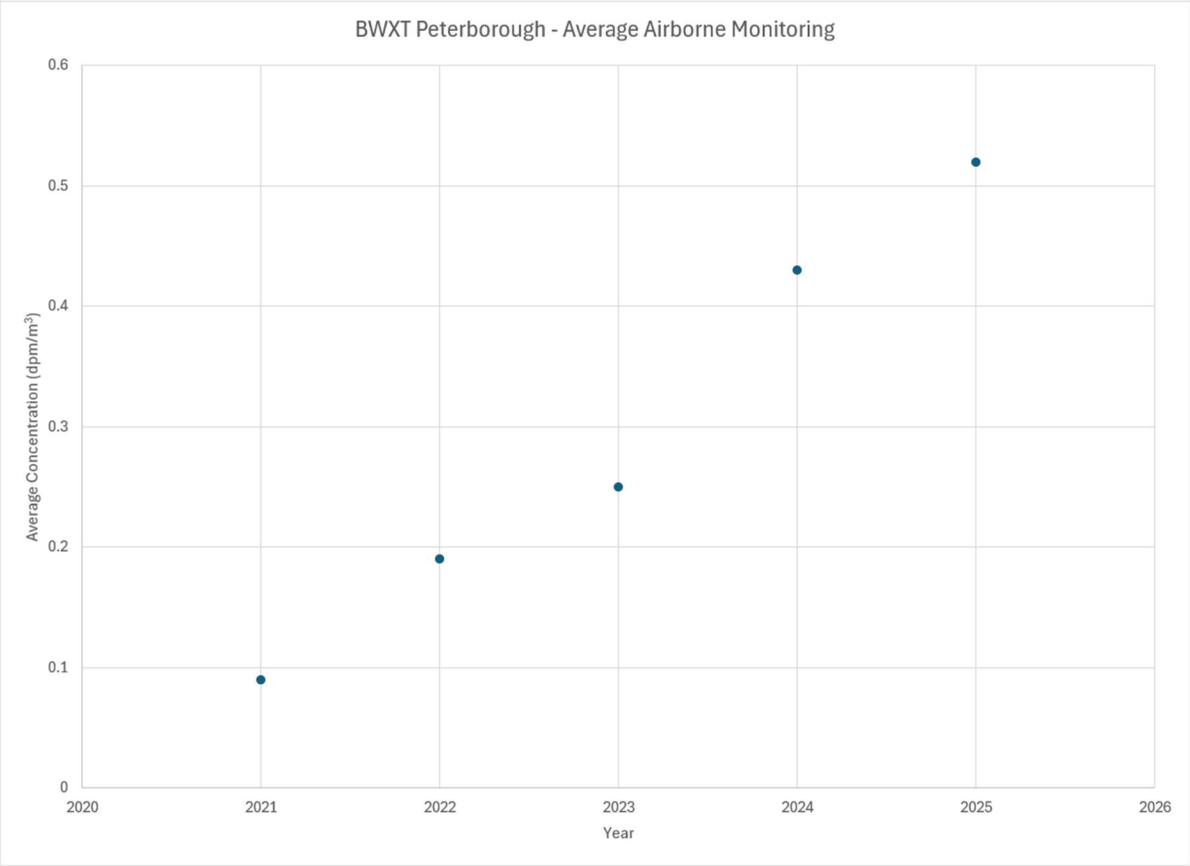

Figure 3 below (RSIC-created graphs of BWXT results from the BWXT submission). Although even the maximum average airborne concentration is still low when compared to the DAC, the increasing trend is obvious, and it is recommended that BWXT NEC pay particular attention to the airborne radioactivity within the facility and act before the elevated results cause increases in contamination and/or dose to workers.

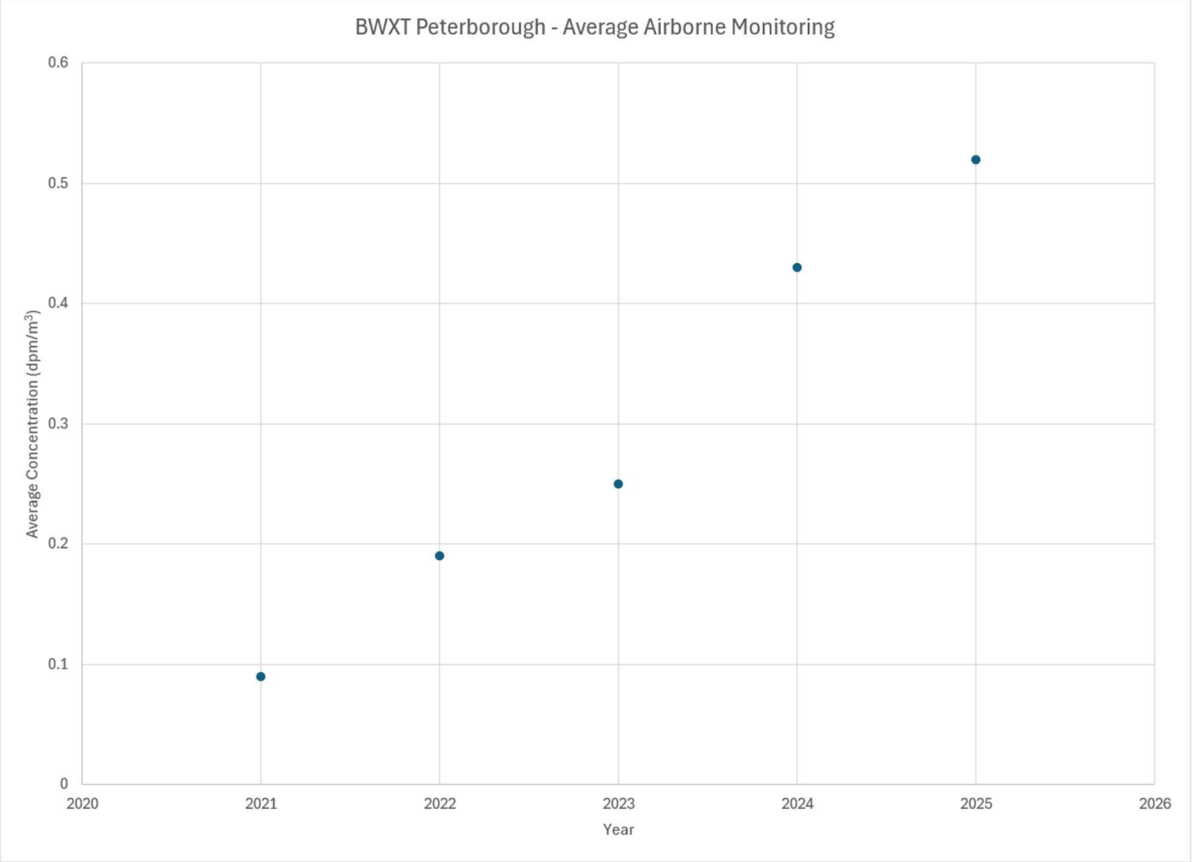

Figure 3 Graph of BWXT air monitoring results for the Peterborough facility for the 5-year period of 2021-2025.

Dose rates on the Peterborough shop floor, while significantly above average background levels of <0.1 µSv/h typical in Peterborough according to the "World Dose Rate Map" (https://wasavies.nict.go.jp/WorldDose_e.html),, are still sufficiently low that if an employee was exposed to the average dose rate all year, worker doses would remain well below the facility Action Level and regulatory dose limit.

2.1.3 Toronto Site

BWXT's mid-term briefing guide for its Toronto location describes its CNSC licenced activity in Toronto as follows "*The Toronto facility operates under a ten-year Class IB Nuclear Fuel Facility Licence (FFL-3621.00/2030) issued by the Canadian Nuclear Safety Commission (CNSC) and effective January 1, 2021. This licence authorizes BWXT NEC to operate and modify its nuclear fuel facility to produce natural and depleted uranium dioxide (UO2) pellets in Toronto at 1025 Lansdowne Ave*." Additional background information is available in the "Safety Analysis" report for Toronto: "*The Toronto operation is licenced for a maximum monthly production rate of 150*

Megagrams (150 tonnes) of uranium pellets under Nuclear Fuel Facility Operating Licence FFL-3621.00/2030." This safety analysis report considered a series of hazards, including:

- Radioactive material;
    - o UO_2 powder;
    - o UO_2 pellets;
- Contaminated waste (e.g., used filter media);
- Compressed gases, hydrogen and natural gas;
- Nearby rail tracks;
- Air traffic over and airport movements in the vicinity of the site; and
- External fires.

The Toronto safety analysis concluded "*that engineering and administrative controls and safeguards implemented by the BXWT NEC Toronto operation provide an adequate level of protection over a broad range of operating conditions*". There were some caveats, however, as the presence of the hydrogen tank on site presented an additional hazard not present in Peterborough. The report notes "*Although exceptionally unlikely, there is potential for hydrogen fire from a hydrogen spill, which could expose individuals outdoors and in the immediate vicinity to the heat from the fire. These hazards are consistent with any industrial use of liquid hydrogen. Appropriate engineering and administrative controls, as identified in the hydrogen system HAZOP, have been established to reduce these conventional industry risks to As Low As Reasonably Achievable*."

BWXT's update stated: "*The facility is located in a residential area with some industrial and commercial buildings in west-central Toronto. Currently, several high-rise apartment buildings are under construction immediately west of the facility and are set for occupancy early in 2026…The facility consists of two separate buildings... Building 7 houses uranium dioxide pellet manufacturing on the first, second and third floors and office space on the fourth floor. Building 9 is a warehouse used for the storage of uranium dioxide as miscellaneous scrap awaiting reprocessing or shipment for disposal, compaction of waste, and decontamination activities*."

The BWXT report notes that the "*…primary radiological hazard from uranium is the inhalation of UO_2 particles. A lesser radiological hazard exists in the form of low-level external gamma and beta radiation exposure to employees*." This is reasonable, as pure uranium (without its decay products, which take significant time to build up following pure uranium's extraction from uranium ore) is an alpha emitter and there should be a relatively low concentration of beta and gamma emitters in the radioactive material used at the site. This makes it clear that BWXT

understands that airborne UO_2 may occur on site and that controls will be required to reduce radiological impact.

On page 10 of the Mid-term licence update document for the Toronto site, Figure 3 shows the "Senior Management Team" for BWXT NEC. As mentioned previously for the Peterborough location, it would have been beneficial to show the "Radiation Safety Management Team" structure as the "Senior Management Team" would have other goals (e.g., maximizing production of CANDU fuel) which could potentially conflict with radiation safety management. Ideally, BWXT should demonstrate that *radiation safety* has a clear management structure *independent* of commercial goals.

Internal licensed activity audits are performed routinely and have not found any significant issues. Note that it might be reasonable to engage an experienced external radiation safety program auditor on a periodic basis to supplement internal audits. A fresh perspective can aid in improving radiation safety performance. CNSC inspections serve a somewhat similar function, but CNSC inspectors are constrained in the advice they can provide.

At the Toronto facility, both external dosimetry (using TLDs) and internal dosimetry (based on urine samples) are used to assess radiation dose to workers.

BWXT performs environmental monitoring to assess radiological emissions and dose rates from facility operations. This includes sampling in community locations, dose monitoring, and continuous boundary monitoring at the facility perimeter.

BWXT refers to "*A project to install shielding over the windows on the third floor grinding room was completed in 2025, and in 2026 additional shielding will be installed on the second-floor windows. These shielding projects help to minimize dose to the anticipated occupants of a new apartment complex being constructed across from the site on Lansdowne Ave*." It is not clear why such shielding would be necessary, given the distance involved, if the gamma ray dose rates on site are as low as has been implied by BWXT.

Based on Table 2 of the mid-term licence update, BWXT Toronto has the following internal control levels for surface contamination (assumed to be uranium).

Table 2 BWXT Toronto internal control levels for surface contamination

Area Classification	Internal control level* (dpm/100 cm^2)	Internal control level** (Bq/100 cm^2)	#samples exceeding internal cntrl level* 2021-2025 (%)
R3	22,000	367	4 (0.2%)
R2	2200	36.7	44 (1.7%)
Active	2200	36.7	9 (1.5%)
Unclassified	220	3.67	45 (1.7%)

* From BWXT's report
**Calculated from BWXT report's numbers

CNSC's website (www.cnsc-ccsn.gc.ca/eng/nuclear-substances/classes-of-nuclear-substances/#wb-auto-3) lists both U-238 and U-235 as "Class A" substances with a suggested contamination limit in public areas of 0.3 Bq/cm^2 (30 Bq/100 cm^2) and a suggested contamination limit in controlled areas of 3 Bq/cm^2 (300 Bq/100 cm^2). The internal control limits for R2, Active and Unclassified areas appear conservative. *The internal control limit for contamination in R3 exceeds the CNSC limit for controlled areas and thus seems high*.

Air monitoring is performed at workstations on site. Air monitoring results can be compared to a calculated Derived Air Concentration (DAC) value, as described above for the Peterborough facility. For the Toronto facility, the DAC would be the same as for the Peterborough location – as calculated above, for processed natural uranium, the DAC is 0.67 Bq/m^3.

From the BWXT submission, the maximum airborne concentration recorded at the Toronto facility over the 5-year period (2021-2025) was 368 dpm/m^3 which is equivalent to 6.13 Bq/m^3. This is almost 10 times higher than the above-calculated DAC. Care will need to be taken to ensure that employees are not exposed to such elevated airborne concentrations for long periods of time, without protection, to limit the intake of radioactive material and the resulting committed effective dose. The BWXT submission also provided that the maximum of the annual "average" concentrations measured in the 5-year timeframe of 2021-2025 was 9.2 dpm/m^3 which corresponds to 0.15 Bq/m^3, roughly one quarter (23%) of the DAC. A worker breathing in air with airborne radioactive material at 23% of the DAC for an entire work year (2000 hours) would receive 23% of the ALI dose, or 4.6 mSv per year. This is approaching 10% of the 50 mSv/y dose limit for Nuclear Energy Workers, and care is recommended to ensure that exposures remain low and doses remain ALARA.

Dose rates on the Toronto shop floor are not that different from the Peterborough facility. Similarly, while above average background levels of <0.1 µSv/h typical for the Toronto area according to the "World Dose Rate Map" (https://wasavies.nict.go.jp/WorldDose_e.html), are

still sufficiently low that if an employee was exposed to the average dose rate all year, worker doses would remain well below the facility Action Level and regulatory dose limit.

There have been two urine samples showing levels above the internal control level, suggesting that some contamination is, on occasion, being ingested or inhaled by some workers.

2.2 Environmental Issues: IEMP and BWXT Results

2.2.1 Peterborough Facility

2.2.1.1.1 CNSC IEMP Results for Peterborough facility

Detailed CNSC IEMP results are available for BWXT's Peterborough facility via the CNSC website (https://www.cnsc-ccsn.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/bwxt-peterborough/). All air sampling results (2014-2024 inclusive) are well below the CNSC-reported guideline reference levels for both uranium and beryllium concentration. Soil sampling results (2014-2024) are also below the applicable guideline reference levels for both uranium and beryllium concentrations. The maximum soil beryllium concentration was 2.34 mg/kg, found at location GP05 in 2019 (approximately half of the 4.0 mg/kg guideline level). The maximum uranium concentration found was 2.05 mg/kg, at location G08, also in 2019 (approximately 10% of the 23 mg/kg guideline level). In fact, analysis of the results shows a decreasing trend for concentrations of beryllium and uranium in soil, as can be seen in

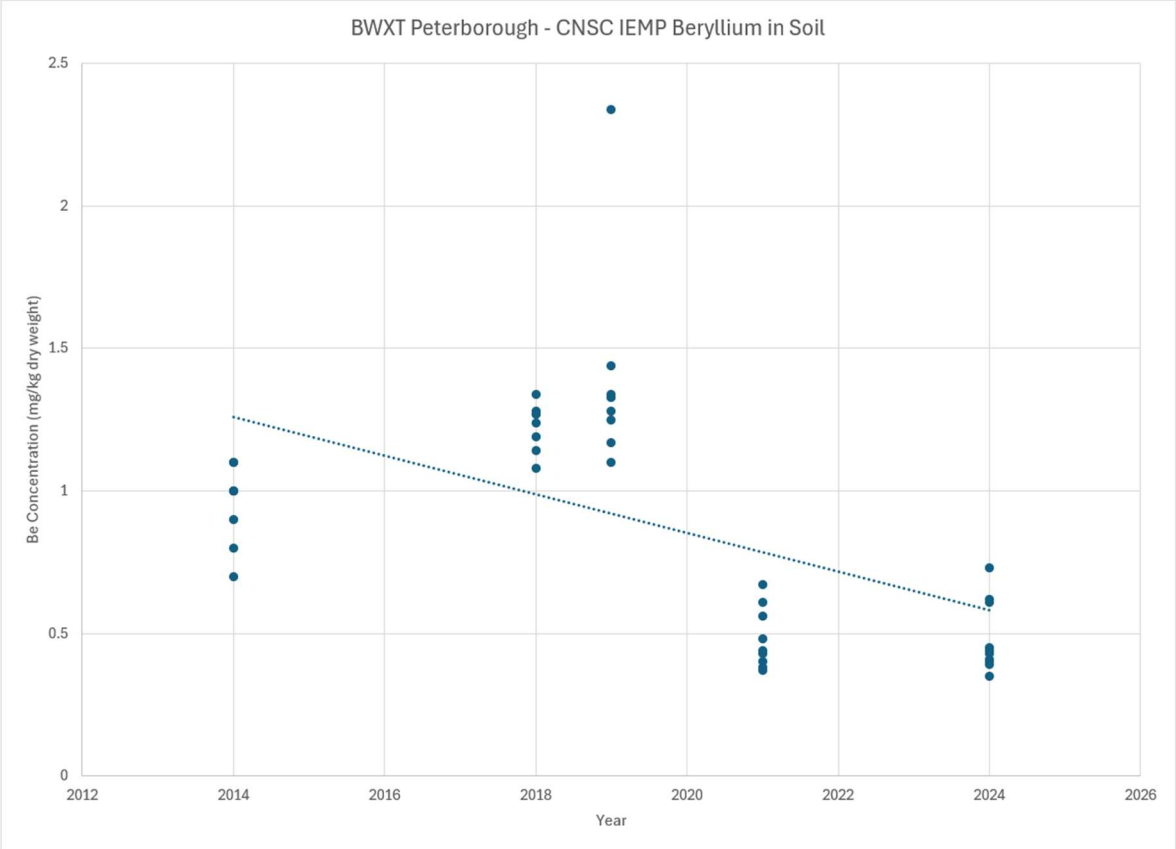

Figure 4 and

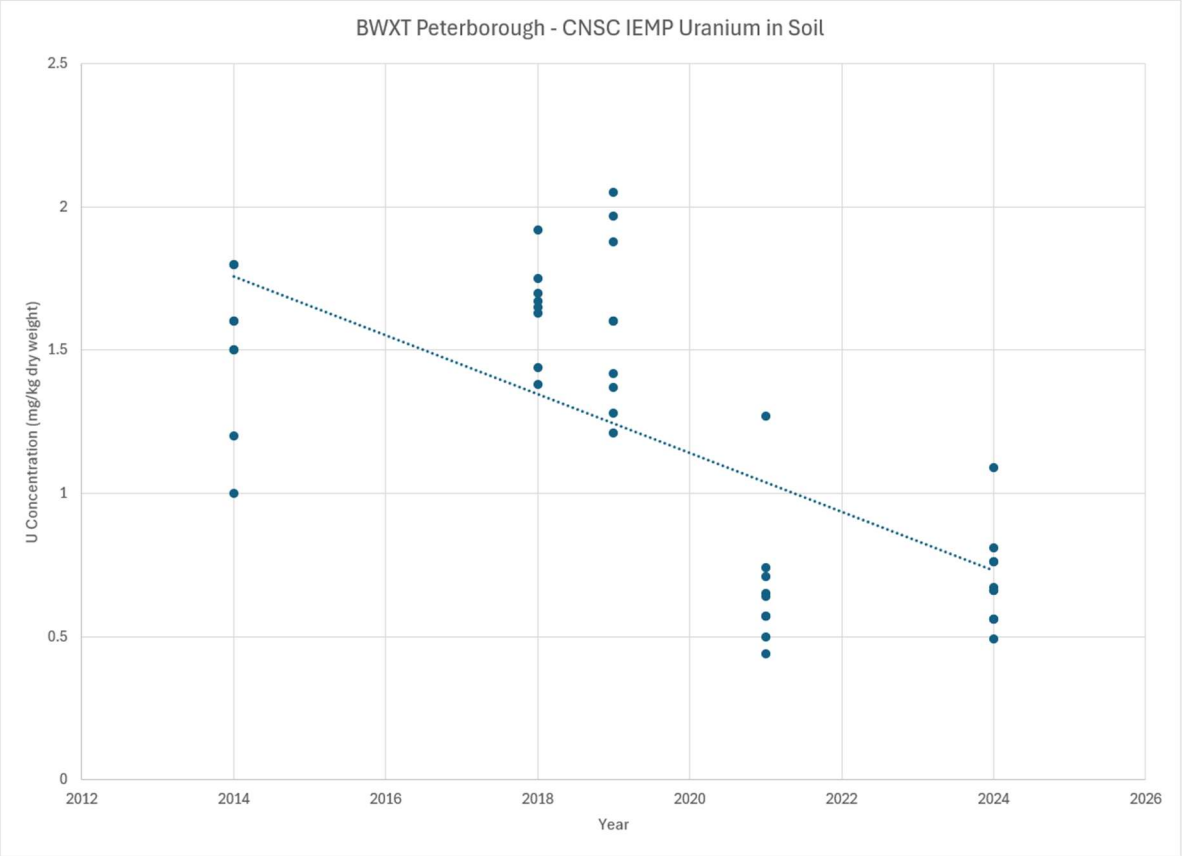

Figure 5 below, (RSIC-created graphs of IEMP results from the CNSC website).

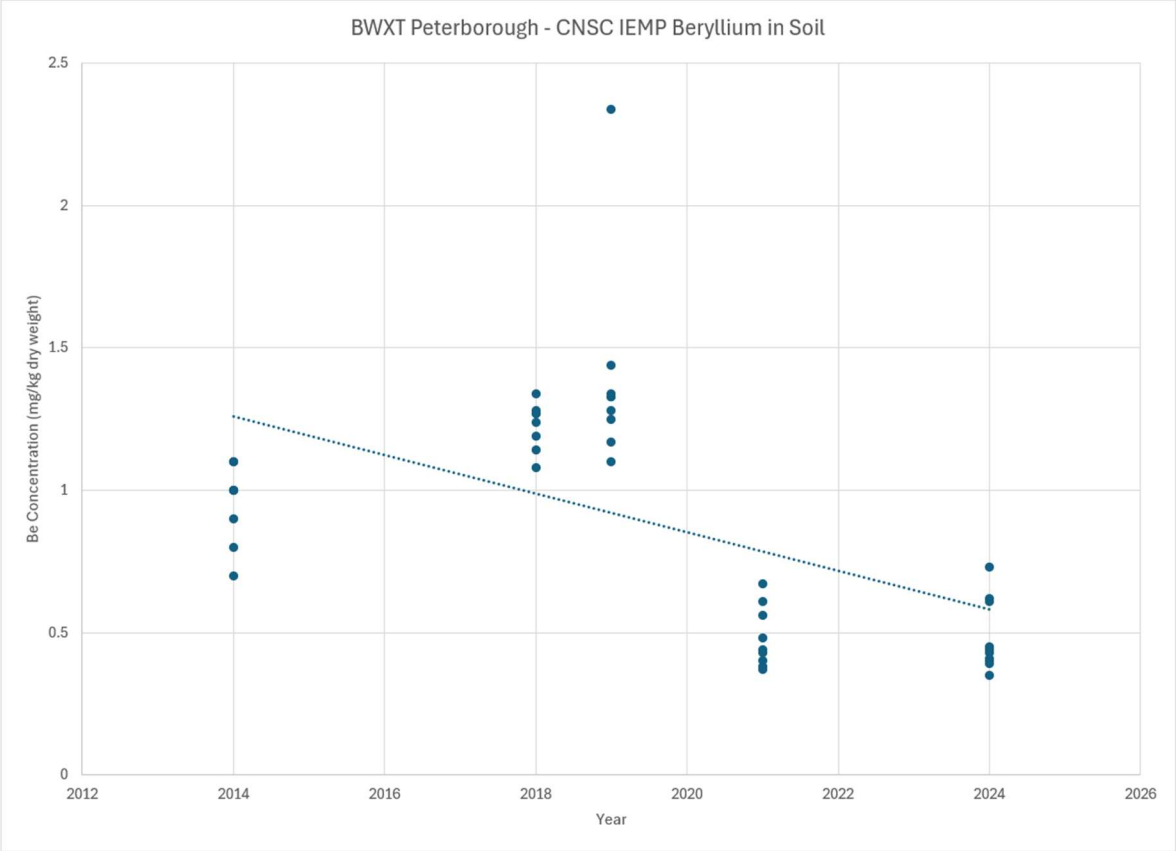

Figure 4 CNSC IEMP soil sampling results for beryllium for the Peterborough facility, with linear trendline.

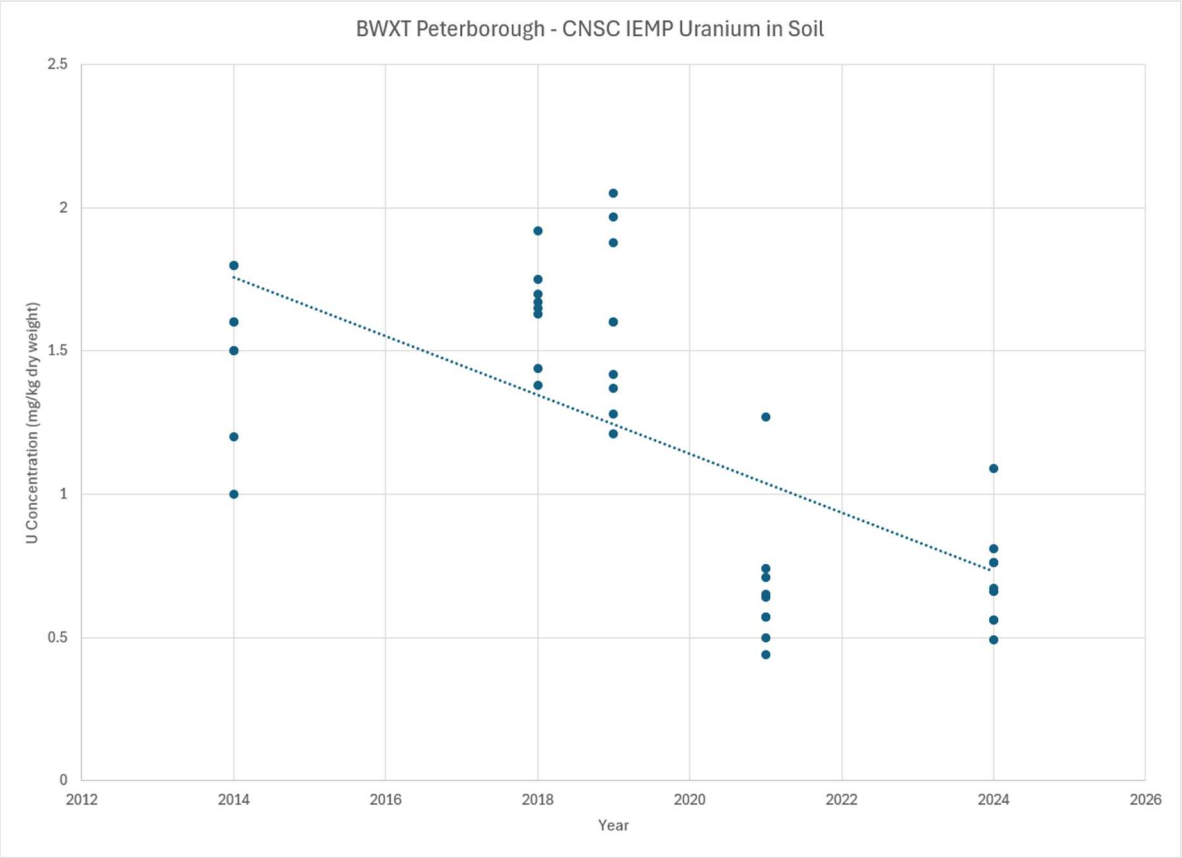

Figure 5 CNSC IEMP soil sampling results for uranium for the Peterborough facility, with linear trendline.

Vegetation sampled for beryllium and uranium were also found to have very low levels, with all results being below the lower limit of detection for the analysis method. No vegetation samples were expected to have any impact on health.

CNSC staff provided a supplemental submission regarding IEMP beryllium results for the Peterborough facility at the time of the licence renewal. Their conclusion was that emissions from BWXT's Peterborough operations are at a level that could not result in significant change to beryllium concentrations in soil.

The CNSC makes the results of its independent environmental monitoring program (IEMP) publicly available.

2024 testing in Peterborough focussing on radioactive nuclear and hazardous substances; "*The levels of radioactivity and hazardous substances measured in air, water, soil and food samples were below available guidelines and our own screening levels. Our screening levels are based on conservative assumptions about the exposure that would result in a dose of 0.1 mSv/year (10% of the regulatory public dose limit of 1 mSv/year)*"

2021 testing in Peterborough focussed on both radioactive and hazardous substances: "*The levels of uranium and beryllium measured in the samples were below available guidelines. Measurements conducted by the IEMP to date have consistently found levels of radioactivity in the environment to be low, and well within the range of natural background radiation levels. The concentrations of beryllium in soil collected around the BWXT Peterborough facility remain well below guidelines. As a result, no health or environmental impacts are expected at these concentrations*."

2020 testing in Peterborough focussed on soil sampling for beryllium: "*The results did not indicate any significant changes in concentrations of beryllium in the soil in Peterborough*."

2014, 2018 and 2019 testing focussed on both radioactive and hazardous substances: "*The levels of uranium and beryllium measured in the samples were below available guidelines*."

2.2.1.1.2 BWXT Environmental Monitoring Results for Peterborough Facility

Results for uranium in air stack monitoring, uranium in wastewater collected from cleaning work in the fuel bundle assembly area, and uranium in soil samples from the facility and its surroundings have been provided for 2023 and 2024. All results are well below applicable standards.

Beryllium is used at the Peterborough site. Beryllium poses significant health risks, including chronic beryllium disease (CBD) and lung cancer, which necessitates strict safety measures in workplaces handling this metal. Results of surface soil sampling for beryllium are shown below in Table 3. Note that the detection limit for these samples is 0.50 µg Beryllium per g of soil. The great majority of the locations tested have results falling below this detection limit. The exceptions have been one test in 2023 in the Bonnerworth Park sampling location and ***all*** tests from 2020 to 2025 inclusive for the "Park on Adeline St. off Patterson St." sampling location (i.e., sample ID location GP06-S06, shown in Figure 6 below the table). While the maximum sample value found, 0.56 µg/g, is well below the Ontario Ministry of the Environment, Conservation and Parks standard of 2.5 µg/g, it is worth noting that the detection of beryllium in soil outside the Peterborough site requires close monitoring and may be of significant concern to local members of the public. *Measurements of beryllium concentrations in the facility's stack air and waste water have been consistently low, with no value exceeding the relevant Action Levels*.

Table 3 Surface soil sampling results – Beryllium – Peterborough (Englobe Annual 2025 Surface Soil Sampling Program report)

Sample ID	Sample Location	Property Use	MECP Table 1 SCS (µg/g)	2020	2021	2022	2023	2024	2025
GP01-S01	R.A. Morrow Memorial Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP02-S02	Turner Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP03-S03	Kinsmen Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP04-S04	Del Crary Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP05-S05	Prince of Wales School	Institutional	2.5	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP06-S06	Park on Adeline St. off Patterson St.	Parkland	2.5	0.52	0.55	0.53	0.56	0.50	0.53
GP07-S07	Victoria Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP08-S08	Bonnerworth Park	Parkland	2.5	<0.50	<0.50	<0.50	0.52	<0.50	NA
GP11-S11	Emily-Omemee Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP12-S12	Emily-Omemee Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP13-S13	Emily-Omemee Park	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP14-S14	BWXT Facility	Industrial	2.5	NA	NA	NA	NA	NA	<0.50
GP15-S15	Curve Lake First Nation Powwow Grounds	Parkland	2.5	NA	NA	NA	NA	NA	<0.50
GP20-S20	Duplicate of GP02-S02	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
GP21-S21	Duplicate of GP12-S12	Parkland	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

Notes
All results expressed as µg/g.

NV	No Criteria/RDL Value
NA	Not Applicable
'<'	Value is less than the Reported Detection Limit (RDL)
MECP	Soil, Ground Water and Sediment Standards for use Under Part XV.1 of the Environmental Protection Act (MECP 2011), Table 1: Full Depth Background Site Condition Standards for Residential, Parkland, Institutional, Industrial, Commercial, Community Property Use.
Yellow Highlight	Exceeds Table 1 Site Condition Standards

Figure 6 Note soil sampling location GP06-S06 where beryllium levels have been consistently detected above the detection limit by BWXT NEC over the past 5 years.

2.2.2 Toronto Facility

Environmental sampling is done both by the CNSC and by BWXT.

2.2.2.1 CNSC IEMP Results for Toronto facility

The CNSC makes the results of its independent environmental monitoring program (IEMP) publicly available (https://www.cnsc-ccsn.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/bwxt-toronto/). Unlike the website for the Peterborough facility, the actual result values are not available from this website, instead summaries are provided.

2025 testing focussing on radioactive nuclear and hazardous substances; "*The levels of radioactivity and hazardous substances measured in air and soil were below available guidelines and our own screening levels…Measurements conducted by the IEMP to date have consistently found levels of radioactivity in the environment to be low and well within the range of natural background radiation levels*."

2022 testing focussed on uranium: "*The levels of radioactivity and hazardous substances measured in soil and air were below available guidelines and our own laboratory screening*

levels…IEMP measurements to date have consistently found levels of radioactivity in the environment to be low and well within the range of natural background radiation levels."

2014, 2016, 2018 and 2019 testing focussed on uranium: "*In July 2014, July 2016, June 2018, and June 2019 samples were collected in areas outside the BWXT NEC – Toronto site perimeter fence and included samples of air and soil. The concentrations of uranium in the samples were below available guidelines. No health or environmental impacts are expected at these levels*."

2.2.2.2 BWXT Environmental Monitoring Results for Toronto Facility

BWXT provides the results of their own environmental monitoring program on their webpage. Results for uranium in air stack monitoring, uranium in wastewater, and uranium in soil samples from the facility and its surroundings have been provided for 2023 and 2024. All results are well below Action Levels and applicable standards. Note that beryllium is not used at the Toronto Facility.

2.3 Worker and Public Radiation Doses

2.3.1 Worker Dose: Peterborough Site

Radiation exposure levels among personnel at the Peterborough facility have remained consistently low over the five-year period from 2021 to 2025, based on monitoring with external dosimeter badges. Although there was a minor increase in average doses received by technicians during this interval, overall values remain below established Action thresholds, indicating compliance with safety standards. The following two figures, below, copied from BWXT's report show that worker doses have been on average low, and even the maximum doses have been well below regulatory limits.

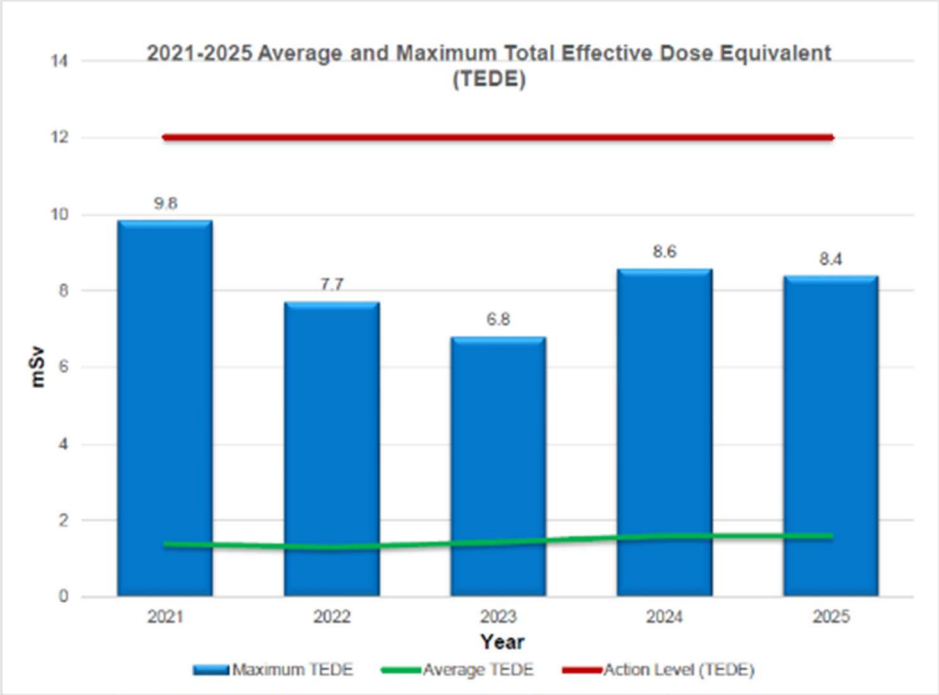

Figure 4: 2021-2025 Maximum and Annual Total Effective Dose Equivalent

Figure 7 BWXT NEC's reported worker Effective Dose Equivalent showing both average and maximum worker doses from 2021 to 2025.

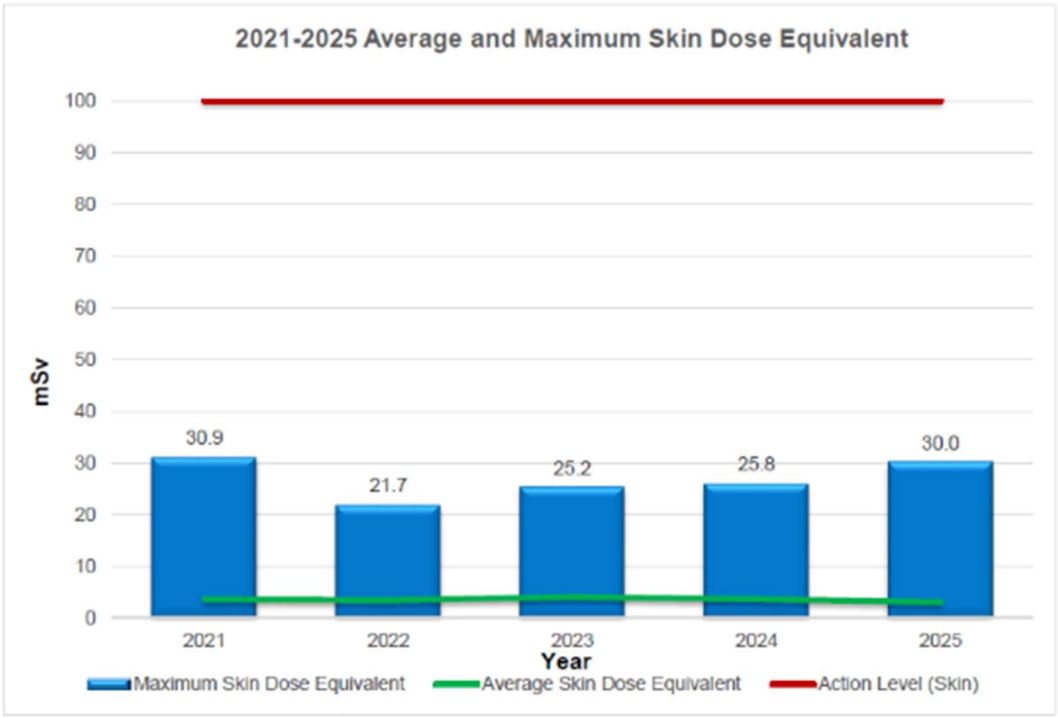

Figure 5: 2021-2025 Maximum and Average Skin Dose Equivalent

Figure 8 BWXT NEC's reported worker Skin Dose Equivalent showing both average and maximum worker doses from 2021 to 2025.

2.3.2 Public Dose: Peterborough Site

Table 4 Estimated dose to the public from the Peterborough facility

Period	Estimated Annual Public Dose (µSv)	% of Public Dose Limit (1,000 µSv = 1 mSv)
2025	5.7	0.6%
2024	0	0.0%
2023	0	0.0%
2022	11.5	1.1%
2021	0.0	0.0%

The table above, reproduced from Table 14 of the BWXT submission, shows that the estimated radiation dose to the public due to activities at the Peterborough facility have been low, well below the 50 µSv/y ALARA guidelines and the 1000 µSv/y CNSC regulatory limit.

2.3.3 Worker Dose: Toronto Site

Due to the forms of radioactive material handled at the Toronto site, there is a risk of radiation exposure both from external sources and through inhalation or ingestion of radioactive material. Thus, at the Toronto site, worker radiation dose monitoring is performed using both external dosimeters (TLDs) to assess whole-body, skin, extremity, and eye doses, as well as urine sampling to evaluate potential internal exposures. Results are shown below.

Table 5 Doses to Toronto workers broken down internal and external dose

	Year	All Workgroups (TEDE)	Operators External Dose Only	Operators Internal Dose Only	Staff (TEDE)
Maximum (mSv)	2025	5.42*	4.12*	2.04	1.16*
	2024	6.72	4.57	2.15	0.00
	2023	5.13	3.87	1.82	0.28
	2022	5.17	4.01	1.38	0.22
	2021	5.72	5.21	1.43	0.56
Average (mSv/person)	2025	1.70*	1.40*	0.93	0.11*
	2024	1.34	1.02**	0.83	0.00
	2023	1.64	1.32	0.92	0.05
	2022	1.39	1.29	0.58	0.06
	2021	1.62	1.46	0.65	0.07

**Data correction from 2024's annual compliance report.

As seen in the table above, reproduced from Table 9 of the BWXT NEC submission, the doses to Toronto workers have been generally low, with the Total Effective Dose Equivalent (TEDE) being well below the annual limit of 50 mSv/y for Nuclear Energy Workers. There appears to be a slight trend towards increased internal dose over the past 5 years. However, there does not appear to be a significant increase in average total dose to workers over the period.

Skin and extremity doses to workers have been monitored and remained low within this licensing period. The maximum annual worker skin dose in this timeframe was 37.2 mSv, which is below the point at which the CNSC requires dosimetry to be used (50 mSv/y) as well as being below the regulatory dose limit of 500 mSv/y for Nuclear Energy Workers. The maximum annual worker extremity dose was 68.6 mSv, which is well below the regulatory dose limit of 500 mSv/y for Nuclear Energy Workers.

2.3.4 Public Dose: Toronto Facility

Table 6 Estimated dose to the most exposed members of the public from the Toronto Facility

Year	Estimated Annual Public Dose (µSv)	% of Public Dose Limit (1,000 µSv = 1 mSv)
2025	109.1	10.9%
2024	137.8	13.8%
2023	40.2	4%
2022	17.3	2%
2021	17.3	2%

The table above provides an estimate of the annual radiation dose to the most exposed member of the public from all licensed activities on site. This estimated doses for 2024 and 2025 were more than 5 times the estimated dose in the first year after the licence was granted (2021). Maximum estimated doses to the public are still well below the 1,000 µSv/y regulatory dose limit for members of the public. While annual doses of 137.8 µSv/year or 109.1 µSv/y are low in comparison to the regulatory limit, they are still at a level where an ALARA assessment is recommended by the CNSC (per REGDOC-2.7.1 Radiation Protection):

"The CNSC may consider that an ALARA assessment is not required if, during the initial analysis, the licensee can demonstrate that:

- individual occupational doses are unlikely to exceed 1 mSv per year or
- doses to individual members of the public are unlikely to exceed 50 µSv per year"

BWXT's goal should be to ensure that public doses do not exceed the ALARA guidelines of 50 µSv/year. Meeting the 1,000 µSv/year public limit is not sufficient from an ALARA perspective.

3 Discussion & Potential Issues

Midway through the CNSC licensing period for BWXT's Peterborough and Toronto sites, there are no quantitative findings that indicate significant safety issues. CNSC's IEMP program confirms BWXT's measurements, showing no significant radioactive or hazardous emissions. At Peterborough, beryllium levels are consistently above background at one environmental soil sampling site but remain below guideline and regulatory limits; it is advisable to minimize beryllium releases.

Radiation exposure to workers at both the Peterborough and Toronto locations is kept within acceptable boundaries. Public exposure at the Peterborough site falls below the ALARA threshold, meaning no further action is required. At the Toronto site, while public exposure does not surpass regulatory limits, it is more than twice the 50 µSv/year dose level at which the CNSC would not recommend further ALARA assessments, suggesting BWXT should take steps to lower this possible worst-case dose. RSIC recommends that BWXT aim to keep public doses under this 50 µSv/year threshold as simply meeting the 1,000 µSv/year public limit does not fulfil ALARA standards.

As noted above "*The internal control limit for contamination in R3 exceeds the CNSC limit for controlled areas and thus seems high*". We recommend BWXT review this internal control limit to determine if it is appropriate for worker safety.