CMD 25-M10 - CNSC Staff Submission

Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities, Research Reactors and Class IB Accelerators in Canada: 2023

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Summary	This CMD presents the Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities, Research Reactors, and Class IB Accelerators in Canada: 2023. - Purpose of document - Key events - Key findings
Actions required	There are no actions requested of the Commission. This CMD is for information only.

CMD 25-M10

Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities, Research Reactors and Class IB Accelerators in Canada: 2023

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Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Canada

Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities, Research Reactors, and Class IB Accelerators in Canada: 2023

Canadian Nuclear Safety Commission

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This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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Publishing history

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Changes to the 2023 regulatory oversight report

Change	Rationale
New template	template created to improve document accessibility

Land acknowledgement and Reconciliation Statement

The Canadian Nuclear Safety Commission (CNSC) is committed to building and strengthening trust and advancing reconciliation with Indigenous Nations and communities.

CNSC staff would like to acknowledge that the facilities and activities regulated by the CNSC and subject to this Regulatory Oversight Report are located on the many traditional and treaty territories of Indigenous peoples in Canada. It is important to give recognition and thanks to the land and the Indigenous peoples that the CNSC works with across Canada.

The CNSC aims to be an open, culturally sensitive, respectful organization that engages in open and transparent dialogue, partnership, and collaboration with Indigenous Nations and communities. The CNSC envisions its staff as being active listeners who understand the role they play in advancing reconciliation and acknowledges that they have a lot to learn from Indigenous peoples and their perspectives.

Plain language summary

The *Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities, Research Reactors, and Class IB Accelerators in Canada: 2023* provides information on the safety performance of the following licensed facilities in Canada:

Uranium Processing Facilities:

- Cameco Corporation Blind River Refinery, Blind River, Ontario
- Cameco Corporation Port Hope Conversion Facility, Port Hope, Ontario
- Cameco Fuel Manufacturing Inc., Port Hope, Ontario
- BWXT Nuclear Energy Canada Inc., Toronto, Ontario
- BWXT Nuclear Energy Canada Inc., Peterborough, Ontario

Nuclear Substance Processing Facilities:

- SRB Technologies (Canada) Inc., Pembroke, Ontario
- Nordion (Canada) Inc., Ottawa, Ontario
- Best Theratronics Ltd., Ottawa, Ontario
- BWXT Medical Ltd., Ottawa, Ontario

Research Reactors:

- McMaster University, Hamilton, Ontario
- Royal Military College of Canada. Kingston, Ontario

- École Polytechnique de Montréal, Montréal, Québec

Class IB Accelerators:

- TRIUMF, Vancouver, British Columbia
- Canadian Light Source, Saskatoon, Saskatchewan

The reporting period covered by this report varies based on facility type. Uranium and Nuclear Substance Processing Facilities (UNSPFs) are reported on annually and thus this report covers the 2023 calendar year. The reporting period for research reactors, which were last included in the 2020 Regulatory Oversight Report (ROR), covers the calendar years 2021-2023. Class IB Accelerators were last included in the 2019 ROR and therefore the reporting period will cover the years 2020-2023.

Over the respective reporting periods, all facilities operated safely. Monitoring data demonstrated that people and the environment remained protected.

This report also provides an update on CNSC staff's regulatory activities pertaining to Indigenous engagement, public information, community engagement, aspects of the CNSC's Independent Environmental Monitoring Program (IEMP) that relate to UNSPFs facilities, Research Reactors and Class IB Accelerator facilities. Where possible, trends are shown, and information is compared to previous years.

Each year, CNSC inspectors and experts complete inspections at these different facilities. The number and scope of inspections at each facility depend on the potential hazards (risks) the facility poses to people and the environment and on its performance history. The CNSC uses a risk-informed approach when planning inspections.

The CNSC uses 14 safety and control areas (SCAs) to evaluate the performance of each licensee; the resulting performance ratings are included in this report. Particular focus is placed on the radiation protection, environmental protection, and conventional health and safety SCAs, as these give a good overview of safety performance.

The SCA ratings in this report were derived from the results of activities conducted by CNSC staff to verify licensee compliance. These activities included onsite and virtual inspections, technical assessments, reviews of licensee reports, reviews of events and incidents, and ongoing exchanges of information with licensees.

This report is available on the CNSC website, and the documents referenced in it are available upon request by contacting:

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1 Introduction

1.1 Background

Each year, the Canadian Nuclear Safety Commission (CNSC) publishes regulatory oversight reports, which offer information on the safety performance of CNSC licensees who are authorized to use nuclear substances. The reports evaluate licensees based on their compliance with regulatory requirements. Key issues and emerging changes in regulation are also highlighted.

Learn more about regulatory oversight reports

1.2 Scope of Report

Through the application of the *Nuclear Safety and Control Act* (NSCA) and its associated regulations, the Canadian Nuclear Safety Commission (CNSC) regulates Canada's nuclear industry to protect the health and safety of persons and the environment and to implement Canada's international commitments on the peaceful use of nuclear energy. The CNSC also disseminates objective scientific, technical, and regulatory information to the public. Licensees are responsible for operating their facilities safely and are required to implement programs that make adequate provision for meeting legislative and regulatory requirements and license conditions.

The reporting period covered by this report varies based on facility-risk type. Uranium and Nuclear Substance Processing Facilities (UNSPFs) are reported on annually and thus this report covers the 2023 calendar year. The reporting period for research reactors, which were last included in the 2020 Regulatory Oversight Report (ROR), covers the calendar years 2021-2023. Class IB Accelerators were last included in the 2019 ROR and therefore the reporting period will cover the calendar years 2020-2023.

1.2.1 Nuclear Facilities Covered by this Report

Uranium Processing Facilities :

Nuclear facility	Location	Licencee
Cameco Corporation Blind River Refinery	Blind River, Ontario	Cameco Corporation Blind River Refinery
Cameco Fuel Manufacturing Inc.	Port Hope. Ontario	Cameco Fuel Manufacturing Inc.
Cameco Corporation Port Hope Conversion Facility	Port Hope, Ontario	Cameco Corporation Port Hope Conversion Facility
BWXT Nuclear Energy Canada Inc.	Toronto, Ontario	BWXT Nuclear Energy Canada Inc.
BWXT Nuclear Energy Canada Inc.	Peterborough, Ontario	BWXT Nuclear Energy Canada Inc.

Nuclear Substance Processing Facilities:

Nuclear facility	Location	Licencee
SRB Technologies (Canada) Inc.	Pembroke, Ontario	SRB Technologies (Canada) Inc.
Nordion (Canada) Inc.	Ottawa, Ontario	Nordion (Canada) Inc.
Best Theratronics Ltd.	Ottawa, Ontario	Best Theratronics Ltd.
BWXT Medical Ltd.	Ottawa, Ontario	BWXT Medical Ltd.

Non-power Reactors:

Nuclear facility	Location	Licencee
McMaster University	Hamilton, Ontario	McMaster University
Royal Military College of Canada	Kingston, Ontario	Royal Military College of Canada
École Polytechnique de Montréal	Montréal, Quebec	École Polytechnique de Montréal

Class IB Accelerators:

Nuclear facility	Location	Licensee
TRIUMF	Vancouver, British Columbia	TRIUMF Accelerators Inc.
Canadian Light Source	Saskatoon, Saskatchewan	Canadian Light Source Inc.

This report discusses all safety and control areas (SCAs), but focuses on radiation protection, environmental protection, and conventional health and safety, as they provide a good overview of safety performance at licensed facilities. The report also provides an overview of licensee operations, licence changes, major developments at licensed facilities and sites, and reportable events. In addition, the report includes information on engagement with Indigenous Nations and communities, and public information programs.

2 Uranium Processing Facilities

Uranium processing facilities are part of the nuclear fuel cycle that includes refining, conversion, and fuel manufacturing. The fuel produced is used in nuclear power plants for the generation of electricity.

2.1 Cameco Blind River Refinery

Cameco Corporation owns and operates the Blind River Refinery, (BRR) in Blind River, Ontario. The facility is located about 5 km west of the town of Blind River and south of Mississauga First Nation. The facility is located within the Robinson-Huron and Robinson-Superior Treaties territory and the traditional territory of the Anishinabek, Métis and Odawa peoples, in particular the Mississauga First Nation.

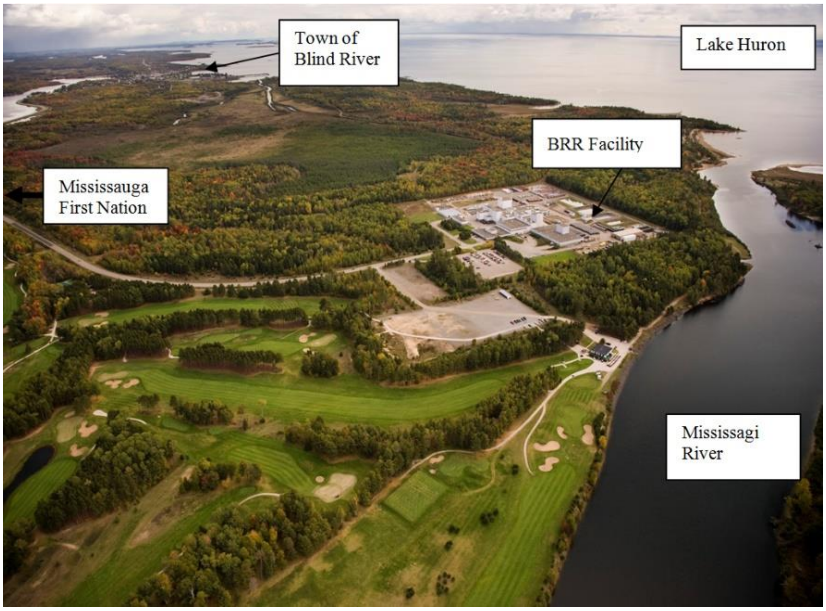


Figure 2-1: Aerial view of the Blind River Refinery, showing its proximity to the town of Blind River, Ontario, the Mississauga First Nation, Lake Huron, and the Mississauga River (Source: Cameco).

The BRR facility refines uranium concentrates (yellowcake) received from uranium mines in Canada and around the world to produce uranium trioxide (UO_3), an intermediate product of the nuclear fuel cycle. The primary recipient of the UO_3 is Cameco's Port Hope Conversion Facility (PHCF).

In 2023, CNSC staff conducted 4 inspections at the BRR that covered 9 SCAs. Table B-1 in Appendix B lists these inspections and the 12 resulting in Notice of Non-Compliance (NNCs).

CNSC staff are satisfied that Cameco's BRR operated safely in 2023 and in accordance with its licensing basis.

2.2 Cameco Port Hope Conversion Facility

Cameco Corporation owns and operates the Port Hope Conversion Facility (PHCF), which is located in Port Hope, Ontario, and is in the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty between Canada and the Mississauga and Chippewa Nations. The facility is situated on the north shore of Lake Ontario, approximately 100 km east of Toronto.

Figure 2-2: Aerial view of the Port Hope Conversion Facility (Source: Cameco)

PHCF converts UO_3 powder produced by Cameco's BRR into uranium dioxide (UO_2) and uranium hexafluoride (UF_6). UO_2 is used in the manufacturing of Canada Deuterium Uranium (CANDU) reactor fuel, while UF_6 is exported for further processing before being converted into fuel for light-water reactors.

In 2023, CNSC staff conducted 5 inspections at PHCF that covered 9 SCAs, as well as compliance verification activities associated with the Vision in Motion (VIM) project (discussed below). Table B-2 in Appendix B lists these inspections and the 17 resulting NNCs.

CNSC staff are satisfied that Cameco's PHCF operated safely in 2023 and in accordance with its licensing basis.

2.2.1 PHCF Financial Guarantee

In 2022, CNSC staff received an updated preliminary decommissioning plan (PDP) and financial guarantee from Cameco for the PHCF to fulfill the requirement to update the PDP and cost estimate at a minimum every 5 years. In 2023, CNSC staff's assessment was completed and CMD 23-H107 was submitted to the Commission for a hearing in writing. In May 2024, the Commission accepted the revised financial guarantee proposed by Cameco for PHCF.

2.2.2 Vision in Motion

VIM is Cameco's project to clean up and renew the PHCF site. The project builds on work now underway through the Port Hope Area Initiative (PHAI) to address historic low-level radioactive waste issues in the municipality of Port Hope. The VIM project is being carried out under Cameco's operating licence, FFOL-3631.00/2027. Licence condition 16.1 states: "The licensee

shall implement and maintain a program to carry out clean-up, decontamination and remediation work". In 2023, Cameco carried out VIM work that included:

- The shipment of 284 dump trucks of waste to the Canadian Nuclear Laboratories (CNL) Port Hope Project Long Term Waste Management Facility (LTWMF). In addition, 1,426 super sacks, 54 roll-off bins, 2,034 drums, and the contents of 89 vac trucks were transferred to the LTWMF from PHCF and the Dorset Street warehouse.
- The complete disassembly of Building 27 (the former UF6 plant) to the ground floor concrete slab, although some stockpiled waste remained to be shipped in the first few months of 2024.
- The initiation of the demolition of Building 14/15 with the internal removals being significantly progressed by the close of December 2023. Full demolition and removal of the building foundation to be completed in early 2024.
- The removal of redundant equipment from Building 5 in readiness for drum dumping equipment to be installed in 2024.

2.3 Cameco Fuel Manufacturing Inc.

Cameco Fuel Manufacturing Inc. (CFM) is a wholly owned subsidiary of Cameco Corporation. CFM is in the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty between Canada and the Mississauga and Chippewa Nations. CFM operates 2 facilities: a nuclear fuel fabrication facility licensed by the CNSC in Port Hope, Ontario (referred to as CFM in this report); and a metals manufacturing facility in Cobourg, Ontario, which manufactures fuel bundle and reactor components. This latter facility is not licensed by the CNSC and is not discussed further in this report.

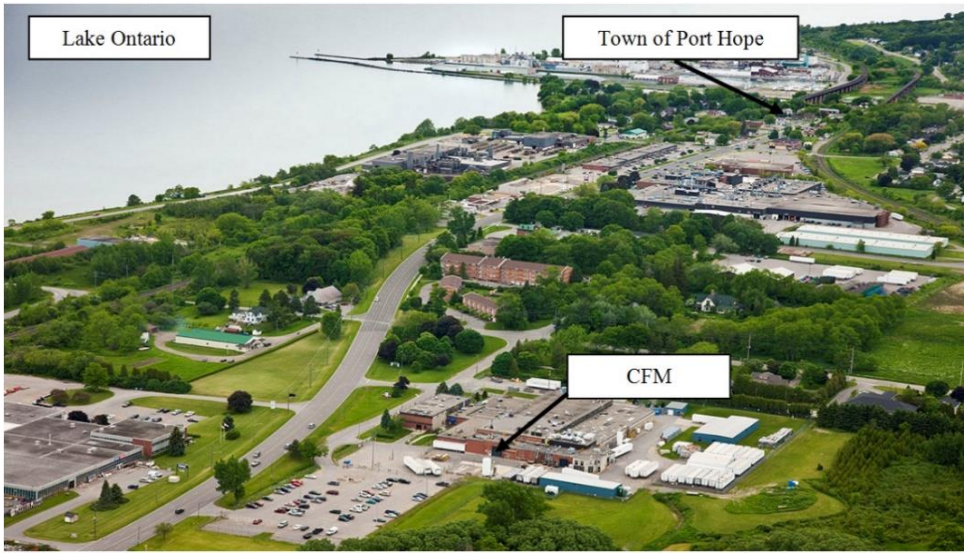


Figure 2-3: Aerial view of the Cameco Fuel Manufacturing facility and its proximity to Lake Ontario and the town of Port Hope (Source: Cameco)

The CFM facility manufactures fuel pellets from UO_2 powder and assembles nuclear reactor fuel bundles. The finished fuel bundles are primarily shipped to Canadian nuclear power reactors.

In 2023, CNSC staff conducted 3 inspections at CFM that covered 4 SCAs. Table B-3 of Appendix B lists these inspections and the 13 resulting NNCs.

CNSC staff are satisfied that CFM operated safely in 2023 and in accordance with its licensing basis.

2.3.1 CFM Licence Renewal

In October 2021, Cameco submitted an application for a 20-year renewal of the CFM licence. In its application, Cameco requested its production limit be increased from 125 tonnes of UO_2 as pellets during any calendar month to 1,650 tonnes of uranium as UO_2 pellets per year. Following a review of Cameco's application and supporting documents, CNSC staff's findings and recommendations were documented in CMD 22-H12, which was reviewed by the Commission at a public hearing in Cobourg (Ontario) on November 23, 2022. In January 2023, the Commission issued its decision (Record of Decision), granting a 20-year renewal of the CFM licence, which expires on February 28, 2043. The Commission directed that, at the midpoint of the 20-year licence period and no later than 2033, CFM shall provide to the Commission a comprehensive midterm update on the conduct of its licensed activities and compliance with requirements.

2.4 BWXT Nuclear Energy Canada Inc. (Toronto and Peterborough

BWXT Nuclear Energy Canada Inc. (BWXT NEC) produces nuclear fuel bundles used in Canadian nuclear power plants. BWXT NEC operates two facilities for this purpose, each under separate CNSC licences. One facility is located in Toronto and the other facility is located in Peterborough, Ontario. Figures 2-4 and 2-5 show aerial views of the BWXT NEC facilities. The Toronto facility is located within the traditional territory of many nations, including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee and the Wendat peoples, and now home to many diverse First Nations, Inuit and Métis peoples. The Peterborough facility resides in the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty between Canada and the Mississauga and Chippewa Nations.

Figure 2-4: Aerial view of the BWXT NEC Toronto facility outlined in red. (Source: Google Maps)

Figure 2-5: Aerial view of the BWXT NEC Peterborough facility outlined in red (Source: Google Earth)

The Toronto facility produces natural and depleted uranium pellets using UO_2 supplied by PHCF. The Peterborough facility manufactures CANDU nuclear fuel bundles using the uranium pellets from Toronto and zircaloy tubes manufactured in-house. The Peterborough facility also runs a fuel services business involved with the manufacturing and maintenance of equipment for use in nuclear power plants.

In 2023, CNSC staff inspected each BWXT NEC facility 5 times, covering 5 SCAs. Table B-4 in Appendix B lists these inspections and the 14 resulting NNCs.

CNSC staff are satisfied that the BWXT NEC facilities operated safely in 2023 and in accordance with their licensing basis.

2.4.1 BWXT NEC Financial Guarantee

In 2022, CNSC staff received an updated preliminary decommissioning plan (PDP) and financial guarantee from BWXT for the Toronto and Peterborough facilities to fulfill the requirement to update the PDP and cost estimate at a minimum every 5 years. In 2023, CNSC staff's assessment was completed and CMD 24-H104 was submitted to the Commission for a hearing in writing.

In April 2024, the Commission accepted the revised financial guarantees proposed by BWXT NEC for its Toronto and Peterborough facilities.

3 Nuclear Substance Processing Facilities

Nuclear substance processing facilities use nuclear substances to manufacture various products for end uses in industrial or medical applications. The nuclear substances can be used for lighting self-luminous emergency and exit signs, sterilizing items such as surgical gloves for sanitary reasons, and providing cancer diagnosis and treatment. All of the facilities are located within the traditional unceded territory of the Algonquin Anishinaabeg peoples.

3.1 SRB Technologies (Canada) Inc.

SRB Technologies (Canada) Inc. (SRBT) is licensed to operate a Class IB nuclear substance processing facility, in Pembroke, Ontario

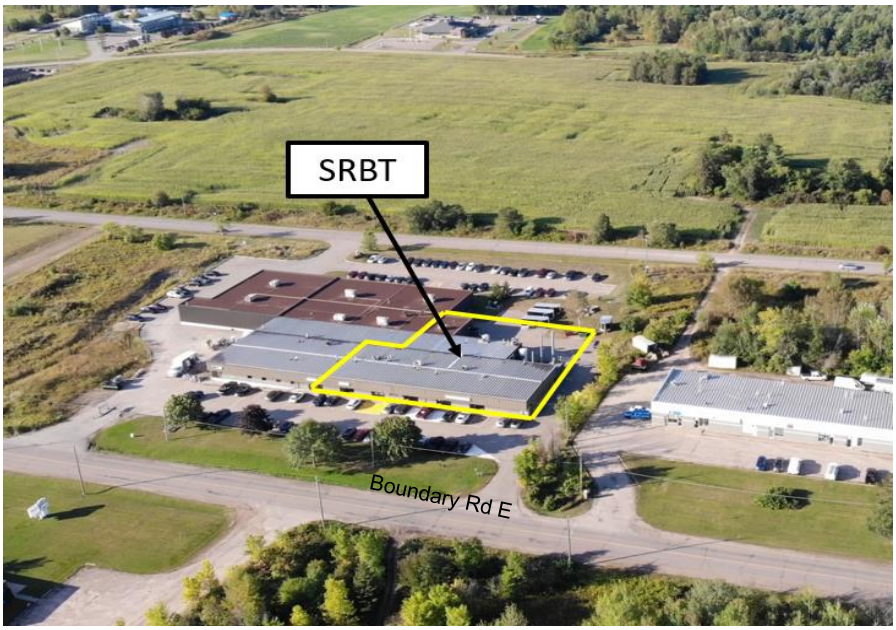


Figure 3-1: Aerial view of the SRBT facility outlined in yellow (Source: SRBT)

The SRBT facility processes tritium gas (HT) to produce sealed glass capsules coated with phosphorescent powder and filled with HT to generate continuous light. Examples of such gaseous tritium light sources include signs, markers, and tactical devices. SRBT distributes its products in Canada and internationally.

In 2023, CNSC staff conducted 2 inspections at SRBT that covered 7 SCAs. Table B-5 in Appendix B lists these inspections and there were 0 resulting NNCs.

CNSC staff are satisfied that SRBT operated safely in 2023 and in accordance with its licensing basis.

3.2 Nordion (Canada) Inc.

Nordion (Canada) Inc. (Nordion) is located in Ottawa, Ontario, and is licensed to operate a Class IB nuclear substance processing facility.

Figure 3-2: Aerial view of the Nordion facility outlined in orange (Source: Nordion/Canadian Aerial Photo Corporation)

Nordion provides cobalt-60 and gamma irradiation systems for medical devices, food safety and health care industries, and innovative applications.

In 2023, CNSC staff conducted 5 inspections at Nordion that covered 4 SCAs. Table B-6 in Appendix B lists these inspections and there were 9 resulting NNCs.

CNSC staff are satisfied that Nordion operated safely in 2023 and in accordance with its licensing basis.

3.2.1 Nordion Financial Guarantee

In February 2023, the Commission approved Nordion's revised financial guarantee (Record of Decision).

3.3 Best Theratronics Ltd.

Best Theratronics Ltd. (BTL) is licensed to operate a Class IB nuclear substance processing facility in Ottawa, Ontario.

Figure 3-3: Aerial view of the Best Theratronics Ltd. Facility (Source: Google Maps)

BTL manufactures cyclotrons and medical equipment, including cobalt-60-based external beam radiation therapy units and cesium-137 self-contained irradiators for blood irradiation.

In 2023, CNSC staff conducted 2 inspections at BTL that covered 2 SCAs. Table B-7 in Appendix B lists these inspections and the 7 resulting NNCs.

CNSC staff are satisfied that BTL operated safely in 2023 and in accordance with its licensing basis.

3.4 BWXT Medical Ltd.

BWXT Medical Ltd. (BWXT Medical) operates a Class IB nuclear substance processing facility in Ottawa, Ontario.

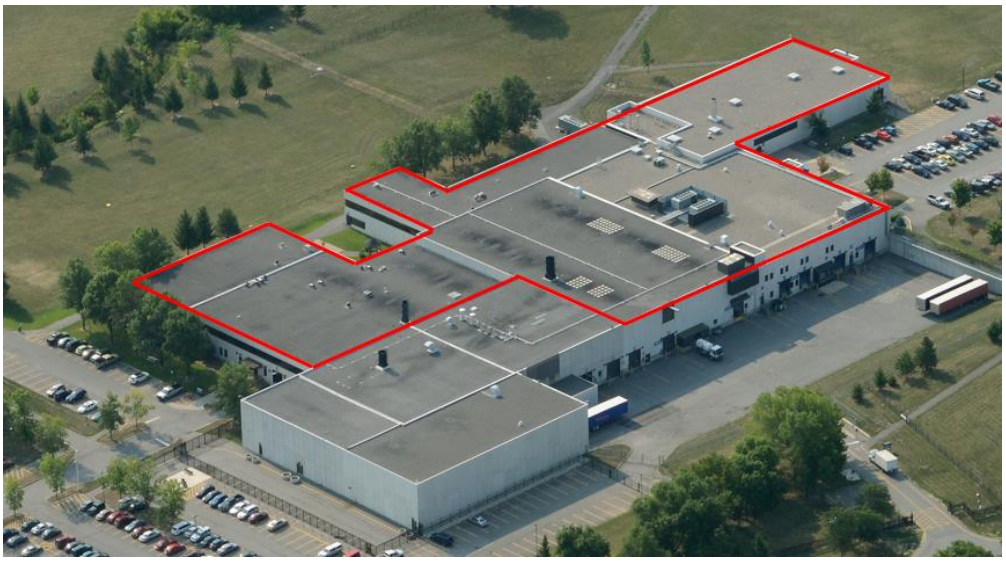


Figure 3-4: Aerial view of the BWXT Medical facility outlined in red (Source: Nordion/Canadian Aerial Photo Corporation)

BWXT Medical processes unsealed radioisotopes such as yttrium-90 and indium-111 for health and life sciences applications.

In 2023, CNSC staff conducted 1 inspection at BWXT Medical that covered 1 SCA. Table B-6 in Appendix B lists this inspection and that resulted in 1 NNC.

CNSC staff are satisfied that BWXT Medical operated safely in 2023 and in accordance with its licensing basis.

4 Research Reactors

Research reactors provide a source of neutrons that are used in a variety of academic and industrial applications, medical isotope production, and for teaching purposes.

4.1 McMaster Nuclear Reactor

McMaster University operates the McMaster Nuclear Reactor (MNR) under a Class 1A non-power reactor licence and is located in Hamilton, Ontario. MNR is a pool-type 5 MW research reactor fuelled with low-enriched-uranium (LEU), residing in an enclosed concrete containment building (Figure 4-1). McMaster University is located within the traditional territory of the Haudenosaunee and Anishinaabe nations.

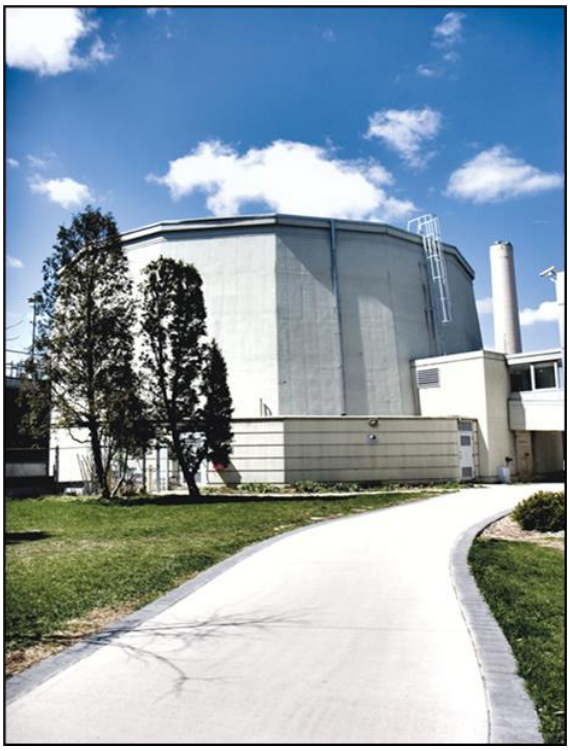


Figure 4-1: Outside view of MNR and its containment building. (source: McMaster University Website)

MNR supports applications such as medical isotope production for cancer treatment, neutron radiography for testing aircraft engine components, and irradiation of materials in support of biomedical research, material science, and earth science.

From 2021 to 2023, CNSC staff conducted 4 inspections at MNR that covered 8 SCAs. Table B-6 in Appendix B lists these inspections and there were 5 resulting NNCs.

CNSC staff are satisfied that MNR operated safely from 2021 to 2023 and in accordance with its licensing basis.

4.1.1 MNR Licence Renewal

In January 2023, McMaster submitted an application for a 20-year renewal of the MNR licence. In its application, McMaster did not request any changes to their authorized activities. Following a review of McMaster's application and supporting documents, CNSC staff's findings and recommendations were documented in CMD 24-H100, a 20 year licence was granted expiring June 2044.

4.2 Royal Military College

The Royal Military College (RMC) operates a 20 kW (thermal) SLOWPOKE-2 Reactor under a Class 1A non power reactor licence and is located in Kingston, Ontario. The research reactor is used for neutron activation analysis, neutron radioscopy, and in education programs. The reactor has been in operation since 1985. RMC is located on the traditional territory of the Huron-Wendat, Anishinaabeg and Haudenosaunee Peoples.

Figure 4-2: Aerial view of the Royal Military College facility outlined in red (Source: RMC webpage)

From 2021 to 2023, CNSC staff conducted 2 inspections at RMC that covered 14 SCAs. Table B-6 in Appendix B lists these inspections and there were 2 resulting NNCs.

CNSC staff are satisfied that RMC operated safely from 2021 to 2023 and in accordance with its licensing basis.

4.2.1 Licence Renewal

In March 2022, RMC applied to the CNSC for the renewal of its operating licence for the SLOWPOKE-2 reactor. On July 1, 2023, the Commission approved a Licence Renewal for a period of 20 years and included a requirement that RMC to present to the Commission a comprehensive mid-term update.

4.3 École Polytechnique de Montréal

École Polytechnique de Montréal (ÉPM) operates a 20 kW (thermal) SLOWPOKE-2 reactor under a Class 1A non power reactor licence and is located on the campus of the Université de Montréal, in Montréal, Quebec. The reactor is used for research, neutron activation analysis and isotope production. ÉPM is located on the traditional and unceded territory of the Kanien'keha:ka (Mohawk), a place which has long served as a site of meeting and exchange amongst nations.

Figure 3-3: Aerial view of ÉPM (Source: ÉPM Website)

From 2021 to 2023, CNSC staff conducted 1 inspection at ÉPM that covered 11 SCAs. Table B-8 of Appendix B lists this inspection and the 2 resulting NNCs.

CNSC staff are satisfied that ÉPM operated safely from 2021 to 2023 and in accordance with its licensing basis.

4.3.1 Licence Renewal

In March 2022, EPM applied to the CNSC for the renewal of its operating licence for the SLOWPOKE-2 reactor. The Commission renewed the licence on July 1, 2023, for a period of 10 years.

4.4 Saskatchewan Research Council SLOWPOKE-2

The Saskatchewan Research Council's SLOWPOKE-2 reactor was decommissioned in 2020 under a decommissioning licence. In 2021, the Commission, through a hearing in writing, issued a licence to abandon for the facility and released it from CNSC's regulatory control.

The SRC SLOWPOKE-2 facility was located within the Innovation Place Research Park in Saskatoon, Saskatchewan and was located on Treaty 6 territory, the traditional territory of Cree Peoples, and the homeland of the Métis Nation of Saskatchewan.

5 Class IB Particle Accelerators

Class IB particle accelerators are used primarily for research purposes; many scientific disciplines benefit from the study of the resulting particle interactions, including particle and nuclear physics, engineering, healthcare, and life sciences.

5.1 Canadian Light Source

The Canadian Light Source (CLS) produces intense light used for science. Scientists from around the world use the CLS to take images of samples, analyze their chemistry, or understand a sample's structure. The Canadian Light Source is operated by Canadian Light Source Incorporated and located in Saskatoon, Saskatchewan, on Treaty 6 territory and the homeland of the Métis Nation of Saskatchewan, in Saskatoon.

Figure 5-1: Inside the Canadian Light Source Facility | Flickr 1 (Source: CLSI)

From 2020-2023, CNSC staff conducted 5 inspections at CLSI, that covered 7 SCAs. Table B-8 of Appendix B lists these inspections and the resulting 13 NNCs.

CNSC staff are satisfied that CLSI is operating safely and in accordance with its licensing basis.

5.1.1 Licence Renewal and Financial Guarantee

In 2022, the Commission conducted a virtual public hearing on the renewal of CLSI's operating licence and financial guarantee. CNSC staff's assessment of the renewal application was presented publicly during the hearing as Commission member document CMD 22-H4 .

In May 2022, the Commission made a decision on the CLSI licence renewal application, as documented in the Record of Decision. In its decision, the Commission renewed CLSI's

operating licence (PA1OL-2.00-/2032) for a period of 10 years and accepted the proposed new financial guarantee.

5.2 TRIUMF Inc.

TRIUMF Inc, operates a 520-MeV proton cyclotron, 4 cyclotrons with proton beam energies of less than 50 MeV and 2 linear accelerators. TRIUMF is also operating to commission an electron accelerator facility and a processing facility under separate Class II licences. TRIUMF Inc.'s operations include particle physics research and isotope production for medical and industrial uses. TRIUMF is located in Vancouver, British Columbia and situated in the traditional territory of the Musqueam people.

Figure 5-2: CNSC staff

From 2020 to 2023, CNSC staff conducted 8 inspections that covered 7 SCAs. Table B-9 of Appendix B lists these inspections and the resulting 38 NNCs.

CNSC staff are satisfied that TRIUMF is operating safely and in accordance with its licensing basis.

5.2.1 Licence Renewal and Financial Guarantee

In 2022, the Commission conducted a virtual public hearing on the renewal of TRIUMF Inc.'s operating licence. CNSC staff's assessment of the renewal application was presented publicly during the hearing as Commission member document CMD 22-H6.B.

In June 2022, the Commission made a decision on the TRIUMF Inc. licence renewal application, as documented in the Record of Decision. In its decision, the Commission renewed TRIUMF Inc.'s operating licence (PA1OL-2.00-/2032) for a period of 10 years and accepted the proposed

new financial guarantee. In the record of decision, the Commission requested updates on TRIUMF's progress in implementing CSA N286-12 Management system requirements for nuclear facilities, as there were outstanding NNCs related to management systems at the time of renewal.

6 Regulatory Oversight

The CNSC performs regulatory oversight of licensed facilities to verify compliance with the requirements of the NSCA and the associated regulations made under it, each facility licence and licence conditions, and any other applicable standards and regulatory documents (REGDOCs).

CNSC staff use the SCA framework to assess, evaluate, review, verify and report on licensee performance. The SCA framework includes 14 SCAs, which are subdivided into specific areas that define each SCA's key components. Further information on the SCA framework can be found on the CNSC's website.

6.1 Regulatory Activities

CNSC staff conducted many risk-informed regulatory oversight activities at Canada's UNSPFs in 2023, Research Reactors in 2020-2023 and Class IB Accelerators in 2019-2023.

In addition to CNSC compliance inspections, the IAEA performs verification activities to confirm that all nuclear material in Canada remains in peaceful use. The CNSC regulatory framework requires Canadian operators to provide the access, assistance and information required for the IAEA to complete its activities. CNSC staff ensure operator compliance with these requirements.

Table 6-1, 6-2 and 6-3 presents CNSC staff's licensing and compliance verification efforts for these facilities for the reportable year.

Table 6-1: CNSC inspections, licensing, and compliance verification efforts at UNSPFs, safeguards verification activities led by the International Atomic Energy Agency (IAEA) and by CNSC staff (2023).

Licensee	Number of CNSC inspections	Person-days, compliance verification activities	Person-days for licensing activities	CNSC-led safeguards inspections	IAEA-led safeguards inspections
BRR	4	223	9	0	5
PHCF	5	384	17	0	8

CFM	3	231	21	0	6
BWXT NEC*	8	150	164	1	9
SRBT	2	70	1	0	0
Nordion	4	195	14	0	0
BTL	4	82	3	0	1
BWXT Medical	1	121	8	0	1

***Note**: During January – March 2023, 2 CNSC inspections covered both the Toronto and Peterborough facilities and starting April 2023 6 inspections were conducted at both facilities (3 each per facility); the person-days for compliance and licensing activities for the Toronto and Peterborough facilities are combined; 5 IAEA-led safeguards inspections covered the Toronto facility, and 4 covered Peterborough; 1 CNSC-led safeguards inspection occurred at the Toronto facility only.

Table 6-2: CNSC inspections, licensing, and compliance verification efforts at Research Reactors, safeguards verification activities led by the International Atomic Energy Agency (IAEA) and by CNSC staff (2021-2023).

Licensee	Number of CNSC inspections	Person-days, compliance verification activities	Person-days for licensing activities	CNSC-led safeguards inspections	IAEA-led safeguards inspections
MNR (2021)	2	85	119	0	2
MNR (2022)	1	43	59	0	0
MNR (2023)	2	86	206	0	4
RMC (2021)	1	31	6	0	0
RMC (2022)	1	85	104	3	0
RMC (2023)	0	13	55	0	0
EPM (2021)	0	10	3	0	0
EPM (2022)	0	34	134	0	0

EPM (2023)	1	38	84	0	0
SRC (2021)	0	16	50	0	0
SRC (2022)	0	12	4	0	0
SRC (2023)	0	0	1	0	0

Table 6-3: CNSC inspections, licensing, and compliance verification efforts at Class IB Accelerator safeguards verification activities led by the International Atomic Energy Agency (IAEA) and by CNSC staff (2020-2023).

Licensee	Number of CNSC inspections	Person-days, compliance verification activities	Person-days for licensing activities	CNSC-led safeguards inspections	IAEA-led safeguards inspections
TRIUMF (2020)	0	156	0	1	0
TRIUMF (2021)	5	262	160	0	0
TRIUMF (2022)	2	221	120	0	0
TRIUMF (2023)	1	195	82	0	1
Canadian Light Source (2020)	1	186	3	0	0
Canadian Light Source (2021)	1	71	130	0	0
Canadian Light Source (2022)	1	88	64	0	0
Canadian Light Source (2023)	2	141	13	0	0

6.2 Licensing

CNSC staff's licensing activities include drafting new or amended licences, preparing CMDs, and drafting or revising licence conditions handbooks (LCHs).

When CNSC regulatory documents are published, CNSC staff update the LCHs as applicable for each facility, taking into consideration the licensee's implementation plans. Appendix C provides a list of changes to UNSPFs, Research Reactors and Class IB Accelerator LCHs in their respective timeframes. CNSC staff verify the implementation as part of ongoing compliance verification activities. Appendix D provides a list of CNSC regulatory documents implemented at UNSPFs, Research Reactors and Class IB Accelerators in their respective timeframes and used by CNSC staff for compliance verification.

6.3 Compliance Verification

The CNSC ensures licensee compliance through verification, enforcement, and reporting activities. CNSC staff implement compliance plans for each site by conducting regulatory activities, including inspections, desktop reviews, and technical assessments of licensee programs, processes, and reports.

Appendix A contains a list of annual compliance reports prepared by the licensees for their reporting periods.

Appendix B contains a list of CNSC inspections carried out. All findings in these inspections were of low safety significance, and none had an impact on safety at the facilities. The licensees have taken, or have committed to take, necessary corrective actions to address the findings.

7 Assessment of Safety and Control Areas

CNSC staff assign performance ratings to licensees based on the results of regulatory oversight activities. These ratings are either "satisfactory" (SA) or "below expectations" (BE) for the UNSPFs (2023), Research Reactors (2021-2023) and Class IB Accelerators (2020-2023). Appendix F provides the SCA ratings for each licensee from 2020 to 2023.

The CNSC regulates all aspects of safety at nuclear sites in Canada, including risks to workers, the public and the environment. All 14 SCAs, discussed in the following paragraphs, have been assessed. Detailed information is provided on radiation protection, conventional health and safety, and environmental protection, since these 3 SCAs are considered the most indicative of safety performance at UNSPFs, Research Reactors and Class IB Accelerators. In particular, the SCAs of radiation protection and conventional health and safety are a good measure of the safety of workers, while the SCA of environmental protection is an appropriate measure of the safety of people and the environment.

7.1 Management System

The management system SCA covers the framework that establishes the processes and programs required to ensure that an organization achieves its safety objectives, continuously monitors its performance against these objectives, and fosters a healthy safety culture.

CNSC staff assess performance in the management system SCA by verifying the compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive. The specific areas assessed within the management system include organization; planning and controlling business activities; resource management; communication; safety culture; change management; information management; work management; problem identification and resolution; and performance assessment, improvement, and management review.

Forty-five (45) NNCs from inspections related to the management system SCA were issued for the following licensees over the reporting periods:

- BRR – 5 NNCs related to updating procedures to reflect current practices, ensuring that all work is initiated and documented through the established processes, ensuring that all calibration activities are performed according to written instructions, ensuring that periodic document reviews are performed in a timely manner, and ensuring that records are preserved and completed.
- CFM – 6 NNCs related to the scope and reporting of internal audits, document control processes, periodic document review completion, contractor oversight activities, and completion of periodic maintenance task audits.
- PHCF – 7 NNCs related to changes to management oversight inspections, change control records, contractor management documents, assessing effectiveness of corrective actions, identifying non-conforming materials in the supply chain, and document control.
- Nordion – 1 NNC related to implementing measures to ensure that records of work permit, and certificates of calibration are complete, preserved and retained in accordance with CSA Standard N286-12, Management systems for nuclear facilities.
- BWXT Medical – 1 NNC related to internal procedures regarding corrective and preventative actions.
- MNR – 2 NNCs related to work and change control, and internal audits.
- CLSI – 3 NNCs related to verification of effectiveness of corrective actions, acceptance criteria for supplier acceptability, and management review, issued in 2020.
- TRIUMF - 20 NNCs were issued related to organizational structure documentation, roles and responsibilities documentation, training and work processes, internal communication practices, document control, ensuring completeness of records, supply

chain management, trend analysis and corrective actions, change control processes, and ensuring that self assessments on compliance to CSA N286-12 are performed effectively.

The licensees have taken, or have committed to take, necessary corrective actions to address the above-noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the management system SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.2 Human Performance Management

The human performance management SCA covers activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee personnel are in all relevant job areas and have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties.

CNSC staff assess performance in the human performance management SCA by verifying the compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive.

Sixteen (16) NNCs from inspections related to the human performance management SCA were issued for the following licensees over the reporting periods:

- BWXT Toronto - 4 NNCs related to ensuring: identification of positions requiring SAT, training governance is up to date, formal evaluations of workers are completed, and trainer qualifications are clear and met.
- BWXT Peterborough - 4 NNCs related to ensuring: identification of positions requiring SAT, training governance is up to date, formal evaluations of workers are completed, and trainer qualifications are clear and met.
- Nordion - 2 NNCs related to ensuring that the training documents are developed and managed such that they are current, complete, and controlled. Also, on-the-job trainers meet and maintain the documented qualification requirements.
- RMC – 2 NNCs related training design, and development, program implementation, documentation, and record keeping.
- CLSI - 4 NNCs related to ensuring: training system governance and outputs accurately record requisite information, a consistent training change management process is implemented, an accurate and up to date training records, and the completion of self-assessments.

The licensees have taken, or have committed to take, necessary corrective actions to address the above-noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the human performance management SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.3 Operating Performance

The operating performance SCA includes an overall review of the conduct of the licensed activities and the activities that enable effective performance.

CNSC staff assess performance in the operating performance SCA by verifying that policies, programs, methods and procedures are in place for the safe operation and maintenance of nuclear facilities. Verification of compliance with the requirements of this SCA is included as part of the CNSC's compliance verification activities, including desktop reviews of annual reports, reviews of event reports and related corrective actions, and planned or reactive inspections.

Seven (7) NNCs from inspections related to the operating performance SCA were issued for the following licensees over the reporting periods:

- PHCF – 1 NNC related to procedural adherence for electronic storage of certificates of inspection for pressure vessels.
- Nordion - 1 NNC related to ensuring that events are reported to the CNSC in accordance with REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills.
- BTL - 4 NNCs related to ensuring that the sealed source database is reconciled with physical inventory as required by their governing documents, assuring that the transaction of each sealed source is known and records support this information, accuracy of shipping documents.
- EPM – 1 NNC related to the late submission of a final incident report.

The licensees have taken, or have committed to take, necessary corrective actions to address the above-noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the operating performance SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.4 Safety Analysis

The safety analysis SCA includes maintenance of the safety analysis that supports the overall safety case for the facility. Safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventive measures and strategies in reducing the effects of such hazards.

CNSC staff assess performance in the safety analysis SCA by verifying the compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive. CNSC staff verify that licensees maintain safety analysis reports (SARs) that include updated information on the description of the facility and the measures in place to protect the safety of workers, the public and the environment under normal operations, abnormal, and accident conditions. CNSC staff assess the SARs to ensure that they provide an assessment of the potential consequences and demonstrate the safety case through defence in depth.

Five (5) NNCs from inspections related to the safety analysis SCA were issued for the following licensees over the reporting periods:

- TRIUMF - 4 NNCs related to operating performance, licensing basis, notifications of operational changes and suitability of environmental monitoring.
- CLSI - 1 NNC related to reviewing and reissuing the safety analysis as per the MS performance expectation.

The licensees have taken, or have committed to take, necessary corrective actions to address the above-noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the safety analysis SCA for the timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.5 Physical Design

The physical design SCA relates to activities that impact the ability of structures, systems and components to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account.

CNSC staff assess performance in the physical design SCA by verifying compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive. CNSC staff verify the physical design SCA requirements by ensuring the implementation of national codes and standards for structural design and

maintaining authorized inspection agency formal agreements including those relating to pressure-retaining programs where applicable.

There were zero (0) NNCs issued from any inspection related to the physical design SCA.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the physical design SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.6 Fitness for Service

The fitness for service SCA covers activities that impact the physical condition of structures, systems, and components to ensure that they remain effective over time. This area includes programs that verify all equipment is available to perform its intended design function when called upon to do so.

CNSC staff assess performance in the fitness for service SCA by verifying compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive. CNSC staff verify that the programs cover activities that affect the physical condition of structures, systems and components over time. Specific areas are assessed within this SCA to ensure that the fitness for service programs are supported by detailed procedures on preventative maintenance, measuring and testing of equipment and new equipment validation.

Three (3) NNCs from an inspection related to the fitness for service SCA was issued for the following licensees over the reporting periods:

- BRR – 1 NNC related to ensuring maintenance records for safety significant equipment are generated and retained appropriately.
- Nordion – 1 NNC related to ensuring that records of work permit, and certificates of calibration are complete, preserved and retained in accordance with CSA Standard N286-12, Management systems for nuclear facilities.
- MNR – 1 NNC related to maintenance records.

The licensees have taken all necessary corrective actions to address the above-noted NNC. The findings were of low safety significance and did not affect the health and safety of workers, people and the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the fitness for service SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.7 Radiation Protection

The radiation protection SCA covers the implementation of a radiation protection program in accordance with the *Radiation Protection Regulations*. The program must ensure that contamination levels and radiation doses received by individuals are monitored, controlled, and maintained as low as reasonably achievable (ALARA).

Twenty (20) NNCs from inspections related to the radiation protection SCA were issued for the following licensees over the reporting periods:

- CFM – 1 NNC related to visually obstructed radiation hazard signage.
- PHCF – 7 NNCs related to providing clarity of Radiation Protection (RP) requirements for all licensed locations and areas, posting of radiation warning signage, and calibrating and maintaining RP instrumentation and equipment.
- BWXT NEC – 1 NNC related to a worker not wearing a thermoluminescent dosimeter in a designated area.
- Nordion – 3 NNCs related to ensuring that waste receptables are properly labelled, documenting, and implementing a process for conducting follow up into lost dosimetry, requiring that previous calibration stickers are removed or defaced prior to returning the unit to service.
- MNR – 1 NNC related to respirator users not receiving continuing training in respiratory use, as scheduled.
- TRIUMF – 4 NNCs related to the posting of radiation warning signs and compliance with the *Radiation Protection Regulations*.
- CLSI – 3 NNCs issued in 2021 related to required program updates to comply with the *Radiation Protection Regulations* and adding update to the isotopes list in the LCH.

The licensees have taken, or committed to take, corrective actions to address the above noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility. CNSC staff rated the radiation protection SCA at all UNSPFs, Research Reactors and Class IB Accelerators as satisfactory.

Appendix J contains data on doses to workers for the UNSPFs, Research Reactors and Class IB Accelerators from 2019 to 2023.

Application of ALARA

CNSC staff confirmed that all UNSPFs, Research Reactors and Class IB Accelerators continued to implement radiation protection measures to keep radiation exposures and doses to persons ALARA. The CNSC requirement for licensees to apply the ALARA principle has consistently resulted in these doses staying well below regulatory dose limits.

Worker dose control

Radiation protection programs include dosimetry methods, identification of workers requiring nuclear energy worker (NEW) status, and the methods for radiation safety of workers. Radiation protection programs vary, depending on the radiological hazards present and the expected magnitude of doses received by workers. CNSC staff confirmed that all UNSPFs, Research Reactors and Class IB Accelerators monitored and controlled the radiation exposures and doses received by all persons present at their licensed facilities, including workers, contractors, and visitors. Direct comparison between facilities of doses received by NEWs does not necessarily provide an appropriate measure of a licensee's effectiveness in implementing its radiation protection program, since radiological hazards differ across these facilities due to complex and varying work environments.

Radiation protection program performance

CNSC staff conducted regulatory oversight activities at UNSPFs, Research Reactors and Class IB Accelerators to verify that the licensees' radiation protection programs complied with regulatory requirements. These oversight activities included inspections, desktop reviews, and compliance verification activities specific to radiation protection. Through these activities, CNSC staff confirmed that all these licensees have effectively implemented their radiation protection programs to control occupational exposures to workers and keep doses ALARA.

Action levels

Action levels for radiological exposures are established as part of the licensees' radiation protection programs. Each licensee is responsible for identifying the parameters of its own program(s) to represent timely indicators of potential losses of control of the program(s). These licensee-specific action levels may also change over time, depending on operational and radiological conditions.

If an action level is reached, it triggers the licensee to determine the cause, notify the CNSC and, if applicable, take corrective action to restore the effectiveness of the radiation protection program. It is important to note that occasional action level exceedances indicate that the action level chosen is likely an adequately sensitive indicator of a potential loss of control of the program.

The following RP action level exceedances occurred at the UNSPFs:

In 2023, Cameco reported 2 radiological action level exceedances at the PHCF. In accordance with Cameco's corrective action process, investigations were performed for the events that resulted in the exceedances. The corrective actions were accepted by CNSC staff, and the verification of these actions will be performed during follow-up compliance inspections.

- The first action level exceedance occurred in July 2023. A contractor's pre-shift urine sample result of 340 micrograms of Uranium per litre (ugU/L) exceeded the action level

set for short-term NEW contractors of 80 ugU/L per day. The contractor was performing work under respiratory protection. However, loose radioactive material was not removed from their coveralls prior to removing (doffing) their respirator, leading to an intake. Cameco RP and safety staff reviewed the respiratory protection requirements with the contractor. A site wide bulletin was also issued to explain lessons learned and provide a reminder to workers and contractors of the importance of following the respiratory protection program when doffing respirators. It is noted that the assigned committed effective dose to the contractor NEW from this event was 0.04 mSv, which is well below CNSC regulatory effective dose limits.

- The second action level exceedance occurred in September 2023. A contractor NEW was working in the UO2 plant on the removal of an old baghouse unit. A full enclosure of the work area had been constructed using scaffolding and tarping for the task. The removal of the loose UO2 powder from the baghouses was being completed using a drum vacuum system. However, there was an issue with system failing, which resulted in a uranium release within the building and outside the enclosure where the contractor NEW was situated without respiratory protection. The contractor NEW subsequently received an unplanned intake, with a committed effective dose assigned of 8.6 mSv, which exceeded the action level for lung counting of 5 mSv but remained below the regulatory limit. A new site-wide procedure is to be implemented by July 2024, which will detail requirements to follow for the construction of an enclosure. Should an enclosure need to be constructed prior to finalizing the new procedure, Cameco's PHCF Engineering group will review the enclosure designs to ensure that it is constructed in a safe manner.

In May 2023, Nordion reported 1 radiological action level exceedance. In accordance with Nordion's corrective action process, investigations were performed for the event that resulted in the exceedance. The corrective actions were accepted by CNSC staff, and the verification of these actions will be performed during follow-up compliance inspections.

- In March of 2023, a worker was found to have a contaminated pen in their lab coat. The pen was disposed of correctly however the associated dose was not noted until the employee's licensed dosimetry report was received recording a whole-body dose of 2.05 mSv, which exceeded Nordion's action level of 2 mSv effective dose per reporting period. As a consequence of this event, contamination monitoring procedures have been updated to include monitoring of lab coats. Clear direction has also been added to procedures for when a surveyor is to be called for follow up after a contaminated object has been found.

Radiological hazard control

CNSC staff verified that UNSPFs continued to implement acceptable measures to monitor and control radiological hazards in their facilities. These measures included delineation of zones for contamination control purposes and in-plant air-monitoring systems. Licensees demonstrated that they have implemented workplace monitoring programs to protect workers. The licensees have also demonstrated that levels of radioactive contamination were below limits within their facilities throughout the year.

Conclusion

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the radiation protection SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.8 Conventional Health and Safety

The conventional health and safety SCA covers the implementation of a program to manage workplace safety hazards and to protect workers.

Appendix K contains health and safety information for each UNSPFs, Research Reactors and Class IB Accelerators from 2019 to 2023.

Performance

Employment and Social Development Canada (ESDC) and the CNSC regulate conventional health and safety programs at UNSPFs, Research Reactors and Class IB Accelerators. CNSC staff monitor compliance with regulatory reporting requirements and, when a concern is identified, consult with ESDC staff.

Licensees are required to report to the CNSC as directed by section 29 of the *General Nuclear Safety and Control Regulations* (GNSCR), including reports on serious illnesses or injuries incurred or possibly incurred as a result of a licensed activity.

A key performance measure for the conventional health and safety SCA is the number of lost-time injuries (LTIs) that occur per year. An LTI is an illness or injury that takes place at work and results in the worker being unable to return to work to carry out their duties for a period of time.

Eight (8) LTIs that were incurred or possibly incurred as a result of a licensed activity were reported by the following licensees over the reporting periods:

- BRR - 1 LTI was recorded for 2023: a worker who was walking up the stairs, pulled on the handrail and felt a tweak in their midback. The next morning the pain had worsened, and this led to lost time.
- BWXT Medical - 2 LTIs were recorded for 2023: a head injury while performing an inspection on a ladder, and an elbow injury after slipping on a wet.
- BTL -1 LTI was recorded for 2023. A worker injured his hand and required outside medical attention and was a lost time incident.
- CLSI - 1 LTI recorded in 2020 for a worker was using a wet saw to cut concrete shielding blocks. Cooling water saturated the wrist of the worker between the gloves and long-sleeved shirt worn, resulting in a prolonged alkaline exposure, and causing a chemical burn. A root cause analysis was completed, resulting in several work process improvements aimed at reducing the risk of this type of injury.
- CLSI - 2021 LTI was recorded for a worker who bumped their head on the bottom of a partially opened overhead door, while emptying water into a drain near the door. The usual location for emptying the bucket was under renovation. CLSI reminded workers to fully open overhead doors before passing underneath, and the worker was informed to use an alternate nearby location to empty the bucket.
- CLSI - 2022 LTI was recorded for a worker who was stepping down from a diffractometer table in a beamline secondary enclosure when their leg was caught in an overhead crane chain, stumbled, and fell on the ground, resulting in a lower back injury. Corrections were implemented to improve housekeeping and cable management practices in the area.
- CLSI - 2023 LTI was recorded for a worker who tweaked a back muscle. Worker returned to work the next day but did not finish their shift. An ergonomic assessment was completed for the worker. CLSI developed and delivered ergonomic training for all our custodial staff to help reduce the risk of a recurrence of a work-related ergonomic injury. No further injuries or concerns have been reported.

Practices

Licensees are responsible for developing and implementing conventional health and safety programs for the protection of their workers. These programs must comply with Part II of the *Canada Labour Code*.

CNSC staff conducted desktop reviews and inspections at all UNSPFs, Research Reactors and Class IB Accelerators to verify compliance of the licensees' conventional health and safety programs with regulatory requirements.

Eight (8) NNC from an inspection related to the conventional health and safety SCA was issued for the following licensee over the reporting periods:

- BRR – 2 NNCs related to ensuring eye wash stations are maintained in a clean state and ensuring that all WHMIS placards and workplace labels comply with WHMIS 2015.

- PHCF – 2 NCCs related to management's monthly review of key performance indicators (KPIs), and distribution of the annual KPI report.
- BWXT NEC Peterborough - 2 NNCs related to workplace safety committee practices and labelling of hazardous containers.
- BTL - 1 NNC regarding ensuring that all signage is in good condition and accurately reflects the hazards and Personal Protection Equipment requirements of the facility.
- MNR – 1 NNC related to housekeeping practices.

The licensees have taken, or committed to take, corrective actions to address the above noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

Awareness

Licensees are responsible for ensuring that workers have the knowledge to identify workplace hazards and take the necessary precautions to protect against those hazards. This is accomplished through training and ongoing internal communications with workers.

During inspections, CNSC staff verify that workers are trained to identify hazards at the facilities. CNSC staff confirmed that the UNSPFs, Research Reactors and Class IB Accelerators have effectively implemented their conventional health and safety programs to keep workers safe.

Conclusion

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the conventional health and safety SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.9 Environmental Protection

Protection of the environment and the public are linked in the Environmental Protection SCA. This SCA covers programs that identify, control, and monitor all releases of radioactive and hazardous substances, and the effects on the environment and people from facilities or as a result of licensed activities.

Based on regulatory oversight activities, CNSC staff rated the Environmental Protection SCA at all UNSPFs, Research Reactors and Class IB Accelerators as "satisfactory".

Five (5) NNCs from inspection related to the environmental protection SCA were issued for the following licensee over the reporting periods:

- BRR – 1 NNC related to updating environmental sampling procedures to reflect current practices.

- Nordion - 1 NNC related to updating the locations of the environmental TLDs in their documentation.
- TRIUMF – 3 NNCs related to environmental management system documentation, internal communication, and performing an annual management review.

The licensees have taken, or committed to take, corrective actions to address the above noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

Appendix G provides the total annual releases of radionuclides for the UNSPFs, Research Reactors and Class IB Accelerator from 2019 to 2023. Appendix H contains data on dose to the public from 2019 to 2023. Appendix I contains supplemental environmental data.

Effluent and emissions control (releases)

All UNSPFs, Research Reactors and Class IB Accelerator implement effluent monitoring programs commensurate with the risks of their operations. Airborne and waterborne releases of radioactive and hazardous substances at UNSPFs, Research Reactors and Class IB Accelerators remained below regulatory limits during their reporting timelines.2023.

Action levels

Action levels serve as an early warning system to ensure that licensees are carefully monitoring their operations and performance to prevent release limits from being exceeded. Action level exceedances are reportable to the CNSC.

Licensee performance is not evaluated on the number of action level exceedances in a given period, but rather on how the licensee responds and implements corrective actions to enhance program performance and prevent reoccurrence. Licensees are required to periodically review their action levels to validate their effectiveness.

The following Environmental Protection action level exceedances occurred at the UNSPFs:

- In 2023, PHCF reported 11 action level exceedances for January 4-5, 13-15, 17-18, March 25-26, and April 5-6 monitoring periods, for uranium in sanitary sewer discharges (daily composite sample). There were no significant impacts to the environment as a result of this event.

CNSC staff concluded that there was no impact to workers, the public or the environment as a result of these action level exceedances. CNSC staff reviewed the licensee's corrective actions in relation to the exceedances and are satisfied with the licensee's responses.

Environmental management system

The CNSC requires each licensee to develop and maintain an Environmental Management System (EMS) that provides a framework for integrated activities related to environmental

protection. The EMS is described in the Environmental Management Program and includes activities such as the establishment of annual environmental objectives, goals, and targets. Licensees conduct internal audits of their programs at least once a year. As part of regular compliance verification, CNSC staff review and assess these objectives, goals, and targets. CNSC staff determined that the UNSPFs, Research Reactors and Class IB Accelerators established and implemented their EMS in compliance with CNSC regulatory requirements.

Assessment and monitoring

CNSC staff verify that UNSPFs, Research Reactors and Class IB Accelerators have environmental monitoring programs commensurate with the risks of the operations at each of their facilities. The environmental monitoring programs are designed to monitor releases of radioactive and hazardous substances, and to characterize the quality of the environment associated with the licensed facility. CNSC staff determined that the UNSPFs, Research Reactors and Class IB Accelerators established and implemented environmental monitoring programs in compliance with CNSC regulatory requirements, where applicable.

Environmental risk assessment

An Environmental Risk Assessment (ERA) of nuclear facilities is a systematic process used by licensees to identify, quantify, and characterize the risk posed by releases of radiological and hazardous substances and physical stressors on representative human and non-human biota receptors, including the magnitude and extent of the potential effects associated with a facility.

REGDOC 2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures* includes a requirement for an ERA in accordance with CSA N288.6, *Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills*. Facility ERAs are to be reviewed on a 5-year cycle or more frequently if major facility changes are proposed that would trigger a predictive assessment.

In general, all the UNSPF facilities have ERAs which are compliant with CSA 288.6. In 2023, BTL worked on addressing CNSC staff comments on its ERA regarding compliance with CSA 288.6 with a revised version submitted in April 2024.

For the research reactors, MNR and RMC have an ERA in compliance with CSA N288.6. ÉPM submitted an ERA to the CNSC in late 2022. A revision is expected later in 2024 to address CNSC staff comments in order to be compliant with CSA N288.6.

For the Class IB accelerators, TRIUMF and CLSI have an ERA in compliance with CSA N288.6.

Protection of people

The protection of the public within the environmental protection SCA is related to ensuring that members of the public are not exposed to unreasonable risk with respect to hazardous and nuclear substances released from the licensed facilities. Licensees use effluent and environmental monitoring programs to verify that releases of hazardous substances do not result in environmental concentrations that may affect public health. CNSC staff receive reports

of discharges to the environment in accordance with reporting requirements outlined in the licence and the LCH. Based on assessments of the programs at the UNSPF, Research Reactors, and Class IB Accelerators CNSC staff concluded that the public continues to be protected from facility emissions of hazardous substances.

Estimated dose to the public

The maximum dose to the public from licensed activities is calculated by considering monitoring results from air emissions, liquid effluent releases and gamma radiation. The CNSC's requirement to follow the ALARA principle, taking into account social and economic factors, means that licensees must monitor their facilities and keep doses to the public below the annual public dose limit of 1 millisievert per year (mSv/year) prescribed in the *Radiation Protection Regulations*.

Table H-1 of Appendix H compares estimated public doses from 2019 to 2023 for the UNSPFs, Research Reactors, and Class IB Accelerators. Estimated doses to the public from all these facilities continued to be well below the regulatory annual public dose limit of 1 mSv/year.

Conclusion

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators have implemented their environmental protection programs satisfactorily for the reportable timeframes. The licensees' programs are effective in protecting the health and safety of people and the environment. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.10 Emergency management and fire protection

The emergency management and fire protection SCA covers emergency plans and emergency preparedness programs that exist for emergencies and for non-routine conditions.

CNSC staff assess performance in the emergency management and fire protection SCA by verifying the compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive. Specific areas assessed within this SCA include licensee response to conventional and nuclear events, both onsite and offsite, and events that can affect the facility. CNSC staff ensure that comprehensive fire protection programs are also in place to minimize the risk to the health and safety of persons and to the environment from fire, through appropriate fire protection system design, fire safety analysis, fire-safe operation, and fire prevention.

Fourteen (14) NNCs from inspections related to the emergency management and fire protection SCA were issued for the following licensees over the reporting periods:

- CFM – 6 NNCs related to fire separations (2 NNCs), transient combustibles, flammable liquids storage, compressed gases storage, and records associated with inspections of specific fire protection equipment.
- BTL – 1 NNC related to ensuring unrestricted access to emergency routes and equipment.
- CLSI – 2 NNCs related to alignment of fire watch requirements with CSA N393 Fire protection for facilities that process, handle, or store nuclear substances, and fire separations inspection program.
- TRIUMF – 5 NNCs related to Emergency Management System, drill program and conduct, emergency personnel and equipment resources deficiencies related to Emergency Management.

The licensees have taken, or committed to take, corrective actions to address the above noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the emergency management and fire protection SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.11 Waste Management

The waste management SCA covers internal waste-related programs that form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. This SCA also covers the planning for decommissioning.

CNSC staff assess performance in the waste management SCA by verifying the compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive. CNSC staff ensure that the licensees properly manage wastes throughout the lifecycle of a nuclear facility, which includes maintaining an up-to-date waste inventory and ensuring continued waste tracking.

The CNSC requires that licensees have a decommissioning plan and financial guarantee to ensure that sufficient financial resources are available to fund all approved decommissioning activities. CNSC staff confirmed that the financial guarantees remain valid, in effect, and sufficient (APPENDIX E).

Three (3) NNCs from inspections related to the waste management SCA were issued for the following licensees over the reporting periods:

- BRR – 2 NNCs related to documenting operating practices to ensure the incinerator operations is within its operating limits and conditions and ensuring that all

contaminated combustible material waste received at BRR is based on an approved waste acceptance criteria.

- BTL - 1 NNC related to ensuring that all radioactive or likely radioactive waste in their facility is handled in such a way that the risk of contamination is minimized.

The licensees have taken, or committed to take, corrective actions to address the above noted NNCs. The findings were of low safety significance and did not affect the health and safety of workers, people or the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the waste management SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.12 Security

The security SCA covers the programs required to implement and support the security requirements stipulated in the regulations, licence, orders, or expectations for the facility or activity.

CNSC staff assess performance in the security SCA by verifying the compliance of licensee documents and programs through desktop reviews and through compliance verification inspections that are planned or reactive. Specific areas assessed within this SCA include programs and procedures relating to access control, response arrangements, security practices, cyber security and drills and exercises. CNSC staff ensure that the security programs in place prevent the loss, unauthorized removal or sabotage of nuclear substances, nuclear materials, prescribed equipment, and information.

Security inspections and details of security arrangements with the licensees are protected and not publicly available.

One (1) NNC from inspections related to the security management SCA were issued for the following licensees over the reporting periods:

- Nordion - 1 NNC related to refresher training on security awareness.

The licensee has taken all necessary corrective actions to address the above noted NNCs. The finding was of low safety significance and did not affect the health and safety of workers, people and the environment, or the safe operation of the facility.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the security SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.13 Safeguards and Non-proliferation

The safeguards and non-proliferation SCA cover the programs and activities required for the successful implementation of the obligations arising from the Canada/IAEA safeguards agreements, as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons* (NPT).

CNSC staff assess performance in the safeguards and non-proliferation SCA by verifying licensee compliance through desktop reviews and in-field activities, including participation in IAEA verification activities (see table 6-4). CNSC staff verify that licensees meet Canada's international safeguards obligations as well as other measures arising from the NPT. CNSC staff ensure that the licensees have implemented and maintained effective programs to allow the implementation of both safeguards measures and non-proliferation commitments.

CNSC staff continue to monitor the facility compliance with REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*. Licensees require a licence, separate from the licensing of their operations, for the import and export of controlled nuclear substances, equipment and information identified in the *Nuclear Non-proliferation Import and Export Control Regulations*.

One (1) NNCs from the review of the safeguards and non-proliferation program was issued to the following licensee over the reporting period:

- MNR was requested to take appropriate actions to ensure that nuclear material accountancy reports and updates to the Design Information Questionnaire are submitted to the CNSC on a timely basis.

In addition, EPM was rated as BE for 2023 for this SCA. EPM failed repeatedly to provide safeguard-related information in a timely fashion. As part of EPM's corrective actions in response to the warning letter that the CNSC issued (see section 9.3 of Events and other matters of regulatory interest), and subsequent meetings with CNSC staff, EPM has prioritized the completion of a safeguards program document to address these matters. There were no impacts to safety.

Otherwise, CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the safeguards and non-proliferation SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

7.14 Packaging and Transport

The packaging and transport SCA covers the safe packaging and transport of nuclear substances to and from licensed facilities. CNSC staff assess performance in the packaging and transport SCA by verifying compliance of licensee documents and programs through desktop reviews and

through compliance verification inspections that are planned or reactive. CNSC staff ensure that all elements of package design, package maintenance, and the registration for use of certified packages are in compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR) and *Transportation of Dangerous Goods Regulations* (TDGR).

One (1) NNC from inspections related to the packaging and transport SCA was issued for the following licensees over the reporting periods:

- BRR - 1 NNC related to ensuring that the information provided in transport documents are in accordance with the TDGR and the PTNSR.

The licensee has taken corrective actions to address the above noted NNC. The findings was of low safety significance and did not affect the health and safety of workers, people, or the environment.

CNSC staff concluded that the UNSPFs, Research Reactors and Class IB Accelerators met regulatory requirements and maintained satisfactory ratings in the packaging and transport SCA for the reportable timeframes. CNSC staff will continue to monitor performance through regulatory oversight activities pertaining to this SCA.

8 Consultation, Engagement and Public Disclosure

8.1 Indigenous Consultation and Engagement

The common-law duty to consult with Indigenous Nations and communities applies when the Crown contemplates actions that may adversely affect potential or established Indigenous and/or treaty rights. The CNSC ensures that all of its licence decisions under the NSCA uphold the honour of the Crown and consider Indigenous peoples' potential or established Indigenous and/or treaty rights pursuant to section 35 of the *Constitution Act, 1982.*

The facilities and activities regulated by the CNSC and subject to engagement activities as outlined in this Regulatory Oversight Report, fall within the traditional and/or treaty territories of many Indigenous Nations and communities (Appendix M). CNSC staff efforts in the reporting timeframes supported the CNSC's ongoing commitment to meet its consultation obligations and build positive relationships with Indigenous peoples with interests in theses facilities and activities. The CNSC's ongoing Indigenous engagement practices include:

- Sharing information and discussing topics of interest with Indigenous Nations and communities.
- Seeking feedback and input on CNSC processes.
- Responding to issues and concerns.
- Collaborating and two-way dialogue on an ongoing basis.
- Collaborating on drafting relevant sections of CNSC reports.
- Providing opportunities to participate in environmental monitoring through the CNSC's Independent Environmental Monitoring Program (IEMP); and,
- Funding opportunities through the CNSC's Participant Funding Program (PFP) to support participation in Commission proceedings and ongoing regulatory activities and build knowledge and capacity through the CNSC's Indigenous and Stakeholder Capacity Fund.

8.2 CNSC Engagement Efforts

CNSC staff's engagement with Indigenous Nations and communities included conducting engagement activities specific to relevant licensing and Commission hearing processes during the reporting timeframes for this ROR. For the research reactors, this included the licence renewals for RMC and EPM SLOWPOKE-2 research reactors (2022/2023) and MNR (2023). For the Class IB accelerators, this included continuing engagement relating to the 2022 Class IB license issued to Canadian Light Source, and the accelerator operating license granted in 2022 to TRIUMF. CNSC staff conducted engagement with potentially interested Indigenous Nations in relation to these Class IB licenses in 2023 and did not receive any specific concerns or

expressed interest from Indigenous Nations and Communities. CNSC staff remain available to answer any questions or provide information about these facilities and CNSC's regulatory oversight role upon request. CNSC staff's engagement in relation to each of these applications and regulatory processes included notifying identified Nations and communities about the application, sharing information about opportunities to participate and get involved, hosting meetings, making funding available through the CNSC's Participant Funding Program (PFP), providing regular updates, and offering to meet to discuss any questions or concerns.

To ensure that all identified Indigenous Nations and communities (see Appendix O) were made aware of this 2023 ROR, CNSC staff provided them with a notice of the PFP opportunity to review and comment on the ROR, as well as the opportunity to submit a written intervention and/or appear before the Commission as part of the Commission meeting. CNSC staff will send copies of this report to all Indigenous Nations, communities and organizations who had requested that they be kept informed of activities at the facilities covered in this report. CNSC staff will offer to hold meetings and anticipates scheduling an information session in the fall of 2024 with the identified Nations and communities to discuss the 2023 ROR and answer any related questions.

8.3 Engagement on Monitoring Activities

CNSC staff have continued to engage and collaborate with Indigenous Nations and communities on the CNSC's Independent Environmental Monitoring Program (IEMP). CNSC staff have made it a priority to ensure that IEMP sampling reflects Indigenous Knowledge, land use, and values, where possible.

In advance of the 2022 IEMP sampling campaign at TRIUMF and 2023 IEMP sampling campaign around the BWXT Medical, Nordion, BRR, and MNR, notification emails were sent to Indigenous Nations and communities near the previously mentioned facilities to notify them of the sampling campaigns and to seek input on the applicable sampling plans. CNSC staff invited each interested Nation and community to provide and share Indigenous Knowledge, as well as suggestions for species of interest, valued components, and potential sampling locations where traditional practices and activities may take place. A representative of the Mississauga First Nation (MFN) joined the CNSC field team to collect samples on MFN territory around BRR. As part of the sampling field work, CNSC staff and the MFN discussed the IEMP in more detail and related aspects of the CNSC's Environmental Protection Framework. The CNSC's sampling team demonstrated sampling techniques as well as packaging and chain of custody procedures. Soil and water samples were collected in locations important to the community, such as a playground, baseball diamond, and Elders Lodge. CNSC staff also met with MFN representative's multiple times during the sampling campaign and made plans for continued engagement activities throughout 2024.

CNSC staff truly appreciated the engagement, discussions, engagement and participation by the Indigenous Nations and Communities in the sampling campaigns and look forward to future

collaboration on the IEMP and other sampling initiatives. Once the results are available for each of the sampling campaigns, CNSC staff are always open to will work with each Indigenous Nation and community to communicate the results to their respective leadership and community members, including collaboration on easy-to-read results cards that can be shared with community members. The CNSC is committed to continuing to engage with interested Indigenous Nations and communities with regards to the IEMP, to ensure that sampling plans and activities are reflective of and incorporates Indigenous Knowledge, values and perspectives.

In 2023, CNSC and Environment and Climate Change Canada (ECCC) engaged with participating Indigenous Nations and communities and Environmental Non-Government Organizations in Phase 1 of the Regional Information and Monitoring Network for the Ottawa River Watershed (RIMNet) Initiative. RIMNet is an initiative to improve information sharing and documentation regarding the environmental aspects of past, existing, and proposed nuclear facilities in the Ottawa River Watershed Basin. RIMNet aims to improve understanding of environmental effects, including cumulative effects of past, existing, and proposed nuclear facilities.

The Algonquins of Pikwàkanagàn First Nation, Kebaowek First Nation, Kitigan Zibi Anishinabeg, and Ottawa Riverkeeper have been engaging with CNSC and ECCC staff to share knowledge, perspectives, and priorities in relation to the RIMNet initiative. Participants met with CNSC and ECCC quarterly to receive updates on data collection and analysis, review of the draft Phase 1 Report, which included contributing to sections of the report where they may have interests, as well as sharing resources and/or Indigenous Knowledge, as appropriate. More information and updates can be found at: Regional Information and Monitoring Network for the Ottawa River Watershed Basin.

8.4 Tracking of ROR Requests, Concerns, and Comments

In direct response to the Commission's action (RIB 26782) following the presentation of the 2021 RORs, CNSC staff have established issues and concerns tracking tables for each Indigenous Nation or Community who intervene in the CNSC Commission proceedings.

These tables capture the requests, concerns and comments included in the interventions in relation to each ROR, or other Commission proceedings as appropriate, from each Indigenous Nation and community. CNSC staff's responses and proposed actions are also included, as appropriate. The tracking tables are shared with each Indigenous Nation and community for validation and discussion in order to make progress on addressing their requests and concerns collaboratively.

CNSC staff have included Appendix P which provides an overview of issues, concerns and recommendations submitted via intervention by each Indigenous Nation and community. The

information presented in Appendix D is derived from interventions submitted specifically for the 2022 ROR and these conversations carried forward into 2023.

CNSC staff have formalized 10 ToR long-term engagement relationships with interested Indigenous Nations and communities through TOR collaboratively developed with each interested Indigenous Nation or community. A summary of the engagement activities that occurred in 2023 in relation to each of the existing ToRs for long-term engagement is included in Appendix N. These summaries were collaboratively drafted between CNSC staff and each respective Indigenous Nation or community.

In 2023, the CNSC developed and finalized a ToR for long-term engagement with the Hiawatha First Nation. This is in addition to existing ToRs with Indigenous Nations and communities with an interest in the facilities and activities covered by this ROR which include: Algonquins of Pikwàkanagàn First Nation, Curve Lake First Nation, the Mississaugas of Scugog Island, the Saugeen Ojibway Nation, the Metis Nation of Ontario and the Historic Saugeen Metis. CNSC staff are working on developing several others in the coming years with interested Indigenous Nations and communities. CNSC staff remain open to developing ToRs for long-term engagement with other Indigenous Nations and communities interested in the facilities and activities covered by this ROR.

8.5 CNSC Terms of Reference for Long-Term Engagement with Indigenous Nations and Communities

CNSC staff have formalized long-term engagement relationships with interested Indigenous Nations and communities through Terms of Reference (ToR) collaboratively developed with each Nation or community. The ToRs and associated work plans, include regular meetings, an accountability and governance structure, specific collaborative activities, as well as topics, facilities, sites, and projects of interest. A summary of the engagement activities that occurred in 2023 in relation to each of the existing ToRs for long-term engagement with these Nations and communities was collaboratively drafted and signed by CNSC and each respective Indigenous Nation or community and can be found in Appendix N. The CNSC has developed and finalized ToRs for long-term engagement with the following Indigenous Nations and communities with an interest in UNSPF, Research Reactors and Class IB Accelerators sites and activities.

- Algonquins of Pikwàkanagàn First Nation
- Mississaugas of Scugog Island First Nation
- Kebaowek First Nation
- Curve Lake First Nation
- Métis Nation of Ontario

The CNSC is also working on developing a number of other ToRs in the coming years with interested Indigenous Nations and communities. CNSC staff remain open to developing ToRs for long-term engagement with other interested Nations and communities with nuclear facilities in their territories upon request. A summary of the engagement activities that occurred in 2023 in relation to each of the existing ToRs for long-term engagement with these Nations and communities was collaboratively drafted between CNSC staff and each respective Indigenous Nation or community and can be found in (Appendix A).

8.6 Licensee Engagement Activities

CNSC staff continued to monitor the engagement work conducted by the UNSPF, Research Reactors and Class IB Accelerators licensees to ensure that there was active engagement and communication with Indigenous Nations and communities interested in their facilities, and that there were also activities in relation to relevant licensing and Commission hearing processes that occurred.

CNSC staff confirmed that the licensees have Indigenous engagement and outreach programs. Throughout the reporting timeframes, the UNSPF, Research Reactors and Class IB Accelerators, licensees met and shared information with interested Indigenous Nations, communities, and organizations. These efforts have included emails, letters, meetings, as well as site visits and tours, upon request.

In response to concerns raised by Algonquins of Pikwákanagán (AOPFN) in their 2022 UNSPF ROR intervention regarding their engagement with BTL and SRBT, CNSC staff met with SRBT and BTL to discuss this feedback, their future engagement plans, and when appropriate provided best-practices resources to support positive improvements in the proponent's ongoing relationships with AOPFN. CNSC staff will continue to work with all licensees to discuss concerns and feedback provided by Indigenous Nations and Communities relating to ongoing engagement.

The CNSC encourages licensees to continue to develop relationships and engage with Indigenous groups who have expressed an interest in the licensee’s activities.

Through 2021 to 2023, Research Reactors licensees met and shared information with interested Indigenous Nations, communities, and organizations. Throughout 2020-2023, Class IB Accelerator licensees met and shared information with interested Indigenous Nations, communities, and organizations. These efforts have included emails, letters, meetings, as well as site visits and tours, upon request. The CNSC encourages licensees to continue to develop relationships and engage with Indigenous groups who have expressed an interest in the licensee’s activities.

8.7 Public Consultation and Engagement

The NSCA mandates that the CNSC disseminate objective scientific, technical, and regulatory information to the public concerning its activities and the activities it regulates. CNSC staff fulfill this mandate in a variety of ways, including hosting in-person and virtual information sessions and through annual regulatory oversight reports.

CNSC staff also seek out other opportunities to engage with the public and Indigenous Nations and communities, often participating in meetings or events in communities with interest in nuclear sites. These allow CNSC staff to educate and answer questions about the CNSC's mandate and role in regulating the nuclear industry. For example, in 2023, CNSC staff participated in the Port Hope Fall Fair as well as the Petawawa Showcase.

In addition, CNSC staff exchanged information and met with the Nuclear Transparency Project (NTP), a civil society organization, with respect to its intervention made for the 2022 ROR as well as its follow up questions. CNSC staff provided to NTP, dispositions to all NTP's recommendations, responses to their questions as well as the 2022 ROR data in CSV format. The main themes of their intervention were related to:

- better transparency on addressing intervenor concerns.
- greater inclusion of environmental-related data.
- provision of data in CSV format.
- suggested improvements to the PFP program.

CNSC staff will continue to engage with NTP on their interests with the facilities reported on in this ROR.

CNSC staff carried out several targeted outreach activities in 2023. Some of these activities were targeted to specific regulatory review and licensing processes underway. Other activities were more generic in nature including the outreach related to the UNSPF ROR. Outreach related to the ROR focused on Indigenous Nations and communities that have traditional and/or treaty territory.

CNSC Activities - BWXT NEC Peterborough

The 2023 ROR provides a follow-up on activities done in accordance with the Commission Record of Decision and CNSC staff's Peterborough Public Engagement Plan.

In 2023, CNSC staff posted the report on the beryllium in air sampling campaign on CNSC's BWXT NEC Peterborough facility webpage and shared it with relevant Indigenous Nations and communities and stakeholders including BWXT's Community Liaison Committee members. CNSC staff also presented this study to the Peterborough Board of Health in early 2024.CNSC

staff are committed to continuing to share information of interest that relates to BWXT NEC and to continue to engage with the public, Indigenous Nations and communities and other interested parties.

8.8 Participant Funding Program

The Canadian Nuclear Safety Commission (CNSC) established the Participant Funding Program (PFP) in 2011 to:

1. enhance individual, not-for-profit organization and Indigenous Nations and Communities participation in the CNSC's environmental assessment (EA) and licensing processes for major nuclear facilities (e.g., uranium mines, nuclear power plants, nuclear substance processing, or nuclear waste facilities)
2. assist individuals, not-for-profit organizations and Indigenous Nations and Communities to bring value-added information to the Commission through informed and topic-specific interventions related to EAs and licensing (i.e., new, distinctive and relevant information that contributes to a better understanding of the anticipated effects of a project).

The CNSC awarded participant funding to assist Indigenous peoples, members of the public and stakeholders in reviewing this ROR and submitting comments to the Commission. Participant funding recipients are listed in Appendix O.

8.9 Public Information and Disclosure:

All UNSPF, Research Reactors and Class IB Accelerators licensees are required to maintain and implement PIDP, in accordance with REGDOC-3.2.1, Public Information and Disclosure. These programs are supported by disclosure protocols that outline the type of facility information to be shared with the public and that provide details on how that information is to be shared. This ensures that timely information about the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities, is effectively communicated to the public.

CNSC staff monitor licensee implementation of the PIDPs to ensure that communication with target audiences is regular and meaningful. CNSC staff also review yearly program updates to verify that licensees are taking public feedback into consideration and making program adjustments accordingly. All UNSPFs, Research Reactors and Class IB Accelerators have approved PIDPs.

In 2023, licensees engaged with stakeholders and members of the public in a variety of ways, including:

- providing website and social media updates with information on facilities/sites/projects, in addition to posting public disclosure protocols and reportable events.
- sending out information externally to local communities and interested stakeholders via newsletter (both virtual and direct mail), as well as internally to employees.
- engaging with local/national media to provide operational and facility updates.
- conducting site tours at facilities for local communities, interested stakeholders and media, as requested.
- hosting and participating in events (in-person and virtual), providing sponsorships, organizing webinars and presentations.

CNSC staff concluded that the UNSPFs met regulatory requirements and maintained and implemented satisfactory PIDPs for the reportable year.

Specific to BWXT NEC Peterborough, the CNSC had concerns about how BWXT NEC was executing its public information program, particularly related to the Community Liaison Committee (CLC) operations in Peterborough.

In 2022, there was very little public engagement, and although there were ongoing COVID restrictions, community outreach virtually or by other means was still required.

The CLC was dissatisfied with BWXT's lack of engagement and meaningful action in terms of topics suggested for information dissemination. A lack of information continuity to the public and the CLC was attributed to new or changing BWXT personnel, and the absence of senior management at CLC meetings.

With recent changes in personnel, including additions to its Communications team, it is expected that BWXT will greatly improve its community outreach in the coming year. As such, BWXT's PIDP is deemed satisfactory and reflects CNSC recommendations to improve engagement and outreach activities in 2024.

9 Events and other matters of regulatory interest

9.1 Reportable Events

Appendix L indicates the number of the reportable events that occurred at each facility over the reporting periods. Reportable events related to LTIs are described in section 7.8. The remaining reportable events are described below, and none had an impact on the environment, the health and safety of persons, or the maintenance of national or international security.

Uranium Processing Facilities

BRR

- On January 20, 2023, there was a transportation incident on Highway 1 west of Warren, Ontario. A truck carrying uranium ore concentrate enroute to BRR was involved in an accident. There was no impact or damage to the sea container. There were no injuries or releases of nuclear material.
- On June 1, 2023, there was a transportation incident on Highway 17 near Upsala, Ontario. A truck carrying uranium ore concentrate enroute to BRR was involved in an accident. There was no impact or damage to the sea container however, the truck was damaged and had to be towed to Thunder Bay, Ontario. There were no injuries or releases of nuclear material.
- On July 27, 2023, a worker received an electrical shock while conducting a repair to a compressed air line. Cameco ERT provided first aid while the paramedics were called to transport the worker to the hospital. The worker was held overnight for observation and subsequently cleared for full duties with no restrictions and no ill effects.

CFM

- On March 22, 2023, CFM identified that a groundwater pumping well was discharging groundwater onto CFM's paved parking surface. Some of the discharged water entered the municipal storm sewer system that outlets to Gages creek and subsequently releases to Lake Ontario. The groundwater pumping and treatment system was not operating at the time of the event as it was undergoing troubleshooting and repair activities and consequently began overflowing when snow melt and spring rain events led to higher groundwater volumes. CFM implemented interim measures to capture and collect discharging groundwater until April 11th, when the groundwater treatment

system operation was fully restored. There were no impacts to the environment because of this discharge.

- On May 30, 2023, CFM identified radiological contamination on the ground when moving exterior drums containing legacy contaminated metallic material. The 4 drums above the impacted area were either overpacked or their contents transferred to new drums. The contaminated area, roughly 1.2m by 3.6m, was excavated and radiation surveys of the area were used to verify the contaminated material had been removed. The impacted area was localized and there were no impacts to the environment because of this event.
- On June 9, 2023, Cameco Corporation reported a security event to CNSC staff. The event was reported to the Commission as an Event Initial Report and discussed during a closed session associated with the December 13-14, 2023, Commission meeting. As the subject matter contains prescribed security information, further details are not provided in this report.
- On July 3, 2023, CFM identified that a small quantity of liquid nitrogen was being released from the exterior bulk chemical storage compound. Investigation identified the leak was due to a cracked gasket on the evaporator. The system was shutdown and the vendor, who operates and maintains the exterior bulk chemical storage was notified. The vendor investigated and replaced the gasket on July 5, 2024. There were no impacts to the environment because of this discharge as the liquid nitrogen evaporates quickly once released.
- On October 17, 2023, CFM identified a forklift had leaked oil while transporting empty pallets outside, to the fuel storage warehouse. A small quantity of oil (estimated 100 mL) entered into a storm drain. The spill was cleaned by applying absorbent material to the impacted paved area as well as the storm drain catch basin. There were no impacts to the environment as a result of this event.

PHCF

- On January 6, 2023, a UF_6 cylinder on a flat rack was being loaded onto a truck using a large fork truck. The load tipped too soon causing the flat rack / cylinder to fall to the ground. There were no injuries or impact to the environment as a result of this event.
- On January 12, 2023, a transport truck leaked a small amount of transmission fluid to the ground. Due to weather conditions, the fluid was able to discharge to a nearby catch basin. The were no significant impacts to the environment as a result of this event.
- On June 5, 6 and 7, 2023, ambient station high volume air sampler (hi-vol) results for total suspended particulate (TSP) were above the dust criteria for visibility (at six sample locations). Cameco determined that poor air quality (smoky conditions) in the area due to wildfires in Ontario and Quebec are the likely cause.

- On July 22, 2023, an operator was filling an emergency generator tank with diesel outside the Powerhouse. An overflow caused approximately 1 L of diesel to enter the sanitary sewer system. The were no significant impacts to the environment as a result of this event.
- On October 6, 2023, Cameco reported to the Ontario Ministry of Environment, Conservation and Parks (MECP) an ambient station hi-vol exceedance of 179 µg TSP/m^3 TSP for the period of October 4-5, 2023, at the Marsh Street Hi-Vol station. The measurement was above the ECCC and MECP 120 µg /m^3 TSP dust criteria for visibility and was attributed by Cameco to construction work immediately adjacent to the hi-vol station.
- On October 16, 2023, non-chlorinated water was able to enter the storm sewer in relation to structure removal hot work taking place at Building 27. Initially the water was thought to be chlorinated which prompted reporting of the event to MECP and the CNSC. The water was later determined by Cameco to be non-chlorinated and therefore, no impact on the environment.
- On December 6, 2023, Cameco was informed of contamination on a lid of a roll-off bin that was transported December 4, 2023, from the PHCF to the Long-Term Waste Management Facility. The lid was decontaminated and transported back to PHCF. Cameco determined that due to the location on the lid, no contamination left the bin during transport.

BWXT NEC

- On February 3,2023, BWXT NEC Peterborough reported a sprinkler impairment in one of their buildings due to a waster supply line leak at nearby premises. BWXT NEC implemented impairment procedures including suspension of hot work, a fire watch and notification to the local fire department as per their procedures. Subsequent repairs fixed the direct cause of this impairment, and the sprinkler systems were returned into service.
- On March 2, 2023, BWXT NEC Peterborough reported a transport incident related to a minor accident that was addressed immediately by the driver. There was no safety impact to the material during transport.
- On March 14, 2023, BWXT NEC Peterborough reported a water spill into its sewer system. BWXT NEC implemented corrective actions including replacement of drain lines and a preventive maintenance schedule for sub-floor drainpipe connections. There was no environmental impact as a result of this spill.

Nuclear Processing Facilities

BWXT Medical

- On February 9, 2023, a Type A package (drum) containing 25 stainless steel cladded depleted uranium generator shields, with a total activity of 6.84 GBq, was received from a supplier in the US with a small dent to the side. The damage occurred during transport just at the corner of BWXT Medical site entrance. BWXT Medical was notified by phone by the driver that the drum had fallen over inside the vehicle. The driver was instructed to proceed to BWXT Medical where the drum was moved to the upright position and unloaded. The plastic skid supporting the drum was damaged. The corrective actions include: the use of rackable pallets, which are more durable than plastic pallets, or the use heavy duty metal pallets. Both pallets and drums will be inspected for structural integrity prior to being re-used. Degraded items will be disposed of appropriately. There is no impact to environment, the health and safety of persons or national security.
- On May 3, 2023, An F-461/F-390 Type A package containing approximately 3 GBq of Y-90 was damaged during transport. The damage was detected upon tendering of the package to the airport terminal in Toronto. BWXT arranged for radiation level and contamination measurements, re-packaging and return shipment. The package was returned for disposal on May 9, 2023.
- On May 26, 2023, an airline for a compressor burst in the secure compound. The compressor is for a drill used to drive piles to reinforce the foundation to support the future waste bunker for the Tc-99m generator project. With the potential for future work, the contractor agreed to install a check valve on all compressors in their store and ensure the user manual is with the equipment. If a compressor is operated, a new step in the “Pre-Operation Safety Inspection” is to confirm a safety check valve is present for hoses greater than ½ inch in diameter, at the compressor side. A warning label at the outlet of the compressor is to require a safety check valve, if the outlet is greater than ½ inch in diameter. There was no injuries or damage to vehicle or property.

SRBT

- No events were reported to the CNSC.

Nordion

- On February 27, 2023, a supplier shipped to Nordion a quantity of radioactive material that the supplier had measured to be within the activity limits of the package. Upon receipt, Nordion measured the activity to be higher such that the activity limit of the package was exceeded by 5%. The radiation levels of the package were within the

regulatory requirements and the package was shipped safely and posed no risk to the environment or the public. The activity discrepancy was attributed to differences in measurement process. Nordion has reduced the allowed activity for this type of package from this supplier.

- On July 18, 2023, the Ottawa Fire Services arrived at Nordion after receiving a call from Nordion's third-party monitoring company. The call was placed in error as Nordion was undertaking work to resolve a power supply issue on the panel. This event did not trigger an actual fire alarm, there was no evacuation, and the emergency response plan was not initiated. The cause of the event was a miscommunication by the third-party monitoring company. A formal communication process was developed with the third-party monitoring company.
- On September 6, 2023, the smoke alarm went off and staff evacuated the building and fire department arrived on site. The Fire Department confirmed there was no fire. An employee was blowing dust out of equipment coils and the combination of the dust and humidity cause the alarm. Nordion reviewed procedures and removed any conflicting information to handling compressed air. Employee was provided additional training on handling compressed air.
- On September 14, 2023, the GC-220 sample chamber became temporarily stuck. The issue was resolved by cleaning the chamber assembly sliding mechanism. The GC-220 is designed such that the sealed source always remain shielded. As such, there were no health or safety impacts from this incident. Increased dirt build-up in the sliding mechanism impacted the ability of the sample chamber to slide. To avoid future reoccurrence, the frequency of regular inspection and maintenance has been increased.
- On September 28, 2023, member of the public inadvertently accessed a secure door. Proper security protocols had not been followed in securing a gate. Supplementary checks of security points have been implemented with the security team.
- On October 4, 2023, the Ottawa Fire Services arrived at Nordion after receiving a call from Nordion's third-party monitoring company. The call was placed in error as Nordion was undertaking routine work on the fire alarm panel. This event did not trigger an actual fire alarm, there was no evacuation, and the emergency response plan was not initiated. The cause of the event was a miscommunication by the third-party monitoring company. The third-party monitoring company implemented additional controls within their system.
- On December 5, 2023, a portion of the water main broke, causing some flooding of the outdoor shipping compound. To facilitate the repair, several fire systems were placed offline. Contingency plans were first implemented to ensure the safety of the facility. There were no health or safety impacts. The water main system is an older system. The water main was repaired within the same day. Nordion will be undertaking a systematic replacement of the water main system.

BTL

- No events were reported to CNSC.

Research Reactors

MNR

- On May 15, 2023, CNSC staff were made aware that MNR removed IAEA safeguards seals on a shipment of fuel prior to receiving written permission from the IAEA. This caused no impact to the environment, health and safety, or national and international security. The IAEA successfully performed an interim inventory verification on May 23, 2023, to inspect the broken seal and related nuclear material. McMaster took adequate corrective actions to prevent similar events from occurring, which CNSC staff have since assessed as satisfactory.

RMC

- RMC reported one incident related to security in 2023.

EPM

- EPM reported one incident related to security in 2023.

Class IB Accelerators

CLSI

- On April 5, 2021, the licensee notified the CNSC that there were several cases of covid-19 among staff members. The licensee moved the facility to warm-standby mode and resumed regular operations on April 19, 2021. CLSI worked with local health authorities to perform contact tracing, and several covid-related procedures were modified prior to the return to normal operations.
- On May 31, 2022, the licensee notified the CNSC that during an Access Control and Interlock System major fault trip, the interlocks did not all respond consistently to the beam trip signal. The ultimate cause was found to be the short duration of the major fault signal. CLSI has installed additional electronics to ensure the system works as designed. No injuries, radiation exposures, or environmental concerns arose from this event.

TRIUMF

- On June 17, 2021, the licensee notified the CNSC that shielding blocks around an experiment beam delivery had been moved without proper authorization. No workers received exposure due to the change in shielding configuration. The licensee has implemented corrective actions, such as a documented approval process for making shielding alterations and informing/training stakeholders.
- On September 28, 2021, the licensee notified the CNSC that the level of a gaseous beta+ emitter was elevated due to a cooling pump issue. Staff present were subjected to a short duration exposure and the licensee estimated the maximum dose received from this situation to be 0.005 mSv which is well below the regulatory limit.
- On October 20, 2021, the licensee notified the CNSC regarding a security breach at their licensed location. The licensee confirmed there were no security related events during that period. The licensee implemented actions to prevent recurrence.
- On November 18, 2021, the licensee notified the CNSC of a vacuum exhaust line that did not terminate at the exhaust stack was unmonitored radioactive materials. The line was rerouted to terminate in the intake of a vault exhaust, exiting via monitored stack. Environmental consequences for the public and the environment were negligible while the exhaust was exiting the building via the unmonitored pipe.
- On November 9, 2022, the licensee notified the CNSCs of a fire in the non-radiological HVAC filtration unit located on the roof of the cyclotron building. The fire was extinguished with no injury, no exposure to hazardous/radiological materials and no significant property damage to the facility. The licensee implemented actions to prevent recurrence.

9.2 PHCF Reactive Inspection and Issuance of Warning Letter

This section is an update on this matter that was first reported in the 2022 ROR.

As a follow-up to the actions of Cameco related to the stopping of a CNSC reactive inspection at PHCF in December 2022, on May 11, 2023, a warning letter was issued to Cameco based on CNSC's graded enforcement approach. As requested by CNSC staff in the warning letter, Cameco responded with planned actions to ensure that Cameco personnel are aware of their obligations under the NSCA during the conduct of an inspection. On December 5, 2023, Cameco submitted an update that all actions had been completed. CNSC staff are satisfied with the response and the actions taken by Cameco.

In addition, CNSC staff conducted an unannounced reactive inspection at PHCF on August 30, 2023. The inspection focused on multiple SCAs including environmental protection, radiation

protection, waste management, conventional health and safety, and PHCF's Vision in Motion Project with a focus on the demolition of Building 27 (the former UF6 plant). Cameco staff fully cooperated with CNSC inspectors during the inspection. Based on the assessment of the information gathered from the inspection team, CNSC staff found the licensee to be in compliance with the inspection criteria, and therefore no enforcement actions were raised.

9.3 EPM Warning Letter

Between 2022 and 2023, CNSC staff had noted that EPM had increasing difficulty in meeting its regulatory commitments. This included reports on nuclear materials inventory which were not being submitted on time, an annual compliance report (ACR) submitted late, document updates that were not completed and general unresponsiveness. In December 2023, CNSC staff issued a warning letter to EPM's licence holder, requesting an action plan to correct the situation.

In its response, EPM acknowledged the seriousness of the problem, identified the causes and developed an action plan to rectify the situation. This action plan includes the hiring of an additional person, restructuring responsibilities, knowledge transfer and certification of a third operator. EPM has also agreed to work collaboratively with CNSC staff and to meet monthly to promote progress on the action plan, regulatory commitments, and outstanding document updates.

CNSC staff are satisfied with EPM's response and progress to-date.

9.4 Emergency Response Team Personal Protective Equipment

In light of an inspector's order issued to Cameco with respect to its Rabbit Lake operations and the issue of expired PPE for its Emergency Response Team (ERT), on November 1, 2023, it was requested other licensees who had onsite ERT capacity, undertake an evaluation of their PPE and report back to the CNSC. In case of the facilities being reported on in this ROR, this applied to BRR and PHCF.

Cameco replied, confirming sufficient, operational onsite PPE, with regular monitoring of its inventory and appropriate replacement plans for both BRR and PHCF. CNSC staff were satisfied with this response.

9.5 TRIUMF Management Systems Follow-Up

In June 2022, the Commission made a decision on the TRIUMF Inc. licence renewal application, as documented in the Record of Decision. In its decision, the Commission renewed TRIUMF Inc.'s operating licence (PA1OL-01.01/2032) for a period of 10 years and accepted the proposed new financial guarantee. In the record of decision, the Commission requested updates on TRIUMF's progress in implementing CSA N286-12, as there were outstanding NNCs related to management systems at the time of renewal.

At the time of renewal, 4 out of 20 NNCs from the 2021 Management System inspection remained open. TRIUMF submitted action plans to address the NNC's and a follow-up inspection was conducted in April 2024 to confirm the implementation of the proposed plans. As of April 2024, only one NNC remained open. CNSC staff required no further information regarding this NCC, found the action plan in place acceptable, and are waiting to verify TRIUMF's implementation of the plan before closing the remaining NNC.

9.6 CNSC Independent Environmental Monitoring Program

The CNSC requires that each nuclear facility licensee develops, implements, and maintains an environmental monitoring program as appropriate to demonstrate that the public and the environment are protected from any releases to the environment related to the facility's nuclear activities. CNSC staff evaluate and assess the results of these monitoring programs to determine compliance with the applicable requirements and limits, as set out in the regulations that govern Canada's nuclear industry.

The Independent Environmental Monitoring Program (IEMP) is an independent from licensee, technical environmental sampling program in publicly accessible areas around nuclear facilities, while using CNSC resources effectively and efficiently. The CNSC continues to strive to build Indigenous and public trust in the CNSC's regulation of the nuclear industry, and thus implements an IEMP as one tool of confirming the effectiveness of a licensee's monitoring program and to promote more awareness and information sharing of CNSC's work in the protection of people and the environment. The IEMP is a regulatory tool that complements and informs the CNSC's ongoing compliance verification program. The IEMP does not rely on licensees to provide samples. CNSC staff or independent contractors obtain samples from publicly accessible areas around nuclear facilities, then measure and report the amounts of radiological and hazardous substances present in these samples to the Commission, Indigenous Nations and communities, and the public.

In 2022, CNSC staff conducted independent environmental monitoring around the TRIUMF facility and in 2023, CNSC staff conducted independent environmental monitoring around MNR, BRR, Nordion and BWXT Medical. There were no results of concern. In addition, these results are consistent with the results submitted by the licensee. The IEMP results add to the body of evidence and supports CNSC staff's assessment that the public and the environment in the vicinity of the uranium and nuclear substance processing facilities, research reactors and Class IB particle accelerators are protected and that the licensees' environmental protection programs are effective.

Results from previous IEMP sampling campaigns are available on the CNSC's Web page.

9.7 Environmental Protection Review Reports

CNSC staff conduct environmental protection reviews (EPRs) for all licence applications with potential environmental interactions, in accordance with CNSC's mandate under the NSCA and associated regulations. An EPR is a science-based environmental technical assessment conducted by CNSC staff. The fulfillment of other aspects of the CNSC's mandate, such as regulating safety and security, are met through other oversight activities.

CNSC staff have posted the following 3 EPR reports for UNSPFs:

- EPR report: Blind River Refinery (2021)
- EPR report: Cameco Fuel Manufacturing Inc. (2022)
- EPR report: SRB Technologies (2023)

The information in EPR reports support staff's recommendations to the Commission in future licensing and regulatory decisions on whether the proposal provides adequate protection of the environment and the health of people.

10 Conclusions

CNSC staff concluded that during the reporting timeframes UNSPFs, Research Reactors and Class IB Accelerators in Canada operated safely. This assessment was based on CNSC staff's verification of licensee activities, including inspections, reviews of reports submitted by licensees, and reviews of events supported by follow-up and general communication with the licensees.

The performance ratings for all UNSPFs, Research Reactors and Class IB Accelerators in all 14 SCAs were rated as "satisfactory" with the exception of EPM for the safeguards and non-proliferation SCA in 2023.

CNSC staff's compliance verification activities concluded that:

- radiation protection programs at all facilities were effective and adequately controlled radiation exposures, keeping doses ALARA.
- environmental protection programs at all facilities were effective in protecting people and the environment.
- conventional health and safety programs at all facilities continued to protect workers.

CNSC staff concluded that the licensees discussed in this report made adequate provision to protect the health and safety of workers, to protect the public and the environment, and to meet Canada's international obligations on the peaceful use of nuclear energy.

CNSC staff will continue to provide regulatory oversight to all licensed facilities.

11 Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the Regulations made under it, and in CNSC regulatory documents and other publications.

Appendix A: Links to Licensee websites and Annual Compliance Reports

Licensee	Website	Annual Compliance Report
BRR	Blind River Refinery	2023 Annual Compliance Report
PHCF	Port Hope Conversion Facility	2023 Annual Port Hope Conversion Facility Compliance Report
CFM	Cameco Fuel Manufacturing	2023 Annual Compliance Report
BWXT NEC Toronto	BWXT Nuclear Energy Canada	2023 Annual Compliance Report
BWXT NEC Peterborough	BWXT Nuclear Energy Canada	2023 Annual Compliance Report
SRBT	SRB Technologies (Canada) Inc	2023 Annual Compliance Report
Nordion	Nordion	2023 Annual Compliance Report
BTL	Best Theratronics Ltd.	2023 Annual Compliance Report
BWXT Medical	BWXT Medical Ltd.	2023 Annual Compliance Report
MNR	McMaster Nuclear Reactor	2021 Annual Compliance Report 2022 Annual Compliance Report 2023 Annual Compliance Report
Royal Military College of Canada	RMC website	Available upon request
École Polytechnique de Montréal	EPM website	2022 annual report
TRIUMF	TRIUMF Inc	Available upon request
Canadian Light Source	Lightsource.ca	Available upon request

Appendix B: CNSC inspections

Table B-1: Inspection, BBR, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
CAMECO-BRR-2023-01	Operating performance, safety analysis, physical design, fitness for service, conventional health and safety and public information and disclosure	March 21-22, 2023	5
CAMECO-BRR-2023-02	Management system	May 16-18, 2023	5
CAMECO-BRR-2023-03	Packaging and transport	September 19-20, 2023	1
CAMECO-BRR-2023-04	Environmental protection	October 4-6, 2023	1

Table B-2: Inspection, CFM, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
CAMECO-CFM-2023-01	Management system, conventional health and safety	March 6-9, 2023	6
CAMECO-CFM-2023-02	Fire protection, radiation protection, conventional health and safety	May 1-2, 2023	7
CAMECO-CFM-2023-03	Security	November 30 – December 1, 2023	0

Table B-3: Inspection, PHCF, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
CAMECO-PHCF-2023-01	Radiation protection	March 6-8, 2023	7
CAMECO-PHCF-2023-02	Physical design, fitness for service, operating performance and conventional health and safety	February 21-23, 2023	3
CAMECO-PHCF-2023-03	Security	May 9, 2023	0

CAMECO-PHCF-2023-04	Unannounced reactive inspection (environmental protection, waste management, radiation protection and conventional health and safety)	August 30, 2023	0
CAMECO-PHCF-2023-06	Management system	October 17–20, 2023	7

Table B-4: Inspection, BWXT NEC Toronto and Peterborough, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
BWXT-NEC-2023-01	Radiation protection	January 17-20, 2023	3
BWXT-NEC-2023-02	Security	March 28-29, 2023	1
BWXT-TOR-2023-01	Human performance management	May 11-12, 2023	4
BWXT-PTB-2023-01	Human performance management	May 8-9, 2023	4
BWXT-TOR-2023-02	Waste management	October 10-13, 2023	0
BWXT-PTB-2023-02	Waste management	October 10-13, 2023	1
BWXT-TOR-2023-03	Conventional health and safety	October 10-13, 2023	0
BWXT-PTB-2023-03	Conventional health and safety	October 10-13, 2023	2

Table B-5: Inspection, SRBT, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
SRBT-2023-01	Human performance management, operating performance, radiation protection, conventional health and safety, environmental protection, waste management	March 14-15, 2023	0
SRBT-2023-02	Fitness for service	September 18-20, 2023	0

Table B-6: Inspection, Nordion, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
Nordion-2023-01	Security	February 21, 2023	1

Nordion-2023-02	Fitness for service, operating performance, radiation protection, environmental protection, conventional health and safety and waste management	March 24, 27-28, 2023	3
Nordion-2023-03	Human performance	July 17-18, 2023	2
Nordion-2023-04	Radiation protection	December 6-8, 2023	2
Nordion-2023-05	Environmental protection	December 6-8, 2023	1

Table B-7: Inspection, BTL, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
BTL-2023-01	Operating Performance, fitness for Service, environmental protection, radiation protection, conventional health and safety, emergency management and fire protection	February 15-17, 2023	6
BTL-2023-02	Waste management	February 15-17, 2023	1

Table B-8: Inspection, BWXT Medical, 2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
BWXT MED-2023-01	Management systems	May 2-4, 2023	**1**

Table B-9: Inspection, McMaster University, 2021-2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
2021-01	Management system	March 2, 2021	**2**
2021-02	Environmental protection	December 6 – 10 2021	**0**
2022-01	Radiation protection	September 21, 2022	**1**
2023-01	Fitness for service, conventional health and safety, emergency management and fire	November 15-21, 2023	**2**

	protection, packaging and transport		

Table B-10: Inspection, Royal Military College of Canada, 2021-2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
2021-01	Management system, fitness for service, radiation protection, security, operating performance, conventional health and safety, safeguards and non-proliferation, safety analysis, human performance management, packaging and transport, emergency management and fire protection, public information and disclosure program	August 28 to September 3, 2021	**0**
2022-01	Human Performance Management	January 24 – 26, 2022	**2**

Table B-11: Inspection, École Polytechnique de Montréal, 2021-2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
2023-01	Operating performance, fitness for service, radiation protection, conventional health & safety, environmental protection, emergency management & fire protection, waste management, packaging and transport, human performance management, security, public information and disclosure.	June 29, 2023	**2**

Table B-12: Inspection, TRIUMF, 2020-2023

Inspection Title	Safety and control area	Inspection Date	#NNCs

ACFD-TRIUMF-2021-02-26	Management system	February 16-26, 2021	**20**
ACFD-TRIUMF-2021-09-17	Radiation protection	September 13-17, 2021	**4**
ACFD-TRIUMF-2022-06-14	Emergency preparedness	October 15-27, 2021	**5**
ACFD-TRIUMF-2022-04-01	Fire protection	October 15-27, 2021	**0**
ACFD-TRIUMF-2022-04-01.1	Waste management	October 15-27, 2021	**2**
ACFD-TRIUMF-2023-01-25	Management system	May 30 - June 4, 2022	**0**
ACFD-TRIUMF-2022-10-04	Environmental protection	September 23 - October 4, 2022	**3**
ACFD-TRIUMF-2023-01-25	Operating performance	January 15 to 25, 2023	**4**

Table B-13: Inspection, Canadian Light Source, 2020-2023

Inspection Title	Safety and control area	Inspection Date	#NNCs
ACFD-CLSI-2020	Management systems	September 28 – October 9, 2020	**3**
ACFD-CLSI-2021	Fitness for service, radiation protection	January 18 – 22, 2021	**3**
ACFD-CLSI-2022	Fire protection, human performance management	April 14 – April 22, 2022	**2**
ACFD-CLSI-2023-1	Operating performance, safety analysis	April 21 – 28, 2023	**1**
ACFD-CLSI-2023-2	Human performance management - training	November 14 – 20, 2023	**4**

Appendix C: Significant changes to licence conditions handbooks

Licensee	Date	Facility License	Summary of Changes
BRR	August 31, 2023	FFL-3632.00/2032	Addition of eye dose action levels, DRL review every 5 years, and updated implementation status of REGDOCs (2.1.2, 2.11.1, 2.11.2 and 3.3.1)
PHCF	August 31, 2023	FFOL-2631.00/2027	Updated LCH issued. Updated the list of version-controlled documents including notification of change requirements. Updated text in preamble sections.
CFM	August 31, 2023	FFL-3641.00/2043	New LCH issued to support issuance of new licence by the Commission.
Nordion	August 22, 2023	NSPFOL-11A.01/2025	New LCH issued to support issuance of new financial guarantee
RMC	July 1, 2023	NPROL-20.00/2043	Issuance of new LCH to reflect the 20-year licence issued on July 1, 2023. Several REGDOCs and standards added to reflect recent regulatory and industry updates.
EPM	July 1, 2023	PERFP-9A.00/2033	Issuance of new LCH to reflect the 10-year licence issued on July 1, 2023. Several REGDOCs and standards added to reflect recent

			regulatory and industry updates.
TRIUMF	March 20, 2020	PA1OL-1.01/2022	Updated references to various TRIUMF documents. Changed ACR date from March 31 to June 30. Increased thorium possession limit to 10 MBq Added N286-12 requirements for Licence Condition 2.1 and updated reference to N286-05 to N286-12 in the guidance section of Licence Condition 3.1. Updated controlled documents according to Table 5-1 of TRIUMF Annual Compliance Report 2018.
TRIUMF	September 18, 2020	PA1OL-1.01/2022	Increased Beamline 1U operation to 10 uA in Appendix C, Section A.2.(j). Updates to TRIUMF LCH documents.
TRIUMF	July 1, 2022	PA1OL-1.01/2032	Issuance of LCH to reflect effective period of 10 year licence, commencing on July 1, 2022.
TRIUMF	October 12, 2023	PA1OL-1.01/2032	Addition of TRIUMF documents to reflect requested TRIUMF Document 148928, *Irradiation of thorium targets at BL1A IPF*, release no. 4 has been added to section 4.2, 4.3 and table G-1 of Appendix G. Section A.4 of Appendix C has been updated to include Thorium Metals in the list of IPF targets and the name “Proton Isotope Facility” has been

			changed to “Isotope Production Facility”. Section C of Appendix C was split into two tables, one for the TR-30-1 and the other for TR-30-2. TR-30-2 is now authorised to beam on Ga,Ni targets with a maximum current of 0.3 mA.
TRIUMF	December 14, 2023	PA1OL-1.01/2032	Appendix C was revised to reflect the current state of the beamlines and other operating parameters. The operating specifications of the TR13 facility were updated. Several lower-tier documents were removed from the LCH. For the CVC documents listed in the SCAs, an additional column was added to reflect if the CNSC requires prior notification or notification at the time of change. References were updated to reflect most recent TRIUMF updates to the documents.
CLSI	February 3, 2020	PA1OL-2.01/2022	Updated references to CLSI documents.
CLSI	August 25, 2021	PA1OL-2.01/2022	Updated revisions of CLSI documents, removal of lower-tier documents from LCH where CNSC staff deemed the necessary information to already be in a higher-tier LCH document.

CLSI	June 1, 2022	PA1OL-2.00/2032	Issuance of LCH to reflect effective period of 10-year licence, commencing on June 1, 2022. Includes transition plans for implementation of REGDOC 2.10.1, REGDOC 2.11.2, and CSA N292.3 and N292.0

Appendix D: Regulatory document implementation

Regulatory documents are a key part of the CNSC's regulatory framework for nuclear activities in Canada. They explain to licensees and applicants what they must achieve in order to meet the requirements set out in the Nuclear Safety and Control Act and the regulations made under the Nuclear Safety and Control Act.

When a new regulatory document or revision is published, CNSC staff will formally request the licensee to conduct a gap analysis and provide an implementation plan. The CNSC will review the plan. The dates provided in the implementation plan are considered the date that the regulatory document becomes effective at the site, at which point it becomes compliance verification criteria. The table below lists the REGDOCs that were implemented.

Table D-1: Uranium Processing Facilities

Licensee	Document Number	Document Title	Version	Status
BRR	REGDOC-2.11.1	Waste Management, Volume I: Management of Radioactive Waste	2021	Implemented
CFM	REGDOC-2.11.1	Waste Management Volume:1: Management of Radioactive Waste	2021	Implemented
PHCF	REGDOC-2.11.1	Waste Management Volume:1: Management of Radioactive Waste	2021	Implemented

Table D-2: Nuclear Substances Processing Facilities

Licensee	Document Number	Document Title	Version	Status
SRBT	REGDOC-2.4.4	Safety Analysis for Class IB Nuclear Facilities	2022	Implemented

Table D-3: Research Reactors

Licensee	Document Number	Document Title	Version	Status
RMC	REGDOC-2.11.1	Waste Management Volume:1: Management of Radioactive Waste	2021	Implemented
RMC	REGDOC-2.11.2	Decommissioning	2021	Implemented
RMC	REGDOC-3.3.1	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	2021	Implemented
RMC	REGDOC 3.2.1	Public Information and Disclosure	2018	Implemented

Table D-4: Class IB Accelerators

Licensee	Document Number	Document Title	Version	Status
CLSI	REGDOC 2.10.1	Nuclear Emergency Preparedness and Response	2016	Implemented
CLSI	REGDOC 2.11.1	Waste Management, Volume I: Management of Radioactive Waste	2021	Implemented
CLSI	REGDOC 2.11.2	Decommissioning	2021	Implemented
TRIUMF	REGDOC 2.10.1	Nuclear Emergency Preparedness and Response	2016	Implemented

Appendix E: Financial Guarantees

Table E-1: Financial Guarantee, Uranium Processing Facilities

Facility	Amount ($CAD)
BRR	$57,500,000
PHCF	$128,600,000
CFM	$10,800,000
BWXT NEC Toronto	$37,362,745
BWXT NEC Peterborough	$10,775,122

Table E-2 Financial Guarantee, Nuclear Substances Processing Facilities

Facility	Amount ($CAD)
SRBT	$770,522
Nordion	$35,003,045
BTL	$1,800,000
BWXT Medical	$10,540,000

Table E-3 Financial Guarantee, Research Reactors

Facility	Amount ($CAD)
McMaster University	$ 18,413,661
Royal Military College of Canada	Letter from the Deputy Minister of National Defence
École Polytechnique de Montréal	$ 5,385,000

Table E-4 Financial Guarantee, Class IB Accelerators

Facility	Amount ($CAD)
TRIUMF	$12,299,900
Canadian Light Source	$14,788,000

Appendix F: Safety and Control Area Ratings

Please note that only the ratings of "satisfactory" (SA) or "below expectations" (BE) were used for the UNSPFs, Research Reactors and Class IB Accelerators. The "fully satisfactory" (FS) rating was not used, consistent with the approach used for the 2019 RORs. It is important to recognize that if a facility received an SCA rating of FS in previous RORs, and now has a rating of SA, it does not necessarily indicate a reduction in performance. The simplified rating approach considerably reduced the effort that is often needed to reach a consensus on a final rating.

Table F-1: SCA ratings, BBR, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-2: SCA ratings, PHCF, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-3: SCA ratings, CFM, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-4: SCA ratings, BWXT NEC Toronto and Peterborough, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-5: SCA ratings, SRBT, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	N/A	N/A	N/A	N/A	N/A
Packaging and transport	SA	SA	SA	SA	SA

Table F-6: SCA ratings, Nordion, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-7: SCA ratings, Best Theratronics, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-8: SCA ratings, BWXT Medical, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	N/A	N/A	SA	SA	SA
Human performance management	N/A	N/A	SA	SA	SA
Operating performance	N/A	N/A	SA	SA	SA
Safety analysis	N/A	N/A	SA	SA	SA
Physical design	N/A	N/A	SA	SA	SA
Fitness for service	N/A	N/A	SA	SA	SA
Radiation protection	N/A	N/A	SA	SA	SA
Conventional health and safety	N/A	N/A	SA	SA	SA
Environmental protection	N/A	N/A	SA	SA	SA
Emergency management and fire protection	N/A	N/A	SA	SA	SA
Waste management	N/A	N/A	SA	SA	SA
Security	N/A	N/A	SA	SA	SA
Safeguards and non-proliferation	N/A	N/A	SA	SA	SA
Packaging and transport	N/A	N/A	SA	SA	SA

Table F-9: SCA ratings, McMaster Research Reactor, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-10: SCA ratings, Royal Military College of Canada, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-11: SCA ratings, École Polytechnique de Montréal, 2019-2023

SCA's	2019	2020	2021	2022	2023
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	BE
Packaging and transport	SA	SA	SA	SA	SA

Table F-12: SCA ratings, TRIUMF, 2019-2023

Changes from FS and SA reflect changes to the CNSC's grading methodology and do not reflect an increase or decrease in performance.

NOTE: SCA ratings will be confirmed mid-July following ACR review

SCA's	2019	2020	2021	2022	2023
Management system	BE	BE	BE	BE	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	BE	SA	SA
Physical design	SA	SA	BE	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	FS	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table F-13: SCA ratings, Canadian Light Source, 2019-2023

Changes from FS and SA reflect changes to the CNSC's grading methodology and do not reflect an increase or decrease in performance.

NOTE: SCA ratings will be confirmed mid-July following ACR review

SCA's	2019	2020	2021	2022	2023
Management system	BE	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	FS	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	FS	SA	SA	SA	SA
Fitness for service	FS	SA	SA	SA	SA
Radiation protection	FS	SA	SA	SA	SA
Conventional health and safety	FS	SA	SA	SA	SA
Environmental protection	FS	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	N/A	N/A	N/A	N/A	N/A
Packaging and transport	FS	SA	SA	SA	SA

Appendix G: Total Annual Releases of Radionuclides to the Environment

The CNSC is making radionuclide release data more readily accessible to the public and Indigenous Nations and communities as part of its commitment to Open Government and its mandate to disseminate this information. This appendix reflects the continued commitment to provide data, within the regulatory oversight reports, on the total annual release of radionuclides.

CNSC staff have commenced publishing annual releases of radionuclides to the environment from nuclear facilities on the Open Government Portal.

Direct releases of radionuclides to the environment from uranium processing facilities are primarily limited to uranium released to the atmosphere. As uranium is more chemically toxic than radiologically toxic, releases are monitored as total uranium. As a result, the annual load is reported in kilograms. Of these facilities, only Cameco's BRR has direct releases to surface water, with the relevant radionuclides being uranium and radium-226.

Direct releases to the environment for the nuclear processing facilities - SRBT, Nordion, and BWXT Medical are limited to atmospheric releases. SRBT, Nordion, and BWXT Medical have no direct releases to surface waters. BTL does not have any airborne or liquid radiological releases.

Direct releases of radionuclides to the environment from the research reactors are limited to atmospheric releases. The atmospheric releases from MNR are Iodine-125 (I-125) and Argon-41 (Ar-41) from the exhaust ventilation. The SLOWPOKES (RMC and EPM) emit Xenon-133 (Xe-133) from weekly reactor head space purges and Ar-41 due to irradiation activities, however the quantities are negligible.

CLSI does not directly release radionuclides to the environment.

Direct releases to the environment from TRIUMF are in the form of airborne and liquid effluent. Airborne releases are generated by air activation during operation of the 520 MeV cyclotron and the release of gaseous radionuclides during chemistry processing. The most significant airborne releases are short lived beta emitters. Liquid effluent releases are generated by the cooling water system, with Tritium being the most significant radionuclide.

It should be noted that annual releases from MNR and TRIUMF are found in Tables I-32, I-33, and I-34 in Appendix I and are not yet on the Open Government portal.

Appendix H: Public Dose Data

This appendix contains information on the estimated dose to the public around the facilities reported on in this ROR. Radiological releases from all the sites covered by this ROR remain well under the derived release limits (DRLs) applicable to those sites and the contribution to the dose to the public from these releases remains well below the regulatory limit for the public of 1 mSv/year, as set out in the *Radiation Protection Regulations*.

Table H-1: Public dose comparison table, Uranium and Nuclear substance processing facilities, Research Reactors and Class IB Accelerators: mSV, Regulatory Limit of 1mSv, 2019–2023

	2019	2020	2021	2022	2023
BRR	0.005	0.009	0.009	0.009	0.009
PCHF Site 1	0.080	0.129	0.072	0.088	0.097
PHCF Site 2	0.127	0.117	0.086	0.118	0.128
CFM	0.027	0.020	0.306[1]	0.2931[1]	0.241[1]
BWXT NEC Toronto	0.023	0.0057	0.0175	0.0173	0.0402
BWXT NEC Peterborough	0.0115	<0.001	<0.001	0.0115	0
SRBT	0.0021	0.0024	0.0020	0.0020	0.002251
Nordion	0.00087	0.00122	0.00185	0.00156	0.000796
BWXT Medical	N/A	N/A	0.0005	0.0005	0.0002
BTL[2]	N/A	N/A	N/A	N/A	N/A
MNR[3]	0.0098	0.0098	0.0098	0.0098	0.0098
RMC[4]	<0.001	<0.001	<0.001	<0.001	<0.001
ÉPM[4]	<0.001	<0.001	<0.001	<0.001	<0.001
TRUIMF	0.0061	0.0024	0.0061	0.0020	0.0045
Canadian Light Source	N/A	N/A	N/A	N/A	N/A

N/A = not applicable; mSv = millisievert

[1]The estimated dose to the public is higher in 2021, 2022 and 2023 than in previous years but there has not been an actual increase in emissions/dose from the facility. Cameco submitted revised DRLs, which included an update to the public dose calculation formulas. The revisions included airborne and liquid emissions in the calculation and a new location for the critical receptor so the results from 2021, 2022 and 2023 cannot be compared to the results from previous years.

[2]No activities occur inside the BTL facility that result in the release of radioactive material to the environment.

[3]McMaster's environmental risk assessment conservatively estimated that the estimated dose to public is 0.0098 mSv/year.

[4]The SLOWPOKEs' environmental risk assessments conservatively estimated that the estimated dose to public is below 0.001 mSv/year.

Appendix I: Environmental Data

This appendix provides environmental data for the UNSPFs, Research Reactors, and Class IB accelerators. Unless otherwise indicated, no environmental action levels were exceeded.

Blind River Refinery

Atmospheric emissions

Cameco monitors uranium, nitrogen oxides (NO_x), nitric acid (HNO_3), and particulates released from facility stacks. The monitoring data in Table I-1 demonstrates that atmospheric emissions from the facility continued to be effectively controlled, as annual averages were consistently well below their respective licence limits between 2019 and 2023.

Table I-1: Air emission monitoring results, Blind River Refinery, 2019–2023

Parameter	Value	2019	2020	2021	2022	2023	Licence Limit[1]
Dust collection and exhaust ventilation stack: uranium (g/h)	Annual weekly average	0.05	0.06	0.08	0.08	0.11	**93**[2]
Dust collection and exhaust ventilation stack: uranium (g/h)	Annual weekly maximum	0.10	0.11	0.14	0.24	0.36	**93**[2]
Absorber stack: uranium (g/h)	Annual weekly average	0.01	0.01	0.01	0.01	0.01	**21**[2]
Absorber stack: uranium (g/h)	Annual weekly maximum	0.01	0.02	0.02	0.04	0.04	**21**[2]
Absorber stack: NO_x + HNO_3 (kg NO_2/h)	Annual weekly average	3.3	3.2	2.9	2.9	3.4	**19**[3]

Absorber stack: NO_x + HNO_3 (kg NO_2/h)	Annual weekly maximum	5.2	5.4	4.8	4.3	4.4	**19[3]**
Incinerator stack: uranium (g/h)	Annual weekly average	<0.01	<0.01	<0.01	<0.01	0.01	**29[2]**
Incinerator stack: uranium (g/h)	Annual weekly maximum	0.01	0.01	0.01	<0.01	0.02	**29[2]**
All stacks: Particulate (g/h)	Annual weekly average	12	10	10	10	10	**15,000[3]**
All stacks: Particulate (g/h)	Annual weekly maximum	25	17	17	18	20	**15,000[3]**

HNO_3 = nitric acid; g/h = gram per hour; kg/h = kilogram per hour; NO_2 = nitrogen dioxide; NO_x = nitrogen oxides
Note: Results less than detection limit are denoted as "<".
[1] Limits were revised in 2022. For the licence limits that were applicable in 2019-2021, please refer to the 2021 Nuclear Substance and Processing Facilities Regulatory Oversight Report
[2] Limit based on weekly averaging
[3] Limit based on daily averaging

Liquid effluent

There are 3 sources of liquid effluent from the BRR facility: plant effluent, storm water runoff, and sewage treatment plant effluent. These effluents are collected in lagoons and treated, as required, prior to discharge into Lake Huron. Cameco monitors uranium, radium-226, nitrates, and pH in liquid effluents to demonstrate compliance with their respective licence limits.

Table I-2 summarizes the average monitoring results from 2019 to 2023. For 2023, the liquid discharges from the facility continued to be below (or, within, in the case of pH) their respective licensed limits.

Table I-2: Liquid effluent monitoring results, Blind River Refinery, 2019–2023

Parameter	Value	2019	2020	2021	2022	2023	Licence Limit[1]
Uranium (mg/L)	Monthly average	0.01	0.01	0.01	0.02	0.01	**1.7**

Uranium (mg/L)	Monthly maximum	0.02	0.02	0.03	0.04	0.03	**1.7**
Nitrates (mg/L)	Monthly average	21	19	18	22	7.4	**N/A**
Nitrates (mg/L)	Monthly maximum	34	26	39	57	37	**N/A**
Radium-226 (Bq/L)	Monthly average	0.01	0.01	<0.01	<0.01	<0.01	**N/A**
Radium-226 (Bq/L)	Monthly maximum	0.01	0.01	0.01	0.1	0.02	**N/A**
pH	Daily minimum	7.2	7.0	7.3	7.0	7.1	**Minimum 6.0**
pH	Daily maximum	8.4	8.4	8.4	8.4	8.6	**Maximum 9.5**

mg/L = milligram per litre; Bq/ L= becquerel per litre

[1] Limits were revised in 2022. For the licence limits that were applicable in 2019-2021, please refer to the 2021 Nuclear Substance and Processing Facilities Regulatory Oversight Report.

Uranium in ambient air

The concentrations of uranium in the ambient air (average and maximum), as monitored by Cameco's sampling network around BRR, continue to be low and all values measured were below the Ontario Regulation (O. Reg) 419/05: Air Pollution – Local Air Quality standard for uranium of 0.03 µg/m^3. In 2023, the maximum concentrations of uranium in ambient air at each sampling location were 0.0015 µg/m^3 (Golf Course), 0.002 µg/m^3 (Southeast Yard), 0.0058 µg/m^3 (East Yard), 0.0003 µg/m^3 (Hydro Yard), and 0.0002 µg/m^3 (Town of Blind River).

Groundwater monitoring

Cameco is in compliance with CSA N288.7-15, *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*. Cameco has an extensive groundwater monitoring program in place around the BRR facility with 35 monitoring wells: 14 wells are located inside the perimeter fence and 21 wells are outside the fence line. Wells are monitored 1 to 3 times per year depending on the location relative to the refinery. Groundwater quality across the site meets the uranium standard set out in table 3 of the Soil, Ground Water, and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*, published by the Ministry of the Environment, Conservation and Parks (MECP), as shown in table I-3. It should also be noted that groundwater in the area flows southwest towards the Mississauga River, and there are no groundwater wells for drinking water purposes located downstream of the site.

Table I-3: Annual groundwater monitoring results, Blind River Refinery, 2019–23

Parameter	2019	2020	2021	2022	2023	MECP Standard*
Average uranium concentration, µg/L	2.0	1.4	1.7	1.5	1.4	**420**
Maximum uranium concentration, µg/L	14.0	14.0	25.0	20.0	18.0	**420**

µg/L = microgram per litre
*MECP Standard MECP Standard Guidelines

Surface water monitoring

Cameco continues to monitor surface water for uranium, nitrate, radium-226, and pH at the location of BRR's outfall diffuser in Lake Huron. The concentrations of uranium, nitrate, radium-226, and the pH levels in the lake remained well below the Canadian Council of Ministers of the Environment (CCME) guidelines. Table I-4 provides surface water monitoring results.

Table I-4: Surface water monitoring results at outfall diffuser in Lake Huron, Blind River Refinery, 2019–2023

Parameter	2019	2020	2021	2022	2023	CCME Guideline*
Average Uranium (µg/L)	<0.7	<0.7	<0.7	<0.7	<0.7	**15**
Maximum Uranium (µg/L)	<0.7	<0.7	<0.7	<0.7	<0.7	**15**
Average Nitrate (mg/L as N)	0.1	0.2	0.2	0.1	0.1	**13**
Maximum Nitrate (mg/L as N)	0.2	0.2	0.2	0.3	0.2	**13**
Average Radium-226 (Bq/L)	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	**N/A**
Maximum Radium-226 (Bq/L)	<0.0005	<0.0005	<0.0005	0.0006	0.0010	**N/A**
Average pH	8.1	7.9	7.7	7.2	7.5	**6.5–9.0**
Maximum pH	8.2	7.9	8.3	8.0	8.1	**6.5–9.0**

Bq/L = becquerel per litre; mg/L = milligram per litre; µg/L = microgram per litre; CCME = Canadian Council of Ministers of the Environment
*CCME, *Canadian Water Quality Guidelines for the Protection of Aquatic Life*
Note: Results below the detection limit are denoted as "<".

Soil monitoring

Cameco collects soil samples at a depth of 0 to 5 cm each year and 5 to 15 cm every 5 years to monitor uranium concentrations in surface soil. The purpose is to monitor the long-term effects of air emissions on soil quality resulting from the deposition of airborne uranium on soil in the vicinity of the BRR facility. The 2023 soil monitoring results remained consistent with the respective concentrations measured in previous years, as shown in table I-5. The average uranium in soil concentrations increased slightly in 2023 but remained within the historical range at each sampling location.

The average concentrations of uranium in soil measured near the BRR facility were close to Ontario's natural background levels (2.5 µg/g) and well below 23 µg/g, which is the most restrictive soil quality guideline set by the CCME for uranium (for residential and parkland land use). This data demonstrates that the current BRR operations do not contribute to the accumulation of uranium in the surrounding soil and no adverse consequences to human and environmental receptors are expected.

Table I-5: Soil monitoring results (0–5 cm depth), Blind River Refinery, µg/g, 2019–2023

Parameter	2019	2020	2021	2022	2023	CCME Guideline*
Average uranium concentration within 1,000 m	2.1	1.4	1.6	2.4	1.5	**23**
Average uranium concentration outside 1,000 m	1.0	0.7	0.6	0.9	0.6	**23**
Maximum uranium concentration	3.8	2.5	2.9	5.7	3.2	**23**

cm = centimetre; m = metre; µg/g = microgram per gram; CCME = Canadian Council of Ministers of the Environment

*CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*

Gamma monitoring

A portion of public dose from BRR operations is due to gamma radiation sources. Consequently, monitoring of gamma radiation effective dose rates at the fence line of the BRR main site and the nearby golf course (the critical receptor location) is essential to ensuring that levels of potential gamma radiation exposure are maintained ALARA. The land immediately outside the

perimeter fence continues to be owned and controlled by Cameco. Therefore, Cameco has set an action level for gamma dose rates of 0.25 µSv/h at the north fence only because the critical receptor location for the gamma component of dose to the public is the neighbouring golf course north of the BRR site. Cameco uses environmental thermoluminescent dosimeters (TLDs) that are replaced monthly to measure the effective dose rates for gamma radiation.

- East location measured 1.35 µSv/h (no action level is in place)
- North location measured 0.11 µSv/h (Cameco's action level is 0.25 µSv/h)
- South location measured 1.04 µSv/h (no action level is in place)
- West location measured 1.87 µSv/h (no action level is in place)

These measurements indicate that gamma dose rates are controlled and that the public is protected.

Port Hope Conversion Facility

Atmospheric emissions

Cameco monitors uranium, fluoride and ammonia released from PHCF stacks. Table I-6 provides air monitoring data for 2019 to 2023. The annual averages have remained consistently below their respective licence limits for 2023 and demonstrates that atmospheric emissions from the facility continued to be effectively controlled.

Table I-6: Air emission monitoring results (annual daily average), Port Hope Conversion Facility, kg/h, 2019–2023

Location	Parameter	2019	2020	2021	2022	2023	Licence Limit
UF_6 plant	Uranium	0.0027	0.0025	0.0022	0.0025	0.0024	**0.280**
UF_6 plant	Fluoride	0.018	0.028	0.029	0.020	0.012	**0.650**
UO_2 plant	Uranium	0.0008	0.0006	0.0005	0.0005	0.0008	**0.240**
UO_2 plant	Ammonia	2.1	2.0	2.0	2.4	2.0	**58**

UO_2 = uranium dioxide; UF_6 = uranium hexafluoride; kg/h = kilogram per hour

Liquid effluent

Cameco's PHCF collects and evaporates its process wastewater effluent. Its operating licence does not allow for any process wastewater effluent to be discharged from PHCF and there were no process liquid discharges from PHCF in 2023.

In compliance with the requirements of other regulators that have jurisdiction, Cameco's PHCF monitors releases of the following point source discharges that are non-process liquid effluent: cooling water, sanitary sewer, storm sewer, and the combined backwash stream associated with the harbour water intake system.

The former UO_2 plant cooling water return was not in operation throughout 2023 because the production facility transitioned to a closed loop cooling system in 2022. In July 2023, a UF_6 plant closed loop cooling water system was commissioned. As a result, Cameco is not required to monitor the harbour water intake and associated once-through cooling water system discharges.

Similar to previous years, in 2023, Cameco's PHCF continued to observe elevated uranium concentrations in the UF_6 plant cooling water return. This is attributed to the inner harbour remedial work by CNL that involved debris removal and resulted in sediment disturbances.

With respect to the daily sanitary sewer discharges, the action level was reached or exceeded 11 times in 2023, as described in the action levels subsection of section 5.9. Cameco is continuing to repair and to replace sections of the sanitary sewer network as part of the Vision in Motion project. CNSC staff concluded that in 2023, Cameco met its licence requirement to not discharge process wastewater effluent and to keep the sanitary sewer discharges below their respective release limits.

Uranium in ambient air

Cameco monitors ambient air at several locations around the PHCF site to measure air quality using high-volume air sampling of total suspended particles (TSP) (uranium from the air is collected on a filter and analyzed) to ensure that the impact of the facility's emissions to the environment is minimized. In 2023, the highest annual average concentration of uranium in TSP in ambient air was 0.006 µg/m^3 for a 24-hour period, which is consistent with values for the years 2019 to 2023. This value is well below the O.Reg 419/05: Air Pollution – Local Air Quality standard for an upper risk threshold of uranium of 1.5 µg/m^3 for a 24-hour period.

Groundwater monitoring

Cameco is in compliance with CSA N288.7-15, *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*.

The PHCF long-term groundwater monitoring program includes groundwater level monitoring and groundwater sampling at select wells. Cameco samples groundwater quality at the PHCF in the following monitoring wells:

- 12 active pumping wells monthly
- 56 monitoring wells in the overburden (soil) on a quarterly basis
- 16 monitoring wells in the bedrock on an annual basis

Groundwater quality across the site in 2023 was generally consistent with that reported in previous annual monitoring reports from the licensee. Similarly, groundwater flow patterns

were consistent with what was observed historically, flowing southeast towards the turning basin.

The pump-and-treat wells have been performing as expected. The operation of the pump-and-treat system has resulted in capture of contaminant plumes originating under the footprints of the current and original UF_6 plants, as well as the UO_2 plant. The mass of contaminants removed by these pumping wells is slightly lower than in previous years (see table I-7 below). These results are either within historical ranges of fluctuation, or attributable to lower contaminant concentrations in pumped groundwater. Indeed, the mass of contaminants entering the harbour is less than calculated in previous years and does not exceed regulatory release limits.

Table I-7: Mass of contaminants removed by pumping wells, Port Hope Conversion Facility, kg, 2019–2023

Parameter	2019	2020	2021	2022	2023
Uranium	27.0	22.0	22.0	16.0	14.0
Fluoride	47.0	47.0	45.0	41.0	37.0
Ammonia	39.0	23.0	21.0	9.2	18.0
Nitrate	69.0	60.0	56.0	19.0	16.0
Arsenic	0.5	0.64	0.82	1.8	1.4

kg=kilogram

Surface water monitoring

The surface water quality in the harbour near the PHCF site has been monitored since 1977 through the analysis of samples collected from the south cooling water intake near the mouth of the Ganaraska River. The trend of surface water quality over time shows improvement since 1977 and very low uranium levels.

Surface water in the harbour is sampled at 13 locations on a quarterly basis with samples collected at depths slightly below the water surface and slightly above the sediment layer. Beginning in 2018, these sampling locations were restricted due to CNL's remedial harbour activities; however, PHCF has continued to monitor the cooling water intake since this is a good indication of the overall water quality under routine and baseline conditions, where routine refers to typical water quality conditions during facility operations and baseline refers to water quality conditions before this facility was in operation.

Table I-8 provides annual average and maximum concentrations of uranium, fluoride, nitrate, and ammonia monitored in the harbour water from 2019 to 2023. CNL harbour isolation works

and CNL harbour remedial activities (dredging) have influenced the Port Hope Harbour water quality and have caused uranium concentrations in the cooling water intake to exceed the CCME water quality guideline of 15 µg U/L. Since observing these elevated concentrations, CNL has implemented a more robust surface water quality monitoring program and has followed up appropriately to reduce, as much as possible, any environmental impacts. Once the contaminated sediment is removed from the harbour, the water quality is predicted to significantly improve. CNSC staff are satisfied that the surface water quality is being adequately monitored to ensure the protection of human health and the environment. CNL will continue to provide updates to Cameco and notify Cameco when dredging is taking place.

Although there was a maximum fluoride concentration in harbour water that measured 0.14 mg/L and this value exceeded the CCME freshwater guideline for the protection of aquatic life of 0.12 mg/L, this fluoride concentration was well below Health Canada's drinking water standard of 1.5 mg/L and the lowest toxicity benchmark for sensitive aquatic biota of 11.5 mg/L. This indicates these were safe fluoride levels for human health and were unlikely to cause adverse effects to aquatic biota.

Table I-8: Harbour water quality, Port Hope Conversion Facility, µg/L 2019–2023

Parameter	2019	2020	2021	2022	2023	CCME Guideline*
Average Uranium	5.1	5.0	70	120	240	**15**
Maximum Uranium	46	12	540	500	740	**15**
Average Fluoride	0.092	0.09	0.066	0.11	0.10	**0.12**
Maximum Fluoride	0.18	0.15	0.17	0.22	0.14	**0.12**
Average Nitrate	0.95	0.92	1.0	0.89	1.3	**13**
Maximum Nitrate	1.6	1.7	1.9	1.9	2.1	**13**
Average Ammonia + ammonium	0.031	0.014	0.015	0.045	0.022	**0.3**
Maximum Ammonia + ammonium	0.21	0.14	0.17	0.76	0.14	**0.3**

mg/L = milligram per litre; µg/g = microgram per gram; CCME = Canadian Council of Ministers of the Environment

*CCME, *Canadian Water Quality Guidelines for the Protection of Aquatic Life*

Soil monitoring

Cameco's annual soil monitoring program at PHCF consists of two monitoring locations at 3 different soil depths beyond the facility's fence line. One of these locations is within a 0 to 500 m radius from the facility, while the remaining location is within a 1,000 to 1,500 m radius from the facility. Location two is no longer sampled as it has been impacted by the CNL remediation work zone established at the West Beach to the west of the municipal water treatment facility.

In 2023, the uranium in soil concentrations for all sampling depths at the clean fill soil location were found to be consistent with and virtually unchanged from values obtained during previous sampling years (see table I-9 for 0-5 cm soil sampling results for the clean fill soil location for 2019 to 2023). All results were well below soil guidelines for residential and parkland set by the CCME in its *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* and are within the range of natural background levels for Ontario (2.5 µg/g). The results suggest that current PHCF operations and their uranium emissions do not significantly contribute to the accumulation of uranium in soil.

Cameco PHCF will review and modify soil monitoring locations as appropriate following the completion of the Port Hope Area Initiative.

Table I-9: Uranium concentrations at waterworks side yard remediated with clean soil, Port Hope Conversion Facility, µg/g, 2019–2023

Soil Depth (cm)	2019	2020	2021	2022	2023	CCME Guideline*
0–5	0.82	0.91	0.87	1.1	N/A	**23**

cm = centimetre; µg/g = microgram per gram; CCME= Canadian Council of Ministers of the Environment
*CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*

Samples weren't collected in 2023 at this location because of the ongoing remediation work by CNL.

Fluoride monitoring

The impact of fluoride emissions on the local environment from PHCF facility operations is determined by monitoring fluoride concentrations and visible foliar damage in vegetation at sampling locations adjacent to the facility and in the surrounding community. The vegetation monitoring program, conducted in coordination with the Ontario Ministry of the Environment, Conservation and Parks (MECP), was modified to sample clusters of trees rather than single trees (starting in 2018). It was further modified in 2021 to remove 4 sampling sites, which was consistent with MECP feedback that these locations were not adding value to the monitoring program. Additionally, some trees previously monitored needed to be replaced with others due

to downed trees and CNL's remedial work in the area. All values are well below the MECP's Ambient Air Quality Criteria (AAQC) value for fluoride in dry forage of 35 ug/g.

Table I-10: Average fluoride concentration in local vegetation, Port Hope Conversion Facility, µg/g, 2019–2023

Parameter	2019	2020	2021	2022	2023	MECP's AAQC
Fluoride in vegetation	<5.0	<5.0	<5.0	<5.0	<5.0	**35**

µg/g = microgram per gram; MECP = Ontario Ministry of the Environment, Conservation and Parks; AAQC = Ambient Air Quality Criteria

Note: For 2023, 17 of 26 samples were below the detection limit of 5 µg/g ; for 2022, 14 of 26 samples were below the detection limit of 5 µg/g; for 2021, 16 of 26 samples were below the detection limit of 5 µg/g; for 2020, 28 of 33 samples were below the detection limit of 5 µg/g; for 2019, 31 of 34 samples were below the detection limit of 5 µg/g; and for 2018, 29 of 34 samples were below the detection limit of 5 µg/g.

Gamma monitoring

A portion of radiological public dose from PHCF operations is from gamma radiation sources. PHCF monitors gamma radiation effective dose rates at the fence line of the 2 sites to ensure that potential exposure levels remain ALARA. The gamma radiation effective dose rates for both sites are measured with environmental TLDs supplied by a licensed dosimetry service.

The 2019 to 2023 maximum monthly doses for gamma radiation are shown in table I-11. In 2023, the maximum monthly gamma measurements were all below the respective derived release limits for this facility and remained consistent with values from previous years. The measurements indicate that gamma dose rates are controlled, and the public is protected.

Table I-11: Gamma monitoring results, maximum monthly, Port Hope Conversion Facility, µSv/h, 2019–2023

Station number and site	2019	2020	2021	2022	2023	DRL
Station 2 - Sites 1 and 2	0.20	0.20	0.21	0.23	0.23	**0.57**
Station 13/10 - Site 1	0.00/ 0.05	0.11	0.02	0.01	0.03	**0.40**
Station 21 - Site 2	0.06	0.09	0.03	0.06	0.06	**0.26**

µSv/h= microsievert per hour

Cameco Fuel Manufacturing Inc.

Atmospheric emissions

Cameco continued to monitor uranium released as atmospheric emissions from the CFM facility. The monitoring data in Table I-12 demonstrates that stack and building exhaust ventilation emissions from the facility continued to be effectively controlled, as annual averages remained consistently well below their licence limits between 2019 and 2023.

Table I-12: Air emission monitoring results, Cameco Fuel Manufacturing, kg/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	Licence Limit
Total uranium discharge through stacks	0.004	0.01	0.01	0.01	0.004	**10.5**
Total uranium discharge through building exhaust ventilation	1.09	0.92	0.89	1.06	1.05	**10.5**

kg= kilogram

Note: CFM's licence limit changed from 14kg/yr to 10.5 kg/yr in 2022. CFM is currently transitioning to a rate-based limit of 1.2 g/h (approximately equivalent to 10.5 kg/yr) that was introduced when the licence was renewed in March 2023.

Liquid effluent

After liquid effluent generated from the production process is collected, an evaporator process is used to remove the majority of the uranium. The condensed liquid is sampled and analyzed prior to a controlled release to the sanitary sewer line. Cameco continues to monitor uranium released as liquid effluent from the facility. The monitoring data in table I-13 demonstrates that liquid effluent from the facility in 2023 remained consistently well below the licence limit and continued to be effectively controlled.

Table I-13: Liquid effluent monitoring results, Cameco Fuel Manufacturing, mg/L, 2019–2023

Parameter	2019	2020	2021	2022	2023	Licence Limit
Average concentration of uranium discharged to sewer	0.01	0.01	0.01	0.02	0.02	**1.7**
Maximum concentration of uranium discharge to sewer	0.03	0.05	0.03	0.09	0.03	**1.7**

mg/L = milligram per litre

Note: The licence limit was changed from 475 kg/yr to 1.7 mg/L in 2022

Uranium in ambient air

Cameco operates high-volume air samplers to measure the airborne concentrations of uranium

at points of impingement of stack plumes. The samplers are located on the east, north, southwest and northwest sides of the facility. In 2023, the results from these samplers showed that the highest annual average concentration of uranium in ambient air (among the sampling stations) was 0.0004 µg/m^3. All of the values are well below the O.Reg 419/05: Air Pollution – Local Air Quality standard for uranium of 0.03 µg/m^3.

Groundwater monitoring

Cameco is in compliance with CSA N288.7-15, *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*.

CFM has a network of 70 monitoring wells that includes 43 overburden, 23 shallow bedrock and 4 deep bedrock wells. Groundwater has been monitored at the site twice a year since 1999 and up to 10 pumping wells and 2 sumps were in operation during 2023. Table I-14 provides annual average and maximum concentrations of dissolved uranium in groundwater from 2019 to 2023.

Table I-14: Dissolved uranium concentrations in groundwater, Cameco Fuel Manufacturing, µg/L, 2019–2023

Parameter	2019	2020	2021	2022	2023	MECP Standard*
Average dissolved uranium concentration for on-site and off-site locations	115	107	53	40		**420**
Maximum dissolved uranium concentration for on-site and off-site locations	2300	2100	710	490		**420**
Average dissolved uranium concentration for on-site locations	-	-	-	-	57	**420**
Maximum dissolved uranium concentration for on-site locations	-	-	-	-	670	**420**
Average dissolved uranium concentration for off-site locations	-	-	-	-	2.2	**420**
Maximum dissolved uranium concentration for off-site locations	-	-	-	-	9.5	**420**

The MECP Table 3 Standard of 420 µg/L applies to most of CFM's well locations (locations > 30 m from West Gage Creek and off-site locations). However, the MECP Table 9 Standard of 330 µg/L applies to 2 on-site well locations < 30 m from West Gage Creek (TW-3 and TW-4)Starting in 2023, the average and maximum values are presented separately for on-site and off-site locations. Previously, they were combined.

µg/L = microgram per litre
*MECP = Ministry of the Environment, Conservation and Parks

Groundwater quality across the site in 2023 generally met the MECP's Table 3 uranium standard of 420 µg/L. Groundwater quality also met the MECP's Table 9 uranium standard of 330 µg/L at the two on-site well locations less than 30 metres from West Gage Creek. Concentrations of dissolved uranium in groundwater ranged from <0.1 µg/L to a maximum value of 670 µg/L across the site. Concentrations of uranium in groundwater exceeded the MECP Table 3 Standard in 1 of the 70 monitoring wells sampled. This exceedance relates to historic waste management practices. The soil impact is confined to a small area. The groundwater monitoring results confirmed that current operations are not contributing to the concentrations of uranium in groundwater on the licensed property.

Groundwater flow at the CFM site is generally from the west and northwest towards the east and southeast in 2023, consistent with historical observations. To the south of CFM (i.e., in the direction of groundwater flow), the closest property boundary (non-residential) is approximately 120 to 140 meters from the facility. As stated in the ERA, the potential for off-site migration of contaminants through groundwater movement is low due to the slow movement of groundwater and the operations of the groundwater recovery and treatment system at CFM. CFM's groundwater recovery system experienced significant downtime in 2022 and into 2023 due to the degradation of several key components and equipment failures. The system was not operational most of Q1 2023 and returned to operation in late-March. Groundwater recovery and treatment operations were subsequently isolated in November 2023 in preparation for the demolition and replacement of groundwater treatment system which was operational as of December 21, 2023. CFM's groundwater monitoring results for downstream locations, taken in the fall of 2023, indicate the system downtime did not have measurable impact on groundwater quality. Groundwater below and immediately downstream of the CFM facility is not used for drinking water purposes.

Surface water monitoring

In 2023, Cameco collected surface water samples at 9 locations in May, August, and October. Three of the sampling locations are drainage features where water is only intermittently present in the spring following rain events. All sample locations were on or adjacent to the licensed site and were analyzed for uranium. Table I-15 provides average uranium in surface water from 2019-2023.

I-15: Surface water quality monitoring results, Cameco Fuel Manufacturing, µg/L, 2019–2023

Parameter	2019	2020	2021	2022	2023	CCME Guideline*
Average Uranium in the West Gage Creek	1.29	0.61	0.87	0.81	0.87	**15 (long-term)**

Average Uranium in the Intermittent Drainage Feature	20.04	6.50	11.10	5.84	2.40	**33 (short-term)**

µg/L = microgram per litre; CCME = Canadian Council of Ministers of the Environment
*****CCME, *Canadian Water Quality Guidelines for the Protection of Aquatic Life*

For all 2023 surface water sampling locations, the total uranium concentrations were below the applicable CCME guidelines. The maximum uranium concentration for surface water samples taken for intermittent drainage locations was 5.5 µg/L, which is below the CCME's short-term uranium guideline of 33 µg/L. The maximum uranium concentration for all other locations was 2.2 µg/L, which is below the CCME's long-term uranium guideline of 15 µg/L.

CNSC staff will continue to oversee Cameco's monitoring at locations around the vicinity of CFM to confirm that uranium concentrations remain at safe levels in surface water.

Soil monitoring

At least every 3 years, Cameco collects soil samples at various depths from 23 locations surrounding the CFM facility. Soil samples were last collected in 2022 and analyzed for uranium content. The soil monitoring results for 0-5 cm are shown in table I-16. The 2022 average uranium concentration in soil near the CFM facility is within the range of results observed previously and slightly above the Ontario natural background level of 2.5 µg/g. These results were below the CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* of 23 µg/g for residential and parkland land use. This is the most restrictive guideline; therefore, no adverse consequences to human and environmental receptors are expected. The maximum concentration of 25.8 µg/g observed in 2022 is from outside the licensed area (but still within Cameco's property) and reflects historical contamination and is not attributable to the current CFM operations. Note that the risk to the environment from an exceedance of a CCME guidance is expected to be minimal due to the conservative assumptions and safety factors that were used to derive the guideline.

Table I-16: Soil monitoring results*, Cameco Fuel Manufacturing, µg/g, 2010–22

Parameter	2010	2013	2016	2019	2022	CCME** Guideline
Average uranium concentration (0-5 cm)	5.6	4.7	3.0	3.0	3.6	**23**
Maximum uranium concentration	21.1	17.4	10.2	10.2	25.8	**23**

µg/g = microgram per gram; CCME= Canadian Council of Ministers of the Environment
*CFM reverted to a 3-year soil monitoring program in 2010.
**CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*.

Gamma monitoring

For the CFM facility, a portion of radiological public dose is due to gamma radiation sources. Consequently, monitoring of gamma radiation effective dose rates at the fence line of the CFM site is essential to ensuring that levels of potential gamma radiation exposure are maintained ALARA. The gamma radiation effective dose rates for the site are measured with environmental TLDs supplied by a licensed dosimetry service. Gamma monitoring results are shown in Table I-17.

In 2023, the gamma measurements were all below the respective derived release limits for this facility and remain consistent with values from previous years.

Table I-17: Annual average gamma monitoring results, Cameco Fuel Manufacturing, µSv/hr, 2019–2023

Location	2019	2020	2021	2022	2023	DRL
1	0.01	0.01	0.01	0.02	0.00	**4.96**
2	0.03	0.03	0.03	0.04	0.03	**0.46**
3	0.00	0.00	0.00	0.00	0.00	-
4	0.00	0.00	0.00	0.00	0.00	-
5	0.00	0.00	0.00	0.00	0.00	-
6	0.00	0.00	0.00	0.00	0.00	-
7	0.00	0.00	0.00	0.00	0.00	-
8	0.00	0.00	0.00	0.00	0.00	-
9	0.00	0.17	0.03	0.04	0.04	-
10	0.00	0.00	0.00	0.00	0.00	-
11	0.25	0.29	0.33	0.27	0.20	-
12	0.32	0.34	0.38	0.36	0.29	**1.35**

µSv/hr = millisievert per hour

These measurements indicate that gamma dose rates are controlled and that the public is protected.

BWXT Nuclear Energy Canada Inc. – Toronto and Peterborough

Atmospheric emissions

To ensure compliance with licence limits, air emissions from the BWXT NEC facilities are filtered and sampled prior to release into the atmosphere. Table I-18 provides BWXT NEC Toronto's

annual maximum uranium emissions from 2019 to 2023. Table I-19 provides BWXT NEC Peterborough's annual maximum uranium and beryllium emissions from 2019 to 2023. The annual emissions remained well below the licence limits for both facilities. The results demonstrate that air emissions of uranium and beryllium were being controlled effectively.

Table I-18: Air emission monitoring results, BWXT NEC Toronto, µg/m³, 2019–2023

Parameter	Stack	2019	2020	2021	2022	2023	Licence limit
Uranium	Rotoclone	0.077	0.204	0.197	0.322	0.145	**65**
Uranium	6H-68	0.111	0.112	0.461	0.086	0.086	**47**
Uranium	4H-48	0.037	0.112	0.072	0.125	0.118	**97**
Uranium	Furnace #1	0.081	0.599	0.224	0.072	0.158	**437**
Uranium	Furnace #2/4	0.103	0.158	0.395	0.322	0.263	**55**
Uranium	Furnace #5/6	0.245	0.908	0.250	0.257	0.257	**52**

µg/m³= microgram per cubic metre

Table I-19: Air emission monitoring results, BWXT NEC Peterborough, µg/m³, 2019-2023

Parameter	Stack	2019	2020	2021	2022	2023	Licence Limit
Uranium	R2 Decan	0.014	0.003	0.003	0.005	0.007	**410**
Beryllium	North	0.001	0.001	0.003	0.001	0.000	**2.6**
Beryllium	South	0.001	0.001	0.001	0.001	0.000	**2.6**
Beryllium	Acid	0.000	0.000	0.002	0.001	0.003	**2.6**

µg/m3= microgram per cubic metre

Liquid effluent

To ensure compliance with licence limits, wastewater from the BWXT NEC Toronto and Peterborough facilities is collected, filtered, and sampled prior to its release into sanitary sewers. Table I-20 provides BWXT NEC's annual maximum concentrations of uranium and beryllium released to the sanitary sewers from 2019 to 2023. In 2023, the releases continued to

be well below the licence limits and the results demonstrate that liquid effluent releases were being controlled effectively.

Table I-20: Liquid effluent monitoring results, BWXT NEC, mg/L, 2019–2023

Facility	Parameter	2019	2020	2021	2022	2023	Licence Limit
BWXT NEC Toronto	Uranium	2.58	2.79	2.55	2.82	2.51	**1000**
BWXT NEC Peterborough	Uranium	0.07	0.37	0.41	0.78	0.20	**2500**
BWXT NEC Peterborough	Beryllium	0.0018	0.0091	0.0031	0.0033	0.0038	**26**

mg/L = milligram per litre

Uranium in ambient air

BWXT NEC Toronto operates 5 high-volume air samplers to measure airborne concentrations of uranium at points of impingement of stack plumes. The results from these samplers show that the annual average concentration of uranium (among the sampling stations) in ambient air measured around the facility in 2023 was below the minimum detection limit and the results are well below the *O.Reg 419/05: Air Pollution – Local Air Quality* standard for uranium of 0.03 µg/m^3. Table I-21 provides air monitoring results for BWXT NEC Toronto.

BWXT NEC Peterborough does not monitor uranium in ambient air because the atmospheric emissions discharged from the facility already meet the *O.Reg 419/05: Air Pollution – Local Air Quality* standard for uranium of 0.03 µg/m^3 at the point of release, thus eliminating the need for additional ambient air monitoring.

Table I-21: Uranium in boundary air monitoring results, BWXT NEC Toronto, µg/m^3, 2019–2023

Parameter	2019	2020	2021	2022	2023
Average concentration	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

µg/m^3= microgram per cubic metre

Soil monitoring

BWXT NEC conducts soil sampling for uranium at its Toronto facility as part of its environmental program. In 2023, soil samples were taken from 32 locations and analyzed for uranium content. The samples were collected from the BWXT NEC Toronto site (table I-22), from commercial lands (table I-23) located along the south border of the site, and from a nearby residential neighbourhood (table I-24). Due to issues with access to the Canadian Pacific Railway property, the 2023 sampling program also included new sample locations. In 2023, the uranium in soil

concentrations ranged from 0.3 µg/g to 1.0 µg/. All 32 locations were below Ontario's background concentrations for uranium of up to 2.5 µg/g and well below the applicable CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* for uranium for industrial, commercial, and residential/parkland land use.

Table I-22: Uranium in soil monitoring results, BWXT NEC Toronto property, µg/g, 2019–2023

Parameter	2019	2020	2021	2022	2023	CCME Guideline*
Average uranium concentration	1.2	1.3	2.4	0.8	0.9	**300**
Maximum uranium concentration**	1.2	1.3	4.6	1.1	1.0	**300**

µg/g = microgram per gram; CCME= Canadian Council of Ministers of the Environment
*CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*.
**Prior to 2021, only one sample was taken, which is why average and maximum value are the same.

Table I-23: Uranium in soil monitoring results, commercial lands, BWXT NEC Toronto, µg/g, 2019–2023

Parameter	2019	2020	2021	2022	2023	CCME Guideline*
Average uranium concentration	1.5	2.9	1.0	6.4	0.5	**33**
Maximum uranium concentration	2.8	17.6	1.0	28.1	0.6	**33**

µg/g = microgram per gram; CCME = Canadian Council of Ministers of the Environment
*CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*.

Table I-24: Uranium in soil monitoring results, residential locations, BWXT NEC Toronto, µg/g, 2019–2023

Parameter	2019	2020	2021	2022	2023	CCME Guideline*
Average uranium concentration	1.1	1.0	1.0	0.6	0.5	**23**
Maximum uranium concentration	1.7	1.0	1.1	2.3	0.8	**23**

µg/g = microgram per gram; CCME = Canadian Council of Ministers of the Environment
*CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*.

BWXT NEC conducted soil sampling for beryllium in 2020 around the Peterborough facility (table I-25), as committed in the CNSC licence renewal hearing (Record of Decision). In 2020, soil samples were taken from 21 locations that were selected for consistency with the CNSC's IEMP. Soil sampling for beryllium and uranium (table I-26), which started in 2021 and is now conducted annually, was conducted at 13 locations in accordance with BWXT's documented plan by a third party-party consultant. The minimum detectable concentration of uranium is 1.0 part per million (1.0 µg U/g) and the samples were within this minimum detection limit. The minimum detectable concentration of beryllium is 0.5 parts per million (0.5 µg Be/g) and the samples that were detected ranged from < 0.5 µg/g to 0.56 µg/g. All samples were well below Ontario's background concentrations of up to 2.5 µg/g for beryllium and well below the applicable CCME soil quantity guideline for the protection of environmental health (4 mg/kg for beryllium) and human health (75 mg/kg for beryllium).

Table I-25: Beryllium in soil monitoring results, institutional or park lands, BWXT NEC Peterborough, µg/g, 2020-2023

Parameter	2020	2021	2022	2023	CCME Guideline*
Average beryllium concentration	0.50	0.50	< 0.50	< 0.50	**4.0**
Maximum beryllium concentration	0.52	0.52	0.53	0.56	**4.0**

µg/g = microgram per gram; CCME = Canadian Council of Ministers of the Environment
*CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*.

Table I-26: Uranium in soil monitoring results, institutional or park lands, BWXT NEC Peterborough, µg/g, 2021-2023

Parameter	2021	2022	2023	CCME Guideline*
Average uranium concentration	1.0	< 1.0	< 1.0	**23**
Maximum uranium concentration	1.0	< 1.0	< 1.0	**23**

µg/g = microgram per gram; CCME = Canadian Council of Ministers of the Environment
*CCME, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*.

Gamma monitoring

A portion of radiological public dose from both the BWXT NEC Toronto and Peterborough facilities is due to gamma radiation sources. Consequently, it is necessary to monitor the gamma radiation effective dose rates at the fence line of the Toronto site and at the Peterborough facility boundary to ensure that levels of potential gamma radiation exposure are maintained ALARA.

In 2023, the annual radiation dose from direct gamma radiation was:

- BWXT NEC Toronto site measured 17.2 µSv
- BWXT NEC Peterborough site measured 11.5 µSv

These estimates indicate that the gamma dose from both BWXT NEC facilities is controlled and was well below the 1 mSv (1,000 µSv) per year effective dose limit to a member of the public.

BWXT Medical

Atmospheric emissions

BWXT Medical performs weekly air exhaust stack sampling and continuously monitors process ventilation, exhaust ductwork, and stack emissions using in-situ detectors, samplers, and computerized recording. As a result of weekly air sampling, there were no detectable airborne releases of radioactive substances. For non-radiological hazardous substances, the airborne emissions from BWXT Medical were well below the limits in its Environmental Compliance Approval from the MECP.

Liquid effluent

BWXT Medical collects wastewater in underground delay tanks and analyzes it before discharging into the sanitary sewer system. In 2023, all radionuclide analysis results from liquid effluent at BWXT Medical were below the laboratory's detection limits and values were therefore well below their regulatory release limits.

Soil sampling

In 2023, soil was sampled around the BWXT Medical facility at 19 locations and there were no gamma-emitting radionuclides detected in the samples.

Gamma monitoring

BWXT Medical monitors gamma radiation at the facility using environmental TLDs. TLDs are also placed in residences of BWXT Medical employees located near the facility and the highest result of these in 2023 was 0.098 mSv. This shows that the gamma radiation levels at offsite monitoring locations were in the range of natural background, which indicates that BWXT Medical’s operations are not contributing to the public’s gamma radiation exposure.

SRB Technologies (Canada) Inc.

Atmospheric emissions

SRBT monitors tritium releases from its facility stacks and reports the monitoring data on an annual basis. The monitoring data for 2019 to 2023 is provided in Table I-28 and demonstrates that atmospheric emissions from the facility remained well below their regulatory limits.

Table I-28: Atmospheric emissions monitoring results, SRB Technologies, GBq/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	Licence limit
Tritium as HTO	11,858	9,755	8,387	8,816	6,509	**67,200**
Total tritium as HTO + HT	31,769	25,186	28,729	26,590	13,965	**448,000**

GBq = gigabecquerels; HTO = hydrogenated tritium oxide; HT = tritium gas

Liquid effluent

SRBT continues to control and monitor tritium released as liquid effluent from the facility. The monitoring data for 2019 to 2023 is provided in table I-29 and demonstrates that liquid effluent from the facility remained well below their regulatory limits.

Table I-29: Liquid effluent monitoring results for release to sewer, SRB Technologies, GBq/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	Licence limit, GBq/year
Tritium-water soluble	13.67	5.56	3.07	1.49	0.68	**200**

GBq = gigabecquerels

Tritium in ambient air

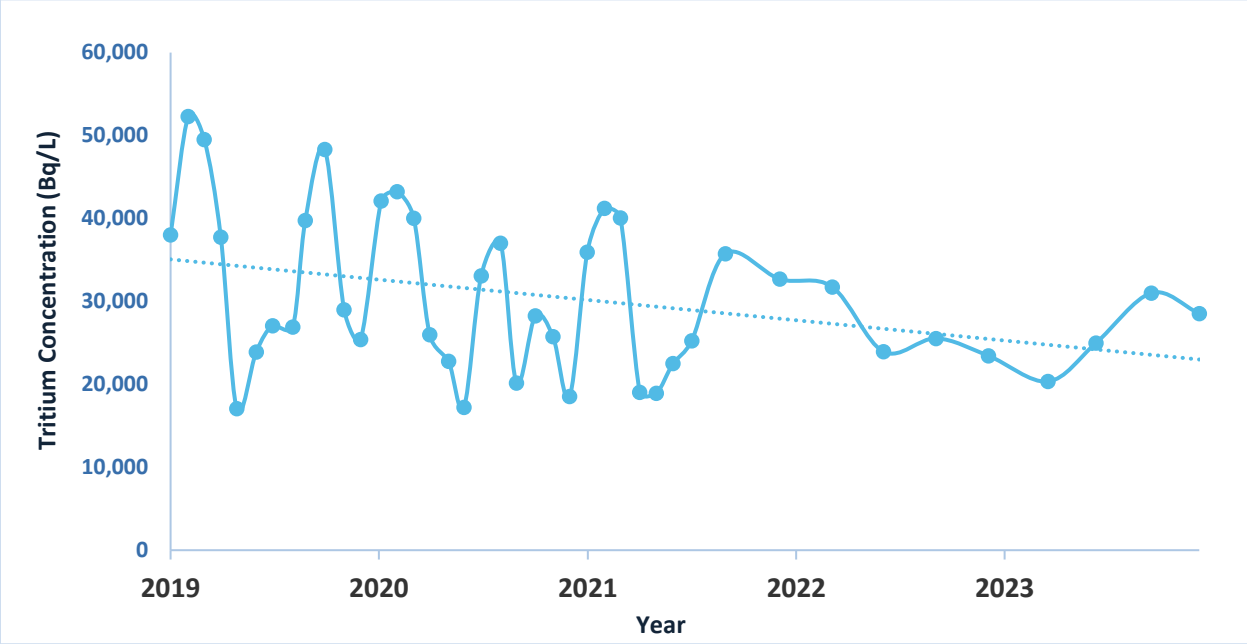
SRBT maintains 40 passive air samplers to monitor tritium in air and 35 of which are located within a 250 m to 2 km radius from the facility. These samplers represent tritium exposure pathways for inhalation and skin absorption and are used to calculate public dose. The 2023 air monitoring results from these samplers demonstrated that tritium levels in ambient air near SRBT remain low and consistent with results from previous years.

Groundwater monitoring

SRBT is in compliance with CSA N288.7-15, *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*.

Groundwater is currently sampled at 29 groundwater monitoring wells (sampled on a quarterly basis), 2 nearby business locations (sampled twice annually), and 5 residential drinking water wells (sampled twice annually). From the 2023 sampling results, the highest tritium concentration was reported for monitoring well MW06-10 (26,163 Bq/L). This is the only well where tritium exceeds the Canadian Drinking Water Guideline value of 7,000 Bq/L and it is located directly beneath the area where the active ventilation stacks are found. This well is a dedicated, engineered groundwater monitoring well which is located very near to the facility within a secured area and is not available to be used as a source of water consumption. The elevated tritium concentration in this well is from historical practices before 2006. SRBT continues to minimize tritium emissions during operation. As a result, tritium concentrations in the groundwater continue to show a declining trend, as shown in Figure I-1 (Source: SRBT ACR 2022).

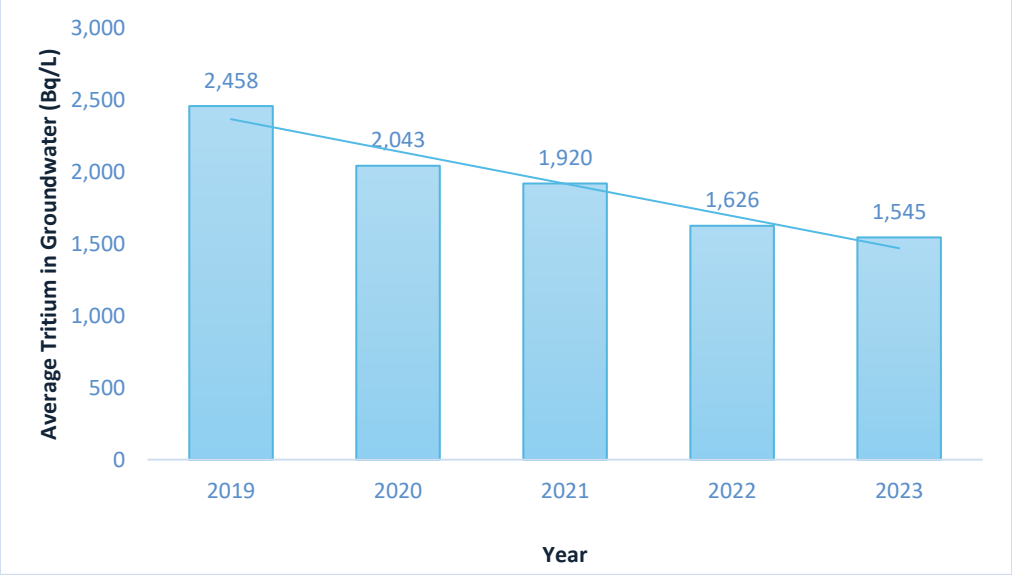
Figure I-1: Tritium Concentrations in monitoring well MW06-10, 2019–23



Throughout 2023, none of the other monitoring wells at the SRBT site exceeded the Canadian Drinking Water Guideline for tritium of 7,000 Bq/L. Tritium concentrations in all monitoring wells are exhibiting consistently decreasing concentrations in recent years. Figure I-2 shows the average tritium concentrations among all the groundwater monitoring wells around the site in the past 5 years (2019-2023).

Of the 5 nearby residential wells around the site, none are in the groundwater flow pathway. The closest well, RW-2, is 1,100 metres away from SRBT. The maximum tritium concentration for all the residential wells monitored in 2023 was 38 Bq/L.

Figure I-2: Average tritium concentrations in groundwater at SRB Technologies, 2019–23



Other monitoring

SRBT samples and analyzes runoff water from its facility and engages a qualified third party to perform monitoring and analysis of precipitation, surface water, produce, and milk. In 2023, SRBT sampled and analyzed tritium in sumac berries at three locations in and around Pembroke, which is a plant of interest to Indigenous communities. The results showed tritium concentrations in the sumac berries were low and not expected to pose a health risk from ingestion. This monitoring complements the principal monitoring activities which focus on air and groundwater.

Nordion (Canada) Inc.

Atmospheric emissions

Nordion controls and monitors radioactive releases from its facility to prevent unnecessary releases of radioisotopes to the atmosphere. Table I-30 provides Nordion's radioactive air emissions monitoring results from 2019 to 2023.

The 2023 monitoring data demonstrates that radioactive air emissions from this facility remained well below the regulatory limits with a very small detectable amount of Co-60 released to the air.

Table I-30: Air emissions monitoring results, Nordion, GBq/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	DRL
Cobalt-60	0.00002	0	0.00004	0.0003	0.000001	**250**
Iodine-125	0	0	0	0	0	**952**
Iodine-131	0	0	0	0	0	**686**
Xenon-133	0	0	0	0	0	**677 million**
Xenon-135	0	0	0	0	0	**102 million**
Xenon-135m	0	0	0	0	0	**69 million**

GBq = gigabecquerel; DRL = derived release limit;

Liquid effluent

Nordion collects its liquid effluent in delay tanks and analyzes it before discharging to the sanitary sewer system.

Table I-31 below provides Nordion's monitoring results for radioactive liquid emissions between 2019 to 2023. The monitoring data demonstrates that authorized radioactive liquid effluent releases from this facility in 2023 remained well below their DRLs.

Table I-31: Liquid effluent monitoring results for releases to the sanitary sewer, Nordion, GBq/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	DRL
β < 1 MeV	0.162	0.226	N/A	N/A	N/A	**763**
β > 1 MeV	0.038	0.057	N/A	N/A	N/A	**35,000**
Iodine-125	0.063	N/A	N/A	N/A	N/A	**1,190**
Iodine-131	0.004	N/A	N/A	N/A	N/A	**389**
Molybdenum-99	0.036	N/A	N/A	N/A	N/A	**10,200**
Cobalt-60	0.020	0.031	0.0046	0.038	0.026	**35.4**
Niobium-95	0.002	0.0015	0.002	0.002	0.0005	**3,250**
Zirconium-95	0.0019	0.0013	0.002	0.001	0.0009	**2,060**
Cesium-137	0.0007	0.00076	0.001	0.001	0.0006	**24.8**

β < 1 MeV = beta particles less than 1 megaelectronvolt; GBq = gigabecquerels; DRL = derived release limit

Groundwater monitoring

There are currently 5 groundwater monitoring wells on the Nordion site. Since 2005, Nordion has been monitoring groundwater wells at least once per year for non-radioactive contaminants. The monitoring results from 2019 to 2023 demonstrate that there were no significant changes in the groundwater in 2023 when compared to previous years and that contaminant concentrations remained below the applicable limits in the Ministry of the Environment's (MECP) Table 3 standard for non-potable groundwater conditions.

Since 2014, Nordion has monitored groundwater at least once per year for radioactive contaminants (Cobalt-60 is the main radionuclide in airborne emissions) from 5 monitoring wells. The results have detected only naturally occurring radionuclides that are not processed at the Nordion facility. The results, which have been either below detection limits or at natural background levels, indicate that releases of radioactive and hazardous substances from Nordion's facility have had no measurable impact on groundwater quality. Additionally, groundwater is not used as a source of potable water in the vicinity of the site.

Soil sampling

In 2023, Nordion conducted its annual soil sampling campaign and collected 19 soil samples from around the facility. All 19 soil samples measured below the lab's minimum detectable amount and no radionuclides attributable to their licensed activities were detected.

Gamma monitoring

Nordion uses TLDs to monitor environmental gamma radiation from the facility. These devices are placed at locations that cover the points of a compass and are preferentially placed east of the facility to receive prevailing winds. TLDs are also placed in the residences of Nordion employees and local businesses near the facility and, in 2023, the highest TLD measurement of these locations was 0.098 mSv. The 2023 annual monitoring results show that gamma radiation levels at offsite monitoring locations were in the range of natural background, which indicates that Nordion's operations are not contributing to the public's gamma radiation exposure.

Best Theratronics Ltd.

Effluent and emissions control (releases)

There are no radiological releases (liquid or airborne) from the BTL facility that require controls or monitoring since it uses radioactive sealed sources that are not produced on-site and do not result in any radioactive releases.

BTL safely manages hazardous liquid effluents from routine operations. They are collected, temporarily stored on-site, and regularly removed for disposal by a certified third-party contractor. Lubricating oil for on-site boring and milling machines is recovered and recirculated. Therefore, there are no hazardous waterborne releases into the environment requiring controls or effluent monitoring.

Hazardous airborne emissions from BTL are related to the exhausting of the lead pouring, paint booth, fire torching and sand blasting areas. Engineering controls, such as filters and ventilation, are in place to reduce or eliminate emissions generated during operations. As a result, BTL does not have an effluent monitoring program or an environmental monitoring program.

Assessment and monitoring

BTL does not conduct environmental monitoring around its facility as there are no radiological releases that require controls or monitoring. Hazardous airborne emissions pertain to the exhaust associated with the lead pouring area. BTL submits a report on lead and its compounds to the National Pollutant Release Inventory and maintains annual compliance with the *Toxics Reduction Act*. There were no environmental occurrences at BTL in 2023 to report.

McMaster University

Effluent and emissions control (releases)

McMaster routinely monitors the exhaust ventilation from the Reactor Building for Iodine-125 (I-125) and Argon-41 (AR-41) which are the only nuclear substances routinely released to the environment in measurable quantities (i.e., above detection limits). Radioactive particulates are also monitored for gross beta to ensure that no unexpected radionuclides are present in the air stream. Samples are collected weekly and analyzed by windowless proportional counting for gross beta and by gamma spectrometry for I-125. During operation of the reactor, daily measurements of Ar-41 concentrations in the exhaust are made using a gas counting chamber.

Table I-32: Airborne emissions monitoring results, McMaster, Bq/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	DRL
Argon-41	8.4E+11	6.9E+11	6.3E+11	9.0E+11	1.8E+12	**1.3E+15**
Iodine-125	1.3E+08	1.3E+08	2.8E+07	3.7E+07	9.1E+07	**9.4E+12**
Gross Beta / Gamma	6.4E+05	3.6E+05	1.0E+05	3.3E+05	4.1E+05	**N/A**

Bq/year- becquerel per year; DRL = derived release limit

There were no releases of contaminated liquids to the municipal sewer system during the 2019-23 period. Any liquid effluent generated by MNR continues to be captured and then it is processed or evaporated in the facility.

Assessment and monitoring

McMaster routinely monitors the exhaust ventilation from the Reactor Building for I-125 and Argon-41 (Ar-41) which are the only nuclear substances routinely released to the environment in measurable quantities (i.e., above detection limits). Radioactive particulates are also

monitored for gross beta to ensure that no unexpected radionuclides are present in the air stream.

SLOWPOKEs (Royal Military College and École Polytechnique de Montréal)

Effluent and emissions control (releases)

The SLOWPOKEs monitor and control their releases to the environment, by implementing an Environmental Protection Program. The effluent and emissions monitoring program includes monitoring of radiological substances in the gaseous releases through sampling before release.

The SLOWPOKEs release small quantities of radioactive noble gases, mainly Xenon (Xe-133), resulting from the weekly purges of reactor head space, and Ar-41, due to irradiation activities. Due to the negligible quantities that are released and the minimal impact to the environment and to people, CNSC staff determined that no formal release limits or action levels are required for the SLOWPOKEs. There are no releases of radioactive liquids to the environment or to the sewers from the SLOWPOKEs.

Assessment and monitoring

The SLOWPOKEs are not required to implement an environment monitoring program because the estimated dose to public is several orders of magnitude below the regulatory public dose limit, and the dose rates to non-human ecological receptors are orders of magnitude lower than conservative benchmarks.

TRIUMF Accelerators Inc.

Effluent and emissions control (releases)

The possible sources of airborne emissions at TRIUMF are the particle accelerators and containment systems such as fume hoods and hot cells where open sources of radioactive materials are being handled. The emissions are vented through the 520 MeV cyclotron vault, beamline 1A, ISAC, and beamline 2C Solid Target facility exhaust systems. These emissions contain short-lived positron emitting radionuclides (Carbon-11, Nitrogen-13 and Oxygen-15) and Argon-41. There are continuous air monitors and controls such as high efficiency particulate air (HEPA) or charcoal filters at each exhaust stack. The exhausted air is also analyzed for releases of tritium, noble gases and volatile and particulate radioactivity.

Particulate sampling is performed at stacks where the exhausted airborne emissions generate particulates. The sampling is done by placing a small charcoal filter in the stream of the exhaust of the shielded enclosure of the continuous air monitor.

Table I-33: Airborne emissions monitoring results, TRIUMF, Bq/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	DRL
β+ emitters	6.8E+13	2.7E+13	6.7E+13	5.5E+13	4.7E+13	1.4E+16
Argon-41	7.6E+12	3.0E+12	8.7E+12	6.1E+12	5.7E+12	6.4E+15
Tritium	1.2E+12	4.9E+11	1.3E+12	9.8E+11	8.5E+11	6.4E+16
Noble Gases	2.4E+12	2.4E+12	2.5E+11	2.6E+11	1.7E+11	4.6E+16
Volatiles & Particulates	2.4E+12	7.1E+07	4.6E+07	2.7E+08	6.9E+08	1.5E+12

Bq/year- becquerel per year; DRL = derived release limit

The most significant source of liquid effluent releases on site is from the target and beam dump cooling water for the 520 MeV cyclotron and associated facilities. The dominant species in the cooling water from these systems is tritium in the form of tritiated water formed from neutron activation in the water.

Liquid effluent from throughout TRIUMF that may contain radionuclides are directed to sumps. Each sump has a warning indicator that sends an alarm signal when the sump is 50% full and a full indicator that sends an alarm signal when the sump is 75% full. When a sump surpasses the 50% level, TRIUMF staff collect a sample and assay it to determine its radioactive contents. The results of the assay are compared against the approved radiological liquid effluent releases to the sanitary sewer and internal control levels. If the results are below these levels, the contents of the sump are released to the sanitary sewer.

Table I-34: Liquid effluent monitoring results for release to sewer, TRIUMF, Bq/year, 2019–2023

Parameter	2019	2020	2021	2022	2023	DRL[1]
Total Activity	5.0E+10	8.4E+10	4.5E+10	1.2E+11	2.5E+10	4.6E+14

Bq/year- becquerel per year ; DRL = derived release limit

[1] The DRL that is selected is the lowest DRL for all the potential radionuclides present in the effluent.

Assessment and monitoring

TRIUMF has an environmental monitoring program that consists of monitoring of storm sewer water, radio-assays of building drains, vegetation samples and gamma/beta measurements at the site boundary. Due to the low levels of emissions from the TRIUMF facility, the results are either below or very close to the detection limit.

Canadian Light Source Inc.

Effluent and emissions control (releases)

The operation of the CLSI accelerators and beamlines does not result in any direct releases of radionuclides or hazardous substances to the environment. To confirm this, CLSI implements an effluent monitoring program that consists of monitoring at any potential discharge locations from the facility.

CLSI monitors any potential radioactive airborne releases by using a gamma probe system installed in the stack to monitor the real time gamma radiation dose rate. The results are consistently within background levels.

Any potentially contaminated wastewater generated at all locations across the facility during maintenance is collected through a sump and stored in a holding tank. CLSI samples and analyzes the contents of the tank prior to releasing to the municipal sewer system to ensure that it meets the city of Saskatoon bylaws. The results are consistently below detection levels.

Assessment and monitoring

Since CLSI does not have any releases to the environment, CLSI has an environmental monitoring program that consists of only environmental/low-level dosimeters located around the perimeter of the building. These dosimeters are exchanged quarterly for processing and are used to determine exposures to members of the public. The results are within background.

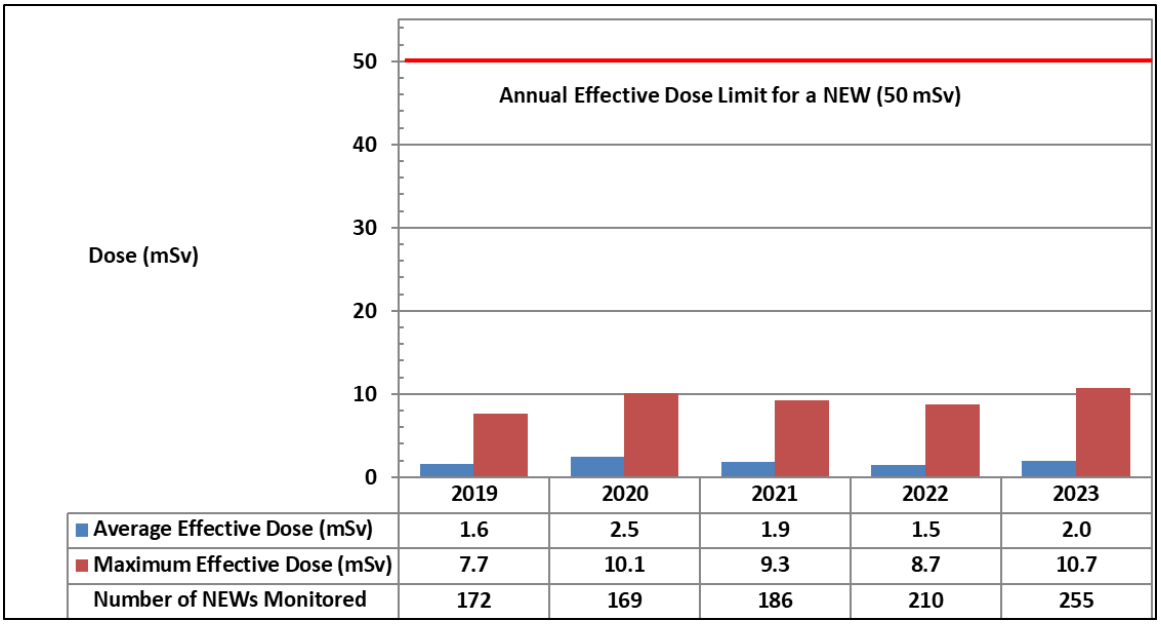
Appendix J: Worker Dose Data

This appendix presents information on doses to NEWs and non-NEWs at the UNSPFs, Research Reactors and Class IB Accelerators.

Blind River Refinery

Figure J-1 provides the average and maximum effective doses for NEWs at BRR between 2019 and 2023. The maximum effective dose received by a NEW in 2023 was 10.7 mSv, which is approximately 21% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period. Average and maximum effective doses over this 5-year period are reflective of the work activities at BRR and influenced by factors such as production levels and number of operating days. The average and maximum effective doses are consistent with previous years.

Figure J-1: Effective dose statistics for NEWs, Blind River Refinery, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	1.6	2.5	1.9	1.5	2.0
Maximum Effective Dose (mSv)	7.7	10.1	9.3	8.7	10.7
Number of NEWs Monitored	172	169	186	210	255

Average and maximum equivalent dose results for skin and extremities (hands) of NEWs, from 2019 to 2023, are provided in tables J-1 and J-2. In 2023, the maximum individual skin dose received by a NEW at BRR was 32.6 mSv, which is approximately 7% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period. The maximum individual extremity dose received by a NEW at BRR was 26.6 mSv, which is approximately 5% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period.

Table J-1: Equivalent (skin) dose statistics for NEWs, Blind River Refinery, mSv, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average skin dose	4.8	5.1	4.4	3.8	3.7	N/A
Maximum individual skin dose	29.2	39.1	39.9	34.2	32.6	500

mSv = millisievert; N/A = not applicable

Table J-2: Equivalent (extremity) dose statistics for NEWs, Blind River Refinery, mSv, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average extremity dose	3.9	3.4	5.2	2.7	4.3	**N/A**
Maximum individual extremity dose	11.9	14.5	27.2	20.2	26.6	**500**

mSv = millisievert; N/A = not applicable

The general classification system for inhaled compounds by their solubility or retention in the human body classifies compounds as type F (fast), type M (medium), and type S (slow). At BRR, the uranium products have solubilities of types F, M and S. Cameco's Fuel Services Division holds a CNSC dosimetry service licence, which authorizes Cameco to provide in-house internal dosimetry services to BRR. The lung counting program is used for assigning worker doses from routine monitoring assuming a chronic pattern of inhalation intakes of uranium products of type M and S. This is a conservative approach for workers exposed to a combination of chronic and acute (short term) inhalation intakes. The urine analysis program assesses the dose from acute intakes of type F material and is also used for monitoring the toxic effects of uranium.

Workers are placed on either a bi-weekly or a monthly urine sampling schedule. Samples may be collected outside of the routine urine sampling schedule, such as when there is a suspected unplanned intake of uranium or following a specific work activity; these are referred to as non-routine samples. The urine analysis program includes graduated responses to increasing uranium in urine concentrations, with potential chemical toxicity of uranium to the kidneys considered.

At BRR, the following action levels for NEWs have been implemented:

- The action level for bi-weekly urine samples is 65 µg U/L, which is the concentration of uranium in urine that results in a potential dose of 1 mSv and represents the chemical toxicity reference limit of 3 µg U/g kidney tissue, assuming the intake occurred at the mid-point of the sampling period.
- The action level for monthly urine samples is 44 µg U/L, which is set at the concentration of uranium in urine that results in a potential dose of 1 mSv and represents the chemical toxicity reference limit of 3 µg U/g kidney tissue, assuming the intake occurred at the mid-point of the sampling period.

In 2023, 5537 urine samples were analyzed, and no routine sample reached an action level.

Table J-3 provides the distribution of uranium in urine results from workers' urine samples collected over 2019-2023.

Table J-3: Urine analysis results for NEWs, Blind River Refinery, µg U/L, 2019-2023

Parameters	2019	2020	2021	2022	2023
Total number of samples analyzed	3671	3795	4192	4215	5537
Number of samples at or above the action level	0	0	0	0	0
Maximum routine sample result (µg U/L)	20.5	15.7	14.0	12.3	12.6
Maximum non-routine sample result (µg U/L)	69	45	180	145	94.8

µg U/L = microgram Uranium per Litre

Non-NEWs at the BRR

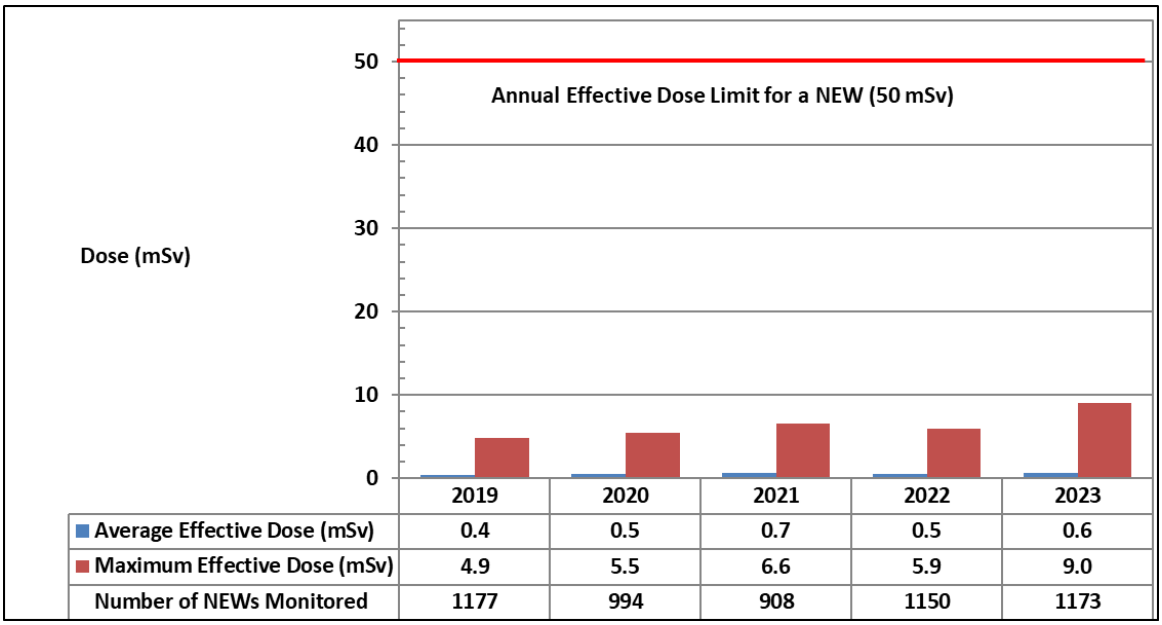
Site visitors and contractors who are not considered NEWs are issued external dosimetry to monitor their radiological exposures while at BRR. In 2023, the maximum individual effective dose received by a site visitor or contactor who was not a NEW was 0.02 mSv, which is well below the CNSC's regulatory effective dose limit of 1 mSv per calendar year for a person who is not a NEW.

Port Hope Conversion Facility

Figure J-2 provides the average and maximum effective doses for NEWs at PHCF between 2019 and 2023. The maximum individual effective dose received by a NEW in 2023 was 9.0 mSv, which is approximately 18% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year

dosimetry period. While the average effective dose is comparable to previous years, the maximum effective dose for a NEW in 2023 was higher. The majority of the NEW's dose was received as a result of an unplanned exposure event, where the NEW received a committed effective dose of 8.6 mSv. Details of this event, which resulted in an action level exceedance, are discussed in the Radiation Protection section of this report.

Figure J-2: Effective dose statistics for NEWs, Port Hope Conversion Facility, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0.4	0.5	0.7	0.5	0.6
Maximum Effective Dose (mSv)	4.9	5.5	6.6	5.9	9.0
Number of NEWs Monitored	1177	994	908	1150	1173

Average and maximum equivalent dose results for the skin of NEWs, from 2019 to 2023 are provided in table J-4. In 2023, the maximum individual skin dose received by a NEW at PHCF was 16 mSv, which is approximately 3% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period. The average and maximum skin doses over this 5-year period have been relatively steady.

Table J-4: Equivalent (skin) dose statistics for NEWs, Port Hope Conversion Facility, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average skin dose	0.5	0.5	0.7	0.5	0.7	N/A
Maximum individual skin dose	20.1	17.0	16.3	12.0	16.0	500

mSv = millisievert; N/A = not applicable

At PHCF, uranium products have solubilities of types F, M and S. Cameco's Fuel Services Division holds a CNSC dosimetry service licence, which authorizes Cameco to provide in-house internal dosimetry services to PHCF. The lung counting program is used for assigning worker doses from routine monitoring assuming a chronic pattern of inhalation intakes of uranium products of type M and S. This is a conservative approach for workers exposed to a combination of chronic and acute (short term) inhalation intakes. The urine analysis program primarily focuses on assessing the dose from acute intakes of type F material and is also used for monitoring the toxic effects of uranium.

The routine urine sampling frequency ranges from daily to monthly, depending on the work group. Samples may also be collected outside of the routine urine sampling schedule, such as when there is a suspected unplanned intake of uranium or following a specific work activity; these are referred to as post-shift (non-routine) urine samples. The urine analysis program includes graduated responses to increasing uranium in urine concentrations, with potential radiation doses and chemical toxicity of uranium to the kidneys considered.

At PHCF, the following action levels for NEWs have been implemented:

- The action level for bi-weekly urine samples is 65 µg U/L, which is the concentration of uranium in urine that results in a potential dose of 0.5 mSv and represents the chemical toxicity reference limit of 3 µg U/g kidney tissue, assuming the intake occurred at the mid-point of the sampling period.
- The action level for monthly urine samples is 25 µg U/L, which is set at the concentration of uranium in urine that results in a potential dose of 0.4 mSv and represents the chemical toxicity reference limit of 3 µg U/g kidney tissue, assuming the intake occurred at the mid-point of the sampling period.
- The action level for daily urine samples is 80 µg U/L, which is set at the concentration of uranium in urine that results in a potential dose of 0.10 mSv and represents a potential kidney burden of 0.98 µg U/g kidney tissue, assuming the intake occurred within 24 hours of the sample being taken.
- The action level for all post-shift (non-routine) urine samples is strictly for monitoring for potential kidney toxicity, and is 500 µg U/L, which represents a potential kidney burden of 0.25 µg U/g kidney tissue, assuming the intake occurred within 12 hours of the sample being taken.

Additionally, an action level of 40 µg U/L has been set for daily urine samples submitted by persons not considered as NEWs. This concentration of uranium in urine results in a potential dose of < 0.05 mSv and represents a potential kidney burden of 0.49 µg U/g kidney tissue, assuming the intake occurred within 24 hours of the sample being taken.

In 2023, 55,900 urine samples were analyzed, and one (1) sample reached an action level. Details of this action level exceedance are discussed in the Radiation Protection section of this report.

Table J-5 provides the distribution of uranium in urine results from workers' (NEWs and persons not considered as NEWs) urine samples collected over 2019-2023.

Table J-5: Urine analysis results for NEWs, Port Hope Conversion Facility, µg U/L, 2019-2023

Parameters	2019	2020	2021	2022	2023
Total number of samples analyzed	44952	28761	28855	46531	55900
Number of samples at or above the action level	0	0	0	0	1
Maximum routine sample result (µg U/L)	60	9.6	14	18	18
Maximum non-routine sample result (µg U/L)	400	390	120	82	340

µg U/L = microgram Uranium per Litre

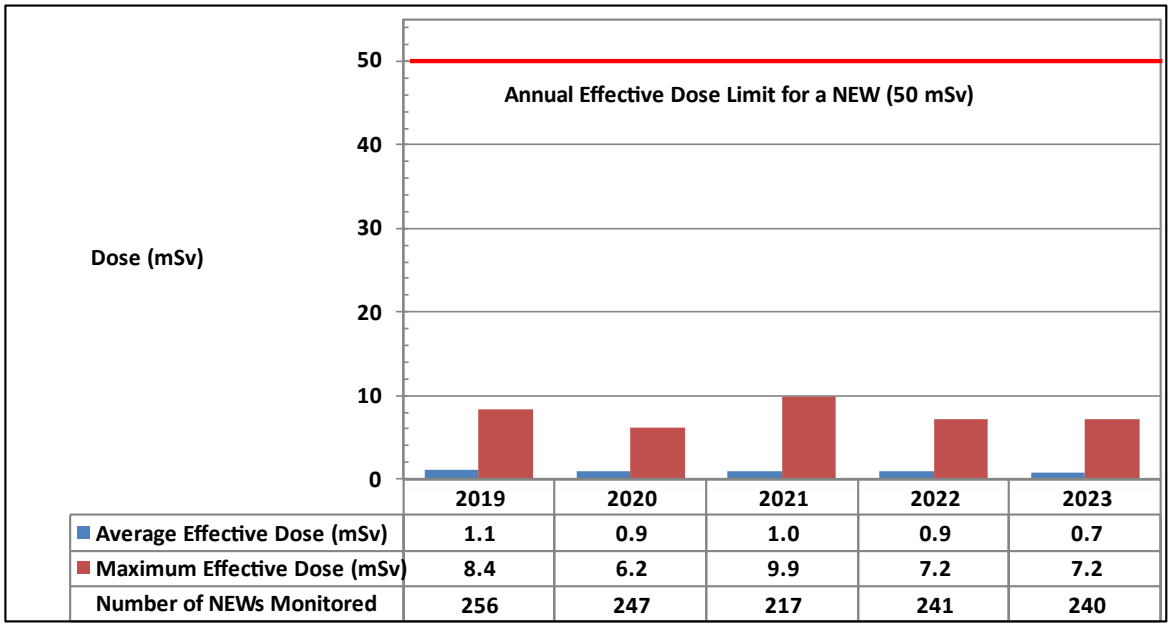
Non-NEWs at the PHCF

Cameco employees, site visitors and contractors whose work activities do not require NEW status may be issued whole-body dosimeters and may participate in the internal dosimetry program to monitor their radiological exposures while at PHCF. In 2023, the maximum individual effective dose received by a person who is not a NEW was 0.02 mSv, which is well below the CNSC's regulatory effective dose limit of 1 mSv per calendar year for a person who is not a NEW.

Cameco Fuel Manufacturing Inc.

Figure J-3 provides the average and maximum effective doses for NEWs at CFM between 2019 and 2023. The maximum individual effective dose received by a NEW in 2023 was 7.2 mSv, which is approximately 14% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period. The average total effective doses over this 5-year period have remained steady.

Figure J-3: Effective dose statistics for NEWs, Cameco Fuel Manufacturing, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	1.1	0.9	1.0	0.9	0.7
Maximum Effective Dose (mSv)	8.4	6.2	9.9	7.2	7.2
Number of NEWs Monitored	256	247	217	241	240

Average and maximum equivalent dose results for the skin and extremities (hands) of NEWs, from 2019 to 2023, are provided in tables J-6 and J-7. In 2023, the maximum skin dose received by a NEW at CFM was 48.6 mSv, which is approximately 10% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period. The maximum extremity dose received by a NEW at CFM was 39.4 mSv, which is approximately 8% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period. The average and maximum equivalent doses have been steady or decreasing over this 5-year period.

Table J-6: Equivalent (skin) dose statistics for NEWs, Cameco Fuel Manufacturing, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average skin dose	3.1	3.1	3.5	2.8	3.1	N/A
Maximum individual skin dose	56.9	55.3	40.9	47.4	48.6	500

mSv = millisievert; N/A = not applicable

Table J-7: Equivalent (extremity) dose statistics for NEWs, Cameco Fuel Manufacturing, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average extremity dose	18.4	17.9	8.4	7.0	7.0	N/A
Maximum individual extremity dose	90.8	65.6	41.9	39.4	39.4	500

mSv = millisievert; N/A = not applicable

At CFM, the input to the pellet manufacturing process is ceramic grade UO_2. UO_2 has a solubility of type S, which clears slowly from the body, and has a retention time in the body of years. The lung counting program is used for assigning worker doses from routine monitoring, assuming a chronic pattern of inhalation intakes. This is a conservative approach for workers exposed to a combination of chronic and acute (short term) inhalation intakes. Cameco's Fuel Services Division holds a CNSC dosimetry service licence, which authorizes Cameco to provide in-house internal dosimetry services to CFM.

To complement the lung counting program, routine biweekly urine samples are collected from workers for monitoring of acute inhalation or accidental ingestion of UO_2. Samples may be collected outside of the routine urine sampling schedule, such as following non-routine work or an elevated air monitoring result in a work area. The urine analysis program at CFM includes graduated responses to increasing uranium in urine concentrations. Cameco developed tables of urine excretion rates for various monitoring intervals and corresponding concentration levels for uranium compounds, which may indicate that the chemical toxicity reference limit of 3 µg U/g of kidney tissue has been exceeded.

At CFM, an action level of 10 µg U/L is implemented for all urine samples. This translates to a range of 0.008 to 0.435 µg U/g of kidney tissue, well below the chemical toxicity reference limit of 3 µg U/g of kidney tissue.

In 2023, 1667 urine samples were analyzed, and no sample reached the action level.

Table J-8 provides the urine analysis results for NEWs at CFM during from 2019-2023. As shown, there have been no exceedances of CFM's action level for urine analysis samples over these years.

Table J-8: Urine analysis results for NEWs, Cameco Fuel Manufacturing, µg U/L, 2019-2023

Parameters	2019	2020	2021	2022	2023
Total number of samples analyzed	1689	1685	1565	1564	1667
Number of samples at or above the action level	0	0	0	0	0
Maximum sample result (µg U/L)	3.1	2.0	1.5	2.2	1.8

µg U/L = microgram Uranium per Litre

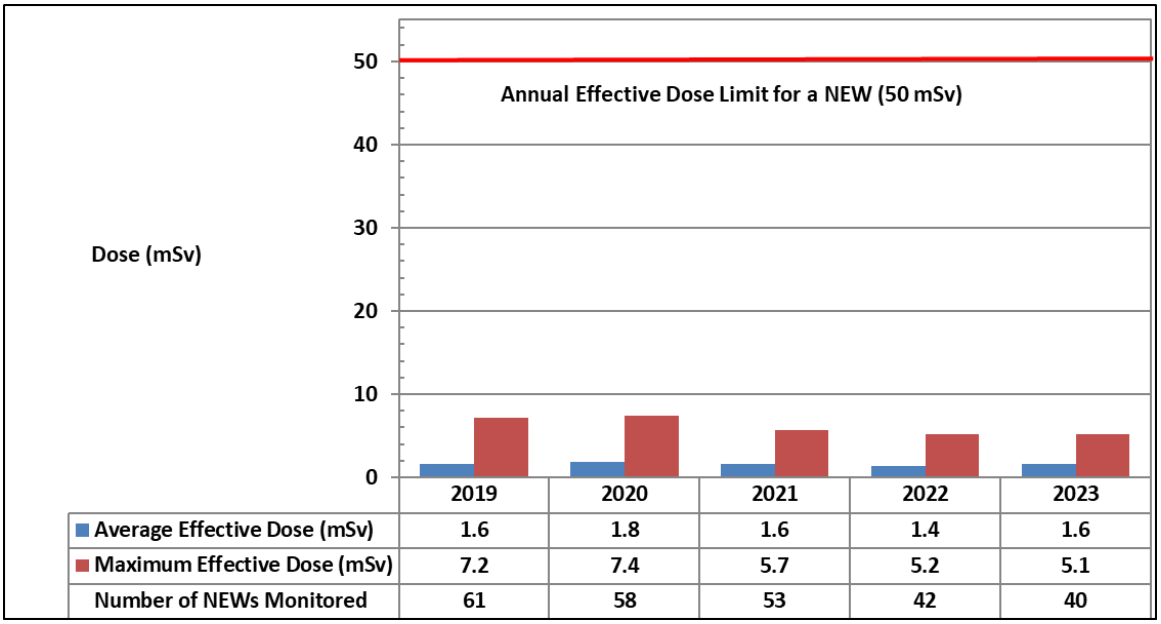
Non-NEWs at CFM

Visitors and contractors that are not considered as NEWs are issued dosimeters to monitor their radiological exposures while at CFM. In 2023, there were no measurable doses recorded on dosimeters issued to persons who are not NEWs.

BWXT Nuclear Energy Canada Inc. Toronto and Peterborough

Figure J-4 provides the average and maximum effective dose for NEWs at BWXT NEC's Toronto facility between 2019 and 2023. The maximum effective dose received by a NEW in 2023 at the Toronto facility was 5.1 mSv, or approximately 10% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period.

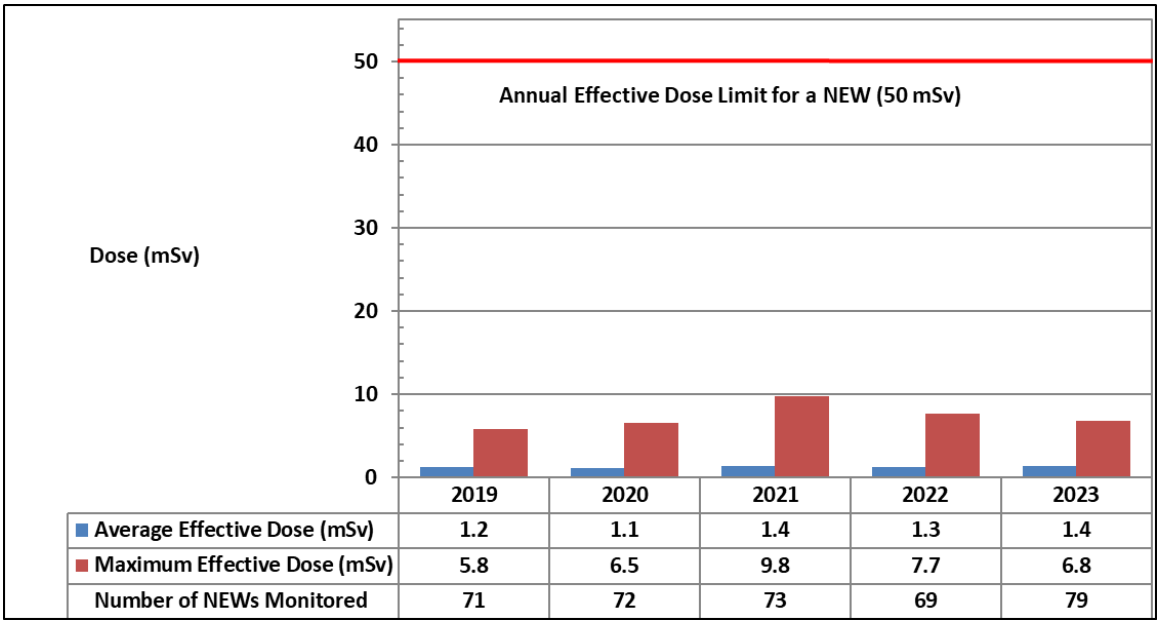
Figure J-4: Effective dose statistics for NEWs, BWXT NEC Toronto, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	1.6	1.8	1.6	1.4	1.6
Maximum Effective Dose (mSv)	7.2	7.4	5.7	5.2	5.1
Number of NEWs Monitored	61	58	53	42	40

Figure J-5 provides the average and maximum effective doses for NEWs at BWXT NEC's Peterborough facility between 2019 and 2023. The maximum effective dose received by a NEW in 2023 at the Peterborough facility was 6.8 mSv, or approximately 14% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period.

Figure J-5: Effective dose statistics for NEWs, BWXT Peterborough, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	1.2	1.1	1.4	1.3	1.4
Maximum Effective Dose (mSv)	5.8	6.5	9.8	7.7	6.8
Number of NEWs Monitored	71	72	73	69	79

Annual average and maximum equivalent doses to the skin and extremities (hands) of NEWs from 2019 to 2023 are provided in tables J-9 through J-12.

In 2023, the maximum individual equivalent skin dose at the Toronto facility was 27.5msv and 25.2msv at the Peterborough facility.

Table J-9: Equivalent (skin) dose statistics for NEWs, BWXT NEC Toronto, mSV/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average skin dose	8.1	8.9	7.9	5.8	7.3	N/A
Maximum individual skin dose	39.8	39.1	37.2	28.7	27.5	500

mSv = millisievert; N/A = not applicable

Table J-10: Equivalent (skin) dose statistics for NEWs, BWXT NEC Peterborough, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average skin dose	3.0	2.8	3.6	3.5	4.1	**N/A**
Maximum individual skin dose	17.4	19.0	30.9	21.7	25.2	**500**

mSv = millisievert; N/A = not applicable

In 2023, the maximum individual equivalent extremity dose at the Toronto facility was 53.4 mSv and it was 63.8 mSv at the Peterborough facility.

Table J-11: Equivalent (extremity) dose statistics for NEWs, mSv/yr, BWXT NEC Toronto, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average extremity dose	20.7	25.4	22.2	21.1	15.9	N/A
Maximum individual extremity dose	79.7	115.5	66.1	68.6	53.4	500

mSv = millisievert; N/A = not applicable

Table J-12: Equivalent (extremity) dose statistics for NEWs, BWXT NEC Peterborough, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average extremity dose	11.3	18.8	23.7	15.6	18.4	N/A
Maximum individual extremity dose	29.4	43.2	59.0	52.0	63.8	500

mSv = millisievert; N/A = not applicable

The maximum individual equivalent doses to the skin was received at the Toronto facility and represents approximately 6% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period. The maximum individual equivalent dose to an extremity was received at the Peterborough facility and represents approximately 13% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period. Over the past 5 years, average equivalent extremity and skin doses have been relatively stable at both facilities.

BWXT's facilities handle ceramic grade UO_2. UO_2 has a solubility of type S, and clears slowly from the body, with a retention time in the body of years. The measurement of uranium in the urine is used as a screening method for assessing whether inhalation of airborne UO_2, or accidental ingestion has occurred. At the Toronto facility, workers are placed on a routine weekly or monthly urine sampling schedule. Workers at the Peterborough facility are on a routine quarterly urine sampling schedule. Samples may be collected outside of the routine urine sampling schedules, such as following non-routine work or an elevated air monitoring result in a work area.

An action level of 10 µg U/L is implemented for all urine samples. This translates to a range of 0.008 to 0.3 µg U/g of kidney tissue at BWXT Toronto, and a range of 0.008 to 0.732 µg U/g of kidney tissue at BWXT Peterborough, well-below the chemical toxicity reference limit of 3 µg U/g of kidney tissue.

At BWXT Toronto in 2023, 1320 urine samples were analyzed, and no sample reached the action level.

Table J-13 provides the distribution of uranium in urine results from workers' urine samples collected from 2019-2023 at BWXT Toronto.

Table J-13: Urine analysis results for NEWs, BWXT NEC Toronto, µg U/L, 2019-2023

Parameters	2019	2020	2021	2022	2023
Total number of samples analyzed	1594	1646	1499	1332	1320
Number of samples at or above the action level	0	0	0	0	0
Maximum sample result (µg U/L)	3.8	4.0	2.7	2.7	5.1

µg U/L = microgram Uranium per Litre

At BWXT Peterborough in 2023, 110 urine samples were analyzed, and no sample reached the action level.

Table J-14 provides the distribution of uranium in urine results from workers' urine samples collected from 2019-2023 at BWXT Peterborough.

Table J-14: Urine analysis results for NEWs, BWXT NEC Peterborough, µg U/L, 2019-2023

Parameters	2019	2020	2021	2022	2023
Total number of samples analyzed	88	86	103	105	110
Number of samples at or above the action level	0	0	0	0	0
Maximum sample result (µg U/L)	0.1	0.4	0.1	0.2	0.1

µg U/L = microgram Uranium per Litre

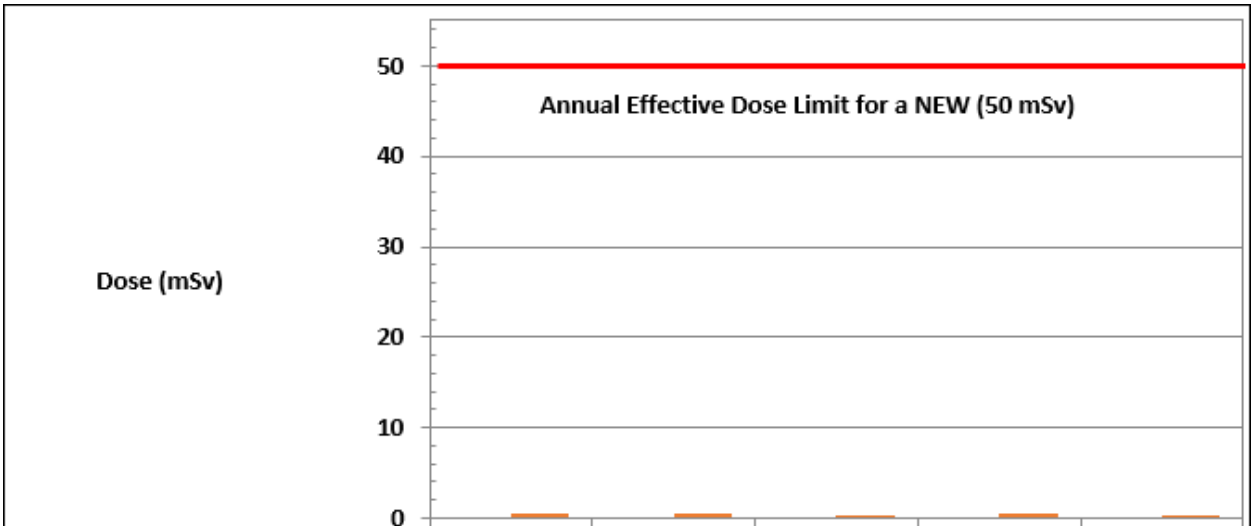
Non-NEWs at BWXT NEC

For both the Peterborough and Toronto facilities, visitors and contractors are all considered non-NEWs and are not directly monitored. Doses are estimated based on in-plant radiological conditions and occupancy factors, to ensure that radiation doses are controlled well-below the CNSC's regulatory effective dose limit of 1 mSv per calendar year for a person who is not a NEW.

SRB Technologies (Canada) Inc.

Figure J-6 provides the average and maximum effective doses for NEWs at SRBT from 2019 to 2023. The maximum effective dose received by a NEW in 2023 was 0.39 mSv, this is below 1% of the CNSC regulatory effective dose limit of 50 mSv in a 1-year dosimetry period. Over the past 5 years, annual effective doses at SRBT have remained stable and very low, with slight variations due to production volumes.

Figure J-6: Effective dose statistics for NEWs, SRB Technologies, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0.065	0.077	0.056	0.048	0.038
Maximum Effective Dose (mSv)	0.57	0.43	0.36	0.46	0.39
Number of NEWs Monitored	45	43	43	42	41

Due to the uniform distribution of tritium in body tissues, equivalent skin doses are essentially the same as the effective whole-body dose provided in figure J-6 and are therefore not reported separately. For this same reason, extremity doses are not separately monitored for workers at SRBT.

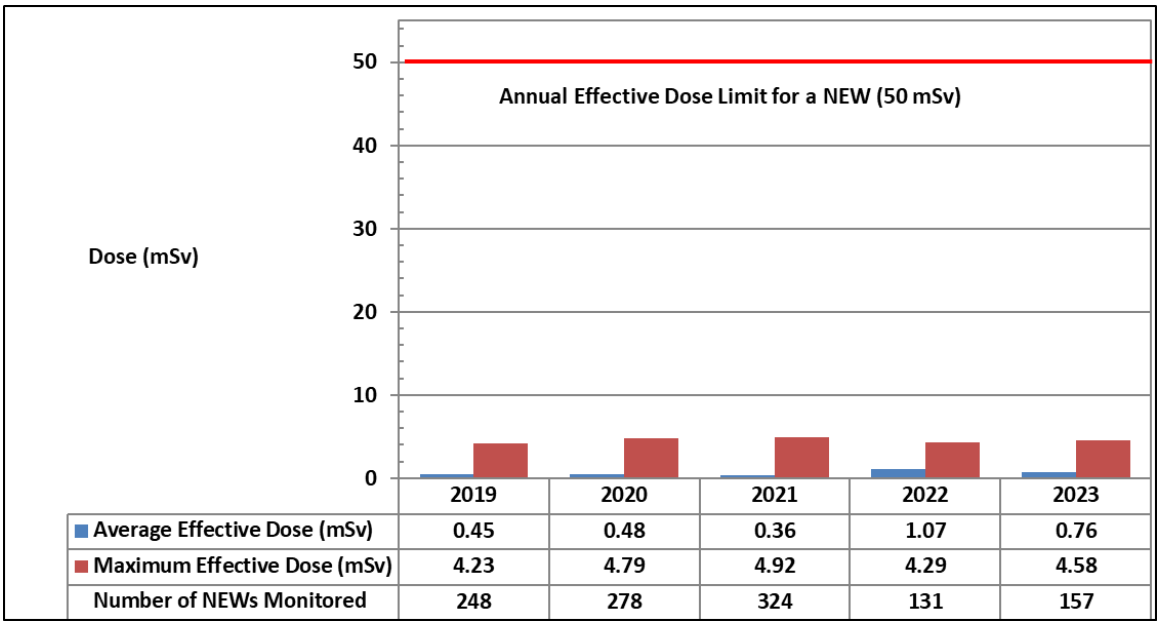
Non-NEWs at SRBT

While contractors are not identified as NEWs, since they do not perform radiological work, their radiological exposures are monitored while they are at the SRBT facility to ensure that their doses remain ALARA and below the CNSC's regulatory dose limit of 1 mSv per calendar year for a person who is not a NEW. In 2023, no contractors received a recordable dose that resulted from work activities performed at the facility.

Nordion (Canada) Inc.

Figure J-7 provides the average and maximum effective doses to NEWs at Nordion from 2019 to 2023. In 2018, Nordion sold its medical isotope business to BWXT Medical who operated as a contractor until receiving their own licence in November 2021. The Cobalt-60 operations drove the maximum doses at Nordion, so the trending there is consistent. The average effective dose was increased in 2021 as the lower doses from the medical isotope operation were no longer included. Nordion reported that the maximum effective dose received by a NEW in 2023 was 4.584 mSv, approximately 9.2% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period. Average and maximum effective doses have been relatively stable over these years.

Figure J-7: Effective dose statistics for NEWs, Nordion, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0.45	0.48	0.36	1.07	0.76
Maximum Effective Dose (mSv)	4.23	4.79	4.92	4.29	4.58
Number of NEWs Monitored	248	278	324	131	157

As the only isotope now used at Nordion is cobalt-60, the equivalent doses to the skin are deemed equal to the effective doses found above in figure J-7.

Annual average and maximum equivalent doses to the extremities (hands) of NEWs from 2019 to 2023 are provided in table J-15. In 2023, the maximum equivalent extremity dose for a NEW in the active area was 4.58 mSv. This dose represents approximately 1% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period.

Table J-15: Equivalent (extremity) dose statistics for NEWs, Nordion, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average extremity dose	1.14	0.93	1.56	1.52	1.96	N/A
Maximum individual extremity dose	20.93	16.48	7.73	4.29	4.58	500

mSv = millisievert; N/A = not applicable

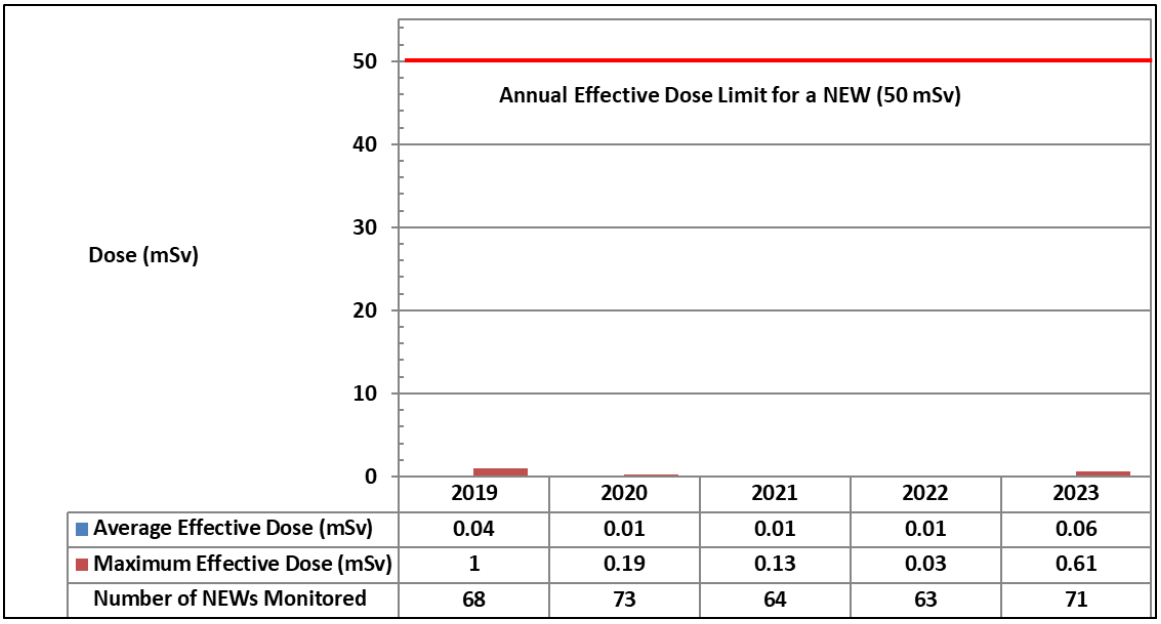
Non-NEWs at Nordion

At Nordion, there may be occasions where workers who are classified as non-NEWs enter the active area but do not perform any radiological work. Nordion monitors non-NEWs as required and provides relevant training to ensure that their doses are kept ALARA. In 2023, Nordion monitored 51 non-NEWs with the maximum effective dose of 0.26 mSv, which is well-below the CNSC's regulatory effective dose limit of 1 mSv per calendar year for a person who is not a NEW.

Best Theratronics Ltd.

At BTL, employees are classified as NEWs if they are expected to have a reasonable probability of receiving an annual occupational dose greater than 1 mSv. Figure J-8 provides the average and maximum effective doses for NEWs at BTL between 2019 and 2023. In 2023, the maximum effective dose received by a NEW at BTL was less than 0.61 mSv, or less than approximately 1.2% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period. Over the past 5 years, annual effective doses at BTL have remained stable and very low, with slight variations due to production volumes.

Figure J-8: Effective dose statistics for NEWs, Best Theratronics Ltd., 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0.04	0.01	0.01	0.01	0.06
Maximum Effective Dose (mSv)	1	0.19	0.13	0.03	0.61
Number of NEWs Monitored	68	73	64	63	71

Annual average and maximum equivalent doses to the extremities (hands) of NEWs from 2019 to 2023 are provided in table J-16. The maximum equivalent extremity dose for a NEW in 2023 was 4.42 mSv, which is approximately 0.9% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period. Over the past 5 years, average equivalent doses to the extremities have remained very low. The maximum effective dose increase this year was due to planned source consolidation work performed by one individual.

Table J-16: Equivalent (extremity) dose statistics for NEWs, Best Theratronics Ltd., mSv/yr, 2019-2023

Dose Data (mSv)	2019	2020	2021	2022	2023	Regulatory Limit (mSv/year)
Average extremity dose	0.22	0.15	0.06	0.02	1.19	N/A
Maximum individual extremity dose	2.51	2.4	0.47	0.13	4.42	500

mSv = millisieverts; N/A = not applicable

The equivalent doses to the skin of NEWs are equal to the effective doses due to the nature of exposure, as provided in figure J-8.

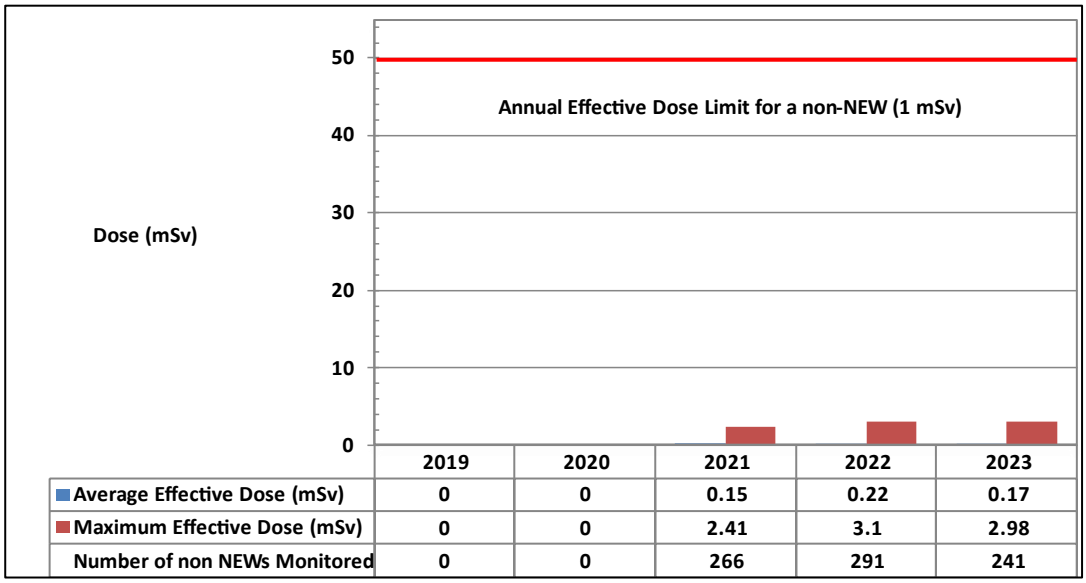
Non-NEWs at BTL

BTL workers identified as non-NEWs, such as administrative staff, are not permitted in controlled areas, and are therefore not occupationally exposed to radiation.

BWXT Medical

BWXT Medical took over the medical isotope facility at Nordion as a contractor in 2018. In November 2021, BWXT Medical received their own licence to perform this work. At BWXT Medical, employees are classified as NEWs if they are expected to have a reasonable probability of receiving an annual effective dose greater than 1 mSv. In 2023, the maximum effective dose received by a NEW at BWXT Medical was 2.98 mSv, or approximately 6.0% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period.

Figure J-9: Effective dose statistics for NEWs, BWXT Medical, 2019-2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0	0	0.15	0.22	0.17
Maximum Effective Dose (mSv)	0	0	2.41	3.1	2.98
Number of non NEWs Monitored	0	0	266	291	241

Annual average and maximum equivalent dose results for skin and extremities (hands) of NEWs in 2023 are provided in tables J-18 and J-19. The maximum equivalent skin dose for 2023 was 3.00 mSv, and the maximum equivalent extremity dose for a worker in the active area was 45.44 mSv. These doses represent approximately 0.6% and 9.1%, respectively, of the CNSC's regulatory equivalent dose limits of 500 mSv in a 1-year dosimetry period.

Table J-18: Equivalent (skin) dose statistics for NEWs, BWXT Medical, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average skin dose	N/A	N/A	0.15	0.17	0.17	N/A
Maximum individual skin dose	N/A	N/A	2.44	3.13	3.00	500

mSv = millisievert; N/A = not applicable

Table J-19: Equivalent (extremity) dose statistics for NEWs, BWXT Medical, mSv/yr, 2019-2023

Dose data (mSv)	2019	2020	2021	2022	2023	Regulatory limit (mSv/year)
Average extremity dose	N/A	N/A	0.56	0.63	0.65	N/A
Maximum individual extremity dose	N/A	N/A	12.58	9.87	45.44	500

mSv = millisievert; N/A = not applicable

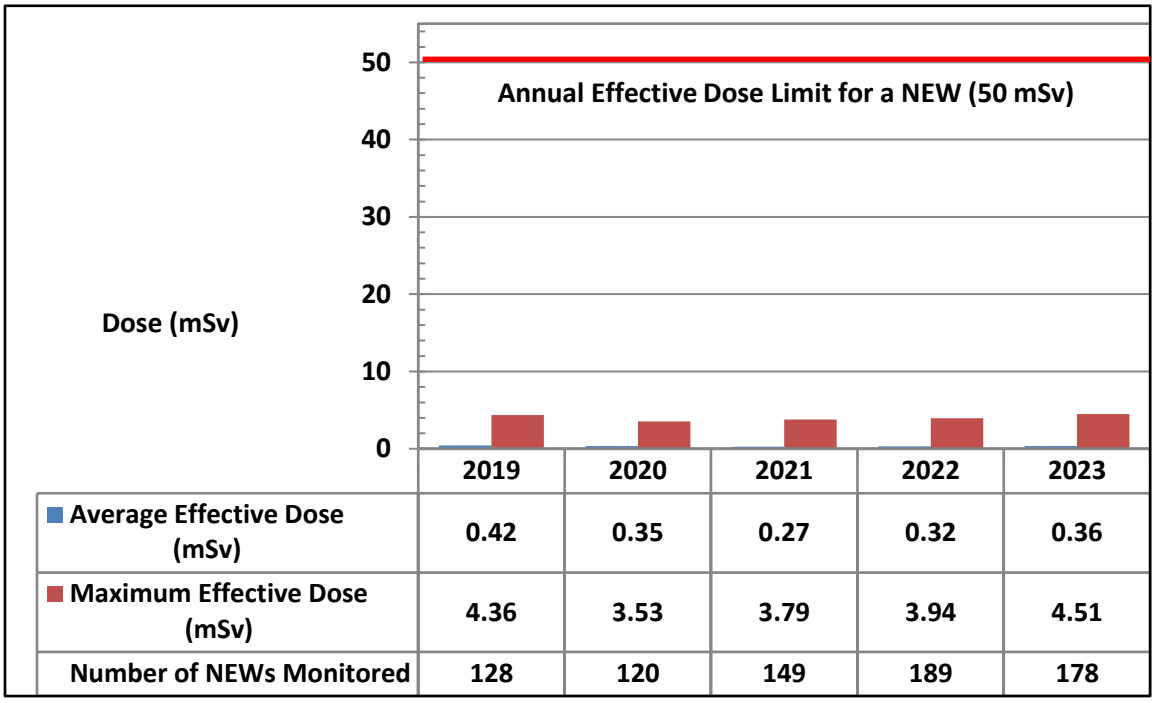
Non-NEWs at BWXT Medical

At BWXT Medical, all contractors are classified as non-NEWS. BWXT Medical monitors non-NEWs as required and provides relevant training to ensure that their doses are kept ALARA. In 2023, 46 non-NEWs (including contractors and employees) were monitored. BWXT Medical reported that the maximum effective dose received by a non-NEW was 0.04 mSv, which is 4.0% of the CNSC's regulatory effective dose limit of 1 mSv per calendar year for a person who is not a NEW.

McMaster Nuclear Reactor

Figure J-10 provides the average and maximum effective doses for NEWs at MNR between 2019 and 2023. From 2019-2023, MNR reported that no internal doses were recorded. Average and maximum effective doses over this 5-year period are reflective of the work activities at MNR and are influenced by factors such as production levels and the scope of radiological work activities. The maximum effective dose, in each of the years from 2019 to 2023, was received by a NEW working as part of the NRay neutron radiography staff. All of the contribution to doses to NEWs working for NRay are from external radiation exposures.

Figure J-10: Effective dose statistics for NEWs, McMaster Nuclear Reactor, 2019 –2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0.42	0.35	0.27	0.32	0.36
Maximum Effective Dose (mSv)	4.36	3.53	3.79	3.94	4.51
Number of NEWs Monitored	128	120	149	189	178

Average and maximum equivalent dose results for the skin and extremities of NEWs, from 2019-2023, are provided in Tables J-13 and J-14. Between 2019 and 2023, the maximum individual skin dose received by a NEW at MNR was 11.75 mSv, which is approximately 2% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period.

The maximum individual extremity dose received by a NEW at MNR was 47.24 mSv, which is approximately 9% of the CNSC's regulatory equivalent dose limit of 500 mSv in a 1-year dosimetry period.

Table J-13: Equivalent (skin) dose statistics for NEWs, MNR, mSv/yr, 2019 –2023

Dose data	2019	2020	2021	2022	2023	Regulatory dose limit
Average skin dose (mSv)	0.59	0.59	0.36	0.48	0.52	--
Maximum individual skin dose (mSv)	11.75	11.09	6.74	4.84	6.4	**500 mSv/year**

mSv = millisievert;

Table J-14: Equivalent (extremities) dose statistics for NEWs, MNR, mSV/yr, 2019 –2023

Dose data	2019	2020	2021	2022	2023	Regulatory dose limit
Average extremity dose (mSv)	6.86	4.78	3.79	2.62	3.39	--
Maximum individual extremity dose (mSv)	47.24	29.24	28.06	24.96	25.06	**500 mSv/year**

mSv = millisievert;

Non-NEWs at MNR

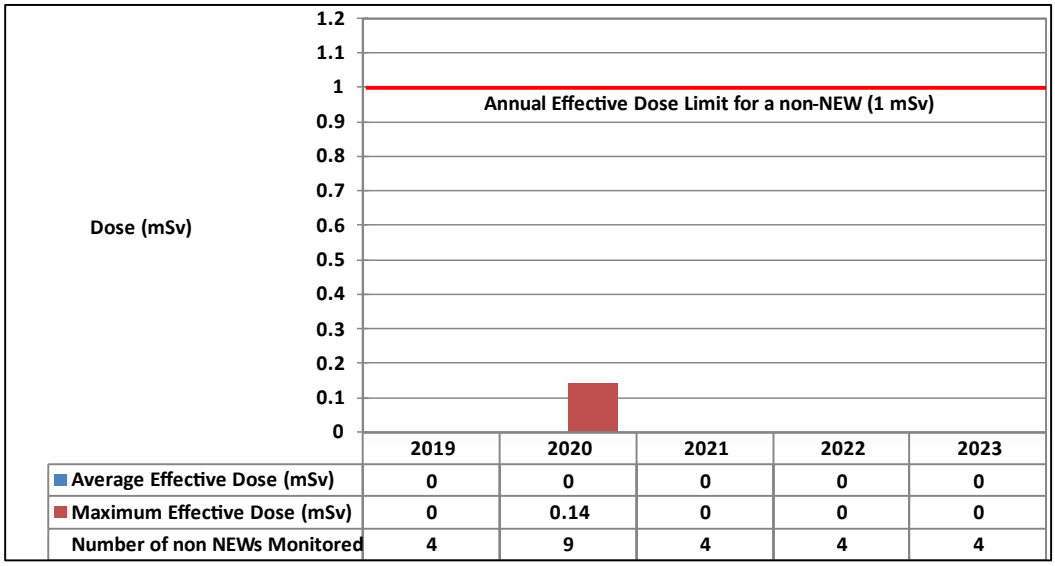
Site visitors and contractors that are not considered NEWs are issued electronic personal dosimeters to monitor their radiological exposures while at MNR. Between 2019 and 2023, the maximum individual effective dose received by a site visitor or contactor that was not a NEW was 0.027 mSv, which is approximately 3.0% of the CNSC's regulatory effective dose limit of 1 mSv per calendar year for a person who is not a NEW.

École Polytechnique de Montréal SLOWPOKE-2

ÉPM workers are exposed externally to sources of radiation. Due to the low potential for exposures, ÉPM workers are classified as non-NEWs and therefore the 5-year dosimetry period does not apply.

Figure J-10 provides the average and maximum effective doses received for non-NEWs at ÉPM between 2019-2023. From 2019-2023, the maximum annual effective dose received by a non-NEW at ÉPM was 0.14 mSv, or approximately 14% of the CNSC's regulatory annual effective dose limit of 1 mSv.

Figure J-10: Effective dose statistics for non-NEWs, ÉPM, 2019 –2023



	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0	0	0	0	0
Maximum Effective Dose (mSv)	0	0.14	0	0	0
Number of non NEWs Monitored	4	9	4	4	4

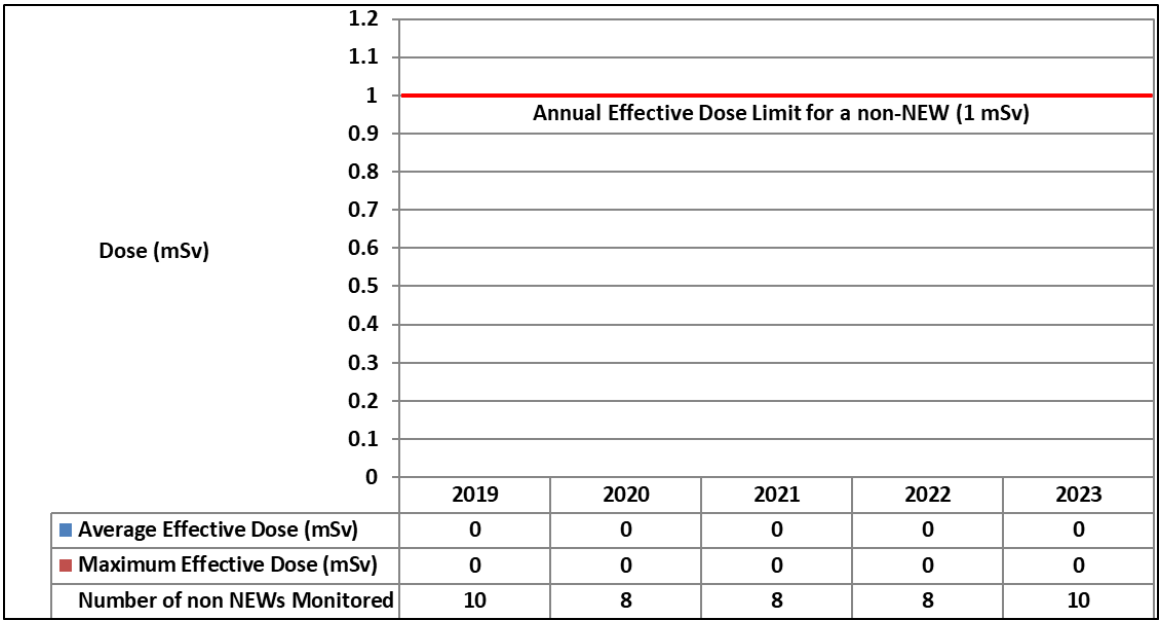
From 2019 to 2023, there were no action level exceedances at ÉPM. Over the past 5 years, annual effective doses at ÉPM have remained stable and very low.

Royal Military College of Canada SLOWPOKE-2

RMC workers are exposed externally to sources of radiation. No doses have been recorded for any NEW over the 5-year dosimetry period. Due to the low potential for exposures, doses to RMC workers are expected to be below 1 mSv and are therefore compared to the annual effective dose limit for a non-NEW (1 mSv). External whole body and equivalent doses are ascertained using licensed dosimeters.

No worker received a dose above the minimum reporting threshold for the dosimeter (i.e. less than 0.1 mSv). Figure J-11 provides the average and maximum effective doses received for NEWs at RMC between 2019-2023. From 2019-2023, the maximum annual effective dose received by a NEW at RMC was 0 mSv.

Figure J-11: Effective dose statistics for NEWs, RMC, 2019 –23



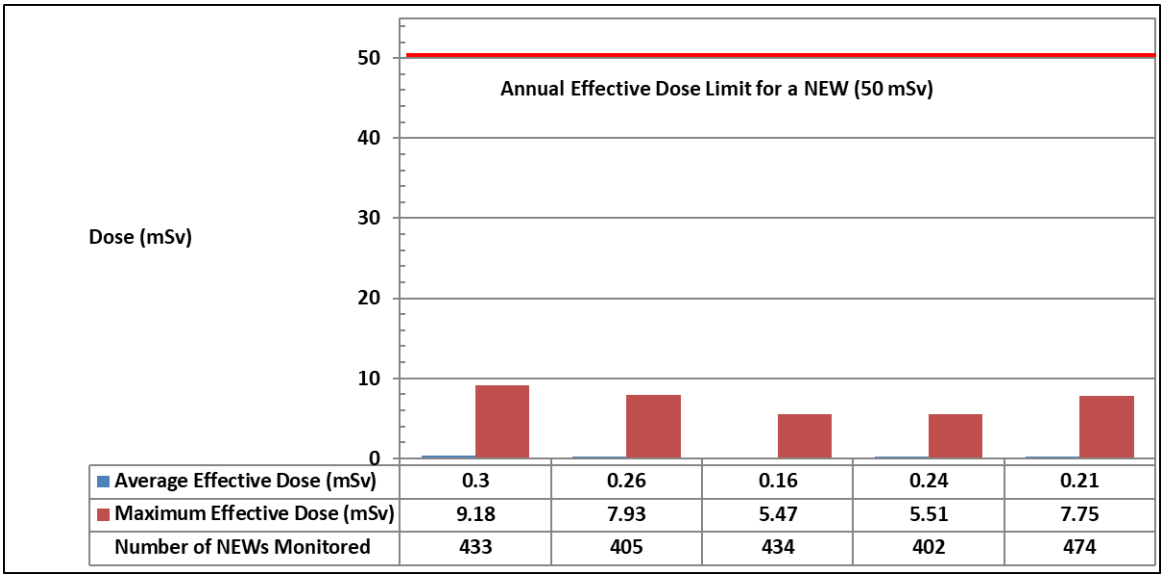
	2019	2020	2021	2022	2023
Average Effective Dose (mSv)	0	0	0	0	0
Maximum Effective Dose (mSv)	0	0	0	0	0
Number of non NEWs Monitored	10	8	8	8	10

From 2019 to 2023, there were no action level exceedances at RMC. Over the past 5 years, annual effective doses at RMC have remained stable and very low.

TRIUMF

Figure J-13 provides the average and maximum effective doses for NEWs at TRIUMF between 2019 and 2023. In 2023, the maximum effective dose received by a NEW at TRIUMF was 7.75 mSv, or approximately 15% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period.

Figure J-13: Effective dose statistics for NEWs, TRIUMF, 2019-2023



Non-NEWs at TRIUMF

TRIUMF also monitored the effective of non-NEWs as shown in table J-15. Effective doses at TRIUMF continue to be at the same level as previous years.

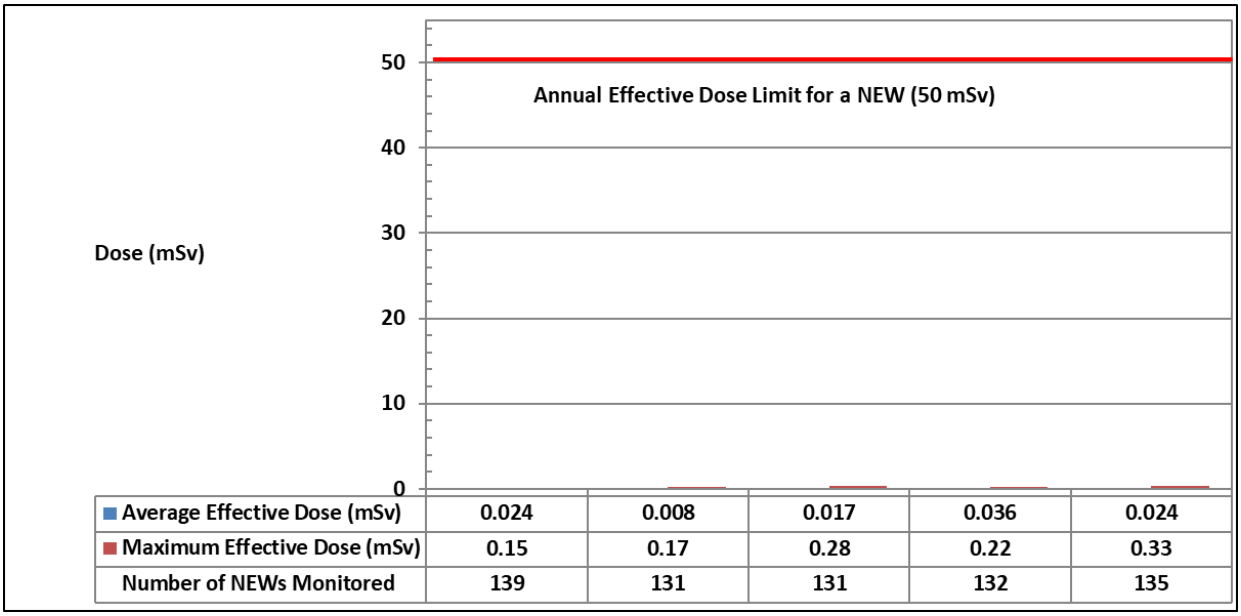
Table J-15: Effective dose statistics for non-NEWs, TRIUMF, 2019 –2023

Dose Data (mSv)	2019	2020	2021	2022	2023
Average Effective Dose	0.003	0.004	0.005	0.004	0.02
Maximum Individual Effective Dose	0.18	0.09	0.16	0.080	0.12
# of Non-NEWs Monitored	1092	701	787	1090	1133

Canadian Light Source Inc.

Figure J-14 provides the average and maximum effective doses for NEWs at CLSI between 2019 and 2023. In 2023, the maximum effective dose received by a NEW at CLSI was 0.33 mSv, or approximately 0.7% of the CNSC's regulatory effective dose limit of 50 mSv in a 1-year dosimetry period. Effective doses at CLSI continue to be low and are following the same trend as previous years.

Figure J-14: Effective dose statistics for NEWs, CLS, 2019-2023



Average Effective Dose (mSv)	0.024	0.008	0.017	0.036	0.024
Maximum Effective Dose (mSv)	0.15	0.17	0.28	0.22	0.33
Number of NEWs Monitored	139	131	131	132	135

Non-NEWs at CLSI

CLSI also monitored the effective doses for non-NEWs employees as shown in Table J-16 and contractors as shown in Table J-17.

Table J-16: Effective dose statistics for non-NEWs, CLSI, 2019 –2023

Dose Data (mSv)	2019	2020	2021	2022	2023	Regulatory Dose Limit
Average Effective Dose	0.007	0.001	0.033	0.025	0.030	-
Maximum Individual Effective Dose	0.09	0.01	0.16	0.20	0.55	1 mS/year
# of Non-NEWs Monitored	58	38	41	50	49	-

Table J-17: Effective dose statistics for contractors, CLSI, 2019 –23

Dose data	2019	2020	2021	2022	2023	Regulatory dose limit
Average extremity dose (mSv)	0.0038	0	0.073	0.029	0.025	--
Maximum individual skin dose (mSv)	0.05	0	0.23	0.53	0.33	**1 mSv/year**
Number of non-NEWs monitored	16	7	8	18	13	--

Appendix K: Health and Safety Data

This appendix contains information on lost-time injury (LTI) statistics for LTIs incurred as a result of a licensed activity at the UNSPFs, Research Reactors and Class IB Accelerators. An LTI is an injury that takes place at work where the worker is unable to return to work for a period of time. The accident severity rate measures total number of days lost to injury for every 200,000 person-hours worked. Severity = [(# of days lost in last 12 months) / (# of hours worked in last 12 months)] x 200,000. The accident frequency rate measuring the number of LTIs for every 200,000 person-hours worked at the site. Frequency = [(# of injuries in last 12 months) / (# of hours worked in last 12 months)] x 200,000.

Table K-1: LTI statistics for BRR, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	1
Severity rate	0	0	0	0	2.08
Frequency rate	0	0	0	0	0.69

Table K-3: LTI statistics for CFM, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K-2: LTI statistics for PHCF, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K-4: LTI statistics for BWXT NEC Toronto, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K-5: LTI statistics for BWXT NEC Peterborough, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K-6: LTI statistics for SRBT, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K-7: LTI statistics for Nordion, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	2	0	0	1	0
Severity rate	4.15	0	0	33.88	0
Frequency rate	0.69	0	0	0.65	0

Table K-8: LTI statistics for BTL, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	2	0	0	0	1
Severity rate	5.47	0	0	0	1.37
Frequency rate	1.37	0	0	0	0.684

Table K-9: LTI statistics for BWXT Medical, 2019–2023

Statistic	2019	2020	2021	2022	2023
LTI	N/A	N/A	1	1	2
Severity rate	N/A	N/A	1.17	9.65	14.13
Frequency rate	N/A	N/A	0.39	0.37	0.83

Table K1-10: LTI statistics for McMaster University 2019-2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K1-11: LTI statistics for École Polytechnique de Montréal 2019-2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K1-12: LTI statistics for Royal Military College 2019-2023

Statistic	2019	2020	2021	2022	2023
LTI	0	0	0	0	0
Severity rate	0	0	0	0	0
Frequency rate	0	0	0	0	0

Table K-1: LTI statistics for CLSI, 2019-2023

Statistic	2019	2020	2021	2022	2023
LTI	0	1	1	1	1
Severity Rate	0.00	4.4	4.1	0.43	2.1
Frequency Rate	0.00	0.44	0.41	0.43	0.43

Table K-2: LTI statistics for TRIUMF, 2019-2023

Statistic	2019	2020	2021	2022	2023
LTI	4	4	3	2	4
Severity Rate	4.5	14	3.0	25	14
Frequency Rate	0.58	1.2	0.45	0.24	0.48

Appendix L: Reportable Events

Reportable Events + LTI's = Number of Events

Facility	Number of Events
BRR	4
CFM	5
PHCF	7
BWXT NEC Toronto	1
BWXT NEC Peterborough	4
SRBT	0
Nordion	8
BWXT Medical	4
BTL	1
McMaster Research Reactor	2021 (0); 2022 (0); 2023 (1)
Royal Military College of Canada	2021 (0); 2022 (0); 2023 (1)
École Polytechnique de Montréal	2021 (0); 2022 (0); 2023 (1)
TRUIMF	2020 (0), 2021(4), 2022 (1), 2023 (0)
Canadian Light Source	2020 (1), 2021 (2), 2022 (2), 2023 (1)

Appendix M: Indigenous Nations, Communities and Organizations that have Traditional and/or Treaty Territories within proximity to UNSPF engaged by CNSC during the reporting period

BRR
• Mississauga First Nation • Métis Nation of Ontario (Region 4) • Sagamok Anishnawbek Nation • Serpent River First Nation • Thessalon First Nation

PHCF, CFM, BWXT NEC Toronto/Peterborough
• Williams Treaties First Nations, which include: - Alderville First Nation - Curve Lake First Nation - Hiawatha First Nation - the Mississaugas of Scugog Island First Nation - the Chippewas of Beausoleil First Nation - the Chippewas of Georgina Island First Nation - the Chippewas of Rama First Nation • Mississaugas of the Credit First Nation • Métis Nation of Ontario (Region 6 and 8) • Mohawks of the Bay of Quinte

SRBT, Nordion, BTL, BWXT Medical
• Algonquin Anishinabeg Nation Tribal Council • Algonquin Nation Secretariat • Algonquins of Barriere Lake • Algonquins of Ontario • Algonquins of Pikwàkanagàn First Nation • Conseil de la Première Nation Abitibiwinni • Kebaowek First Nation • Kitcisakik First Nation • Kitigan Zibi Anishinabeg • Conseil de la Nation Anishnabe de Lac Simon • Long Point First Nation • Métis Nation of Ontario (Regions 5 and 6) • Mohawks of the Bay of Quinte • Timiskaming First Nation • Wahgoshig First Nation • Wolf Lake First Nation

McMaster
• the Mississaugas of the Credit • Six Nations of the Grand River • Métis Nation of Ontario (MNO) – Region 9 • Haudenosaunee Confederacy Chiefs Council

Royal Military College
• the Mohawks of the Bay of Quinte • the Metis Nation of Ontario

École Polytechnique de Montréal
• Mohawks of Kanesatake • the Mohawks of Kahnawake • the Mohawks of Akwesasn

TRIUMF
• Musqueam First Nation

CLSI
• Whitecap Dakota First Nation • Métis Nation of Saskatchewan

Appendix N: Summary of engagement in relation to CNSC's Terms of Reference for Long-term Engagement and Associated Workplans

The Algonquins of Pikwàkanagàn First Nation - CNSC Long-term Engagement Terms of Reference

As committed to with the Algonquins of Pikwàkanagàn First Nation (AOPFN) as part of the terms of reference (ToR) for long-term engagement with the CNSC, CNSC staff prepared the following summary and offered to co-author and validate the text with AOPFN. CNSC staff did not receive a response to the request to review to date but are committed to collaborating with the Nation on content related to our engagement and ToR should they be interested moving forward.

On November 30, 2022, CNSC Staff and the AOPFN signed a ToR for long-term engagement, providing a formalized structure for ongoing dialogue on CNSC-regulated facilities and activities of interest in AOPFN's traditional territory. As part of the ToR, a yearly work plan is developed between the CNSC and AOPFN, which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement.
In 2023, the work plan included activities that CNSC staff and AOPFN collaborated on to implement throughout 2023 and beyond, including:

- participation in the CNSC's Independent Environmental Monitoring Program (IEMP)
- updates and discussions on specific projects and ongoing operations of existing nuclear facilities of interest
- information, communication and other topics (i.e., REGDOC updates, feedback on CNSC reporting and processes, and PFP opportunities).

In 2023, AOPFN and CNSC staff met regularly in monthly and quarterly meetings, including an in-person quarterly meeting in July 2023, and worked collaboratively to make progress on the agreed upon initiatives in the workplan. CNSC staff and AOPFN continued to track, collaboratively verify, and provide responses to key concerns and issues raised by AOPFN throughout 2023 including through AOPFN's submissions and interventions to the Commission. Topics of discussion related to Uranium and Nuclear Substances and Processes Facilities in AOPFN territory included updates and discussions related to Best Theratronics Ltd., Nordion Canada Inc., BWXT Medical Canada Inc., and SRB Technologies Inc.

In 2023, AOPFN presented on their nuclear sector principles, and indicated their desire for the CNSC to respect and support these principles in environmental assessments (EAs), including the NPD closure project's EA. AOPFN also provided early feedback on the CNSC's REGDOC 3.2.2: Indigenous engagement. In addition, CNSC and AOPFN discussed incorporation of AOPFN's proposed criteria for the assessment of the adequacy of CNSC staff and licensee consultation and engagement as well as the incorporation of Indigenous Knowledge into CNSC staff reports and Regulatory Oversight Reports (RORs).

Throughout 2023, AOPFN also engaged in the Regional Information Monitoring Network (RIMNet) for the Ottawa valley watershed initiative with CNSC and ECCC.

In 2024, AOPFN and CNSC staff plan to continue monthly and quarterly meetings to work on agreed upon initiatives in the workplan. Some of the activities planned for 2024 include continued consultation and engagement activities for Uranium and Nuclear Substances and Processes Facilities in AOPFN territory, continued work on collaborating on enhancing the approach to weaving AOPFN's Algonquin Knowledge into CNSC staff's assessments and processes respecting AOPFN's Algonquin Knowledge Protocols for project assessments, engagement and collaboration on the IEMP sampling campaign for the SRB Technologies facility in Pembroke, Ontario and ongoing collaboration on the RIMNet initiative.

CNSC and AOPFN will also continue to work together on validating, responding to and addressing AOPFN's issues, concerns and recommendations raised in AOPFN's interventions to the Commission and identified through ongoing discussions and engagement.

CNSC staff and AOPFN continue to be committed to strengthening the relationship through ongoing, respectful dialogue to share knowledge, information on culture and history, and perspectives that help CNSC staff and AOPFN learn from each other. CNSC staff will also continue to look for ways to enhance the relationship with AOPFN and identify areas for ongoing improvement in the CNSC's approach to engagement and reporting. CNSC staff and AOPFN will also continue to have discussions on areas of interest and on issues or concerns related to existing and proposed CNSC-regulated nuclear activities of interest to AOPFN. collaboratively verify and provide responses to key concerns and issues raised by AOPFN throughout 2023 including through AOPFN's submissions and interventions to the Commission. Topics of discussion related to Uranium and Nuclear Substances and Processes Facilities in AOPFN territory included updates and discussions related to Best Theratronics Ltd., Nordion Canada Inc., BWXT Medical Canada Inc., and SRB Technologies Inc.

Kebaowek First Nation (KFN)-CNSC Long-term Relationship Arrangement and Project Terms of Reference

As committed to with Kebaowek First Nation (KFN) as part of the long-term relationship arrangement with the CNSC, the update below was prepared in collaboration with KFN representatives.

In 2022, CNSC staff and KFN representatives started discussions to establish an arrangement for a long-term relationship, as well as, a Project specific Terms of Reference (ToR) for a number of nuclear facilities that are proposed or exist on their unceded lands, including the Micro Modular Reactor, Nuclear Power Demonstration Closure, and Near Surface Disposal Facility projects. The long-term relationship Arrangement was signed on September 29, 2022, with the aim of providing a formalized structure for ongoing dialogue with the CNSC for facilities and activities where KFN has identified concerns in relation to a project's construction or existing operations on their rights, interests, culture, current and traditional uses of their territory. The Project Terms of Reference was signed on June 9, 2023, and aims to provide a mutually determined framework for consultation and Rights Impact Assessment on the Micro Modular Reactor, Nuclear Power Demonstration Closure, and Near Surface Disposal Facility projects.

As part of the Arrangement and ToR, the CNSC and KFN remain in discussions to develop an annual work plan, with the aim that it will provide information on the scope of work, detailed activities, and timelines associated with work items for collaboration, consultation, and engagement. There have been delays in coming to an agreement about the work plan given differing priorities, approaches and understandings of the nature and scope of work which ought to be considered – with the recent Near Surface Disposal Facility hearing highlighting KFN's position regarding ongoing deficiencies in the CNSC's approach to consultation, free prior informed consent, and inclusion of Indigenous knowledge within its oversight of nuclear projects.

The CNSC and KFN aim to have a work plan which may include activities that CNSC staff and KFN will work to implement throughout 2024 and beyond, including:

- **collaborative annual reporting to the Commission and to the KFN Chief and Council updates and discussions on specific projects and ongoing operations of licensed nuclear facilities of interest**

- **consultation opportunities, steps, and processes for the Nuclear Power Demonstration Closure Project**

- **consultation opportunities, steps, and processes for the Global First Power Micro Modular Reactor Project**

- **enhanced information sharing and communication between the CNSC and KFN members**

- **ongoing dialogue on the CNSC's approach to the United Nation Declaration Act 2021 implementing UNDRIP (2007) including the Government of Canada's approach to Free, Prior, and Informed Consent for hazardous and natural resource projects to meet CNSC's annual reporting on developments with NRCan and DOJ.**

- **at the November 1, 2023, commission meeting, Kebaowek suggested a UNDA pilot project, the proposal is part of the 2023 LTRA workplan**

- **opportunities to comment and review policies and regulations including those related to nuclear safety, non-proliferation, and Indigenous engagement.**

- **engagement and discussions relating to OPG's Darlington New Nuclear Project**

The following facilities covered in this ROR are of interest in the to be developed work plan:

- **BWXT Medical**

- **Nordion**

- **SRBT**

CNSC staff and KFN are committed to continuing to strengthen the relationship through ongoing, respectful dialogue and the sharing of knowledge, information on culture and history, and perspectives that help CNSC staff learn from KFN. CNSC staff will also continue to have discussions on areas of interest and concern related to CNSC-regulated nuclear activities of interest to KFNAs committed to with Kebaowek First Nation (KFN) as part of the terms of reference (ToR) for long-term engagement with the CNSC, CNSC staff prepared the following summary and offered to co-author and validate the text with KFN. CNSC staff did not receive a response to the request to review to date but are committed to collaborating with the Nation on content related to our engagement and ToR should they be interested moving forward who declined the offer to co-author this summary and will communicate to the Commission directly through an intervention.

Mississaugas of Scugog Island First Nation Long-term Engagement Terms of Reference

As committed to with the Mississaugas of Scugog Island First Nation (MSIFN) as part of the Terms of Reference (ToR) for long-term engagement with the CNSC, the update below was prepared in collaboration with MSIFN representatives.
In September 2021, CNSC staff started discussions with MSIFN to establish a formal long-term relationship with the community, and a ToR was signed between MSIFN and the CNSC in March 2022. As part of the ToR, a yearly work plan is developed between the CNSC and MSIFN, which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement. CNSC also provides funding and capacity support to MSIFN through its Indigenous and Stakeholder Capacity Fund to support the meetings, engagement, and collaboration work as per the ToR and engagement work plan.
The work plan included:

- Participation in the CNSC's Independent Environmental Monitoring Program (IEMP)
- Collaborative annual reporting to the Commission and to MSIFN Chief and Council

- Updates and discussions on specific projects and ongoing operations of licensed nuclear facilities of interest. Enhancing information sharing and communication between the CNSC and MSIFN
- Emergency management and preparedness

In 2023, MSIFN and CNSC staff continued to meet monthly and work collaboratively to make progress on a number of the agreed-upon initiatives in the work plan. CNSC staff and MSIFN continued to track, collaboratively verify, and provide responses to key concerns and issues raised by MSIFN throughout 2023.

Topics of discussion related to Uranium and Nuclear Substances and Processes Facilities in MSIFN's territory included updates about the Port Hope Conversion Facility, Cameco Fuel Manufacturing Facility license renewal application, and BWXT NEC Toronto and Peterborough. Topics of discussion related to Canadian Nuclear Laboratories facilities and sites in MSIFN's territory included updates regarding Chalk River Laboratories, the Nuclear Power Demonstration Closure Project, and the Port Hope Area Initiative license renewal and arsenic clean-up criteria licence amendment.

MSIFN has raised concerns regarding the future Darlington New Nuclear Project, including the requirement for consent from impacted First Nations, the lack of plans for Species at Risk habitat compensation, decommissioning, and nuclear waste management, and the fact that the project is proceeding with an outdated environmental assessment that does not meet current standards. MSIFN continues to assert that the DNNP project will have impacts on Rights. CNSC is moving forward with drafting a Rights Impact Assessment regarding MSIFN's rights around the DNNP project, prior to its license to construct hearing in late 2024. MSIFN has expressed concerns that the short timeline provided to complete the RIA will result in a limited understanding of MSIFN's rights in relation to the project, and collaboration is lacking as the CNSC independently prepares the draft RIA without MSIFN's input into designing the study. CNSC staff are working with MSIFN to address these concerns. MSIFN's perspectives including these concerns will be reported to the Commission through the regulatory process for the DNNP Licence to Construct application.

CNSC staff and MSIFN are committed to continuing to strengthen the relationship through ongoing respectful dialogue to share knowledge, information on culture, history and perspectives that help CNSC staff and MSIFN learn from each other and improve communications and collaboration. CNSC staff will also continue to have discussions regarding areas of interest and issues or concerns related to CNSC-regulated nuclear activities of interest to MSIFN.

Curve Lake First Nation - CNSC Long-term Engagement Terms of Reference

As committed to with Curve Lake First Nation as part of the Terms of Reference for long-term engagement with the CNSC, the update below was prepared in collaboration with Curve Lake First Nation representatives.

In February 2021, CNSC staff and Curve Lake First Nation signed a Terms of Reference (ToR) for long-term engagement, providing a formalized structure for ongoing dialogue on CNSC-regulated facilities and activities of interest in Curve Lake First Nation's traditional and treaty territories. As part of the ToR, a yearly work plan is developed between the CNSC and Curve Lake First Nation that provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement. In 2023 the work plan included activities that CNSC staff and Curve Lake First Nation collaborated on to implement throughout 2023 and beyond, including:

- Participation in the CNSC's Independent Environmental Monitoring Program (IEMP)
- Updates and discussions on specific projects and ongoing operations of existing nuclear facilities of interest
- Information, communication, and other topics (i.e., REGDOC updates, feedback on CNSC reporting and processes, funding opportunities, radiation monitoring and cumulative effects)
- Developing a plan for a Curve Lake First Nation Indigenous Knowledge Study

In 2023, due to capacity constraints and other priorities Curve Lake First Nation and CNSC were not able to initiate discussions on developing a plan for an Indigenous Knowledge study. However, Curve Lake First Nation and CNSC are committed to developing a plan for a Curve Lake First Nation IK Study in 2024. Due to capacity constraints, despite best efforts by Curve Lake First Nation, and funding opportunities made available by CNSC, there are topics and issues that have not been adequately discussed and addressed. Both Curve Lake First Nation and CNSC are committed to an ongoing effort to close such gaps. Also, in 2023, Curve Lake First Nation and CNSC staff continued to meet monthly and work collaboratively to make progress on the agreed upon initiatives in the work plan. Through monthly meetings and interactions, Curve Lake First Nation and CNSC have developed a good working relationship; one that has been conducive to open and direct communications. Topics of discussion related to Uranium and Nuclear Substances and Processes Facilities in Curve Lake First Nation's territory included updates and discussions related to the BWXT NEC (Toronto and Peterborough), Port Hope Conversion Facility, and Cameco Fuel Manufacturing.

CNSC staff attended Curve Lake First Nation community events, including the Alternative Routes Career fair in January 2023 and Harvesters Symposium in September 2023. CNSC staff look forward to continuing to enhance information sharing and communication with Curve Lake First Nation community members and leadership.

In December 2023, CNSC staff had an in-person meeting with Curve Lake First Nation representatives, in their community. CNSC staff provided updates on and an overview of all nuclear facilities and activities in their Treaty and traditional territories.

Curve Lake First Nation provided feedback through their intervention on the 2022 RORs and continue to do so through ongoing discussions. CNSC staff have made a number of improvements to CNSC staff reports and documentation based on the feedback, updating the language used throughout CNSC reports and having discussions on how to better incorporate Indigenous Knowledge and perspectives in CNSC's regulatory processes (including Environmental Protection Review Reports). In 2023 CNSC staff and Curve Lake First Nation had focused discussions on the key themes raised in their interventions to the Commission and are working together to discuss and address the issues, concerns and recommendations raised in Curve Lake First Nation's interventions.

CNSC staff and Curve Lake First Nation continue to be committed to strengthening the relationship through on-going respectful dialogue to share knowledge, information on culture, history, Rights and interests and perspectives that help CNSC staff and Curve Lake First Nation learn from each other and improve collaboration and communications. CNSC staff are committed to continuing to have discussions regarding areas of interest and issues or concerns related to existing and proposed CNSC-regulated nuclear activities of interest to Curve Lake First Nation.

Hiawatha First Nation - CNSC Long-term Engagement Terms of Reference

As committed to with Hiawatha First Nation as part of the Terms of Reference for long-term engagement with the CNSC, the update below was prepared in collaboration with Hiawatha First Nation representatives.

In May 2023, CNSC staff and Hiawatha First Nation signed a Terms of Reference (ToR) for long-term engagement, providing a formalized structure for ongoing dialogue on CNSC-regulated facilities and activities of interest in Hiawatha First Nation's traditional and treaty territories. As part of the ToR, a yearly work plan is developed between the CNSC and Hiawatha First Nation that provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement. In 2023, the work plan included activities that CNSC staff and Hiawatha First Nation collaborated on implementing throughout 2023 and beyond, including:

- Participation in the CNSC's Independent Environmental Monitoring Program (IEMP)
- Updates and discussions on specific projects and ongoing operations of existing nuclear facilities of interest
- Information, communication, and other topics (i.e. REGDOC updates, feedback on CNSC reporting and processes, funding opportunities, radiation monitoring and cumulative effects)

- Developing a plan for a Hiawatha First Nation Indigenous Knowledge Study

Hiawatha First Nation and CNSC were not able to initiate discussions on developing a plan for an Indigenous Knowledge (IK) study. However, Hiawatha First Nation and CNSC are committed to developing a plan for a Hiawatha First Nation IK Study in 2024.

In 2023, Hiawatha First Nation and CNSC staff continued to meet monthly and work collaboratively to make progress on the agreed upon initiatives in the work plan. Through monthly meetings and interactions, Hiawatha First Nation and CNSC are progressing their working relationship.

Topics of discussion related to Uranium and Nuclear Substances and Processes Facilities in Hiawatha First Nation's territory included updates and discussions related to the BWXT NEC (Toronto and Peterborough), Port Hope Conversion Facility, and Cameco Fuel Manufacturing.

In December 2023, CNSC staff had an in-person meeting with Hiawatha First Nation leadership, in their community. CNSC staff provided updates regarding an overview of all nuclear facilities and activities in their traditional and treaty territory. CNSC staff and Hiawatha First Nation also discussed concerns and priorities for 2024 and beyond.

Hiawatha First Nation provided feedback through their intervention on the 2022 Regulatory Oversight Reports and continue to do so through ongoing discussions with CNSC staff. CNSC staff have made a number of improvements to CNSC staff reports and documentation based on the feedback, such as updating language used throughout CNSC documentation and having discussions on how to better incorporate Indigenous Knowledge and perspectives in CNSC's regulatory processes (including Environmental Protection Review Reports). In 2023 CNSC staff and Hiawatha First Nation had focused discussions on the key themes raised in their interventions to the Commission and are working together to discuss and address the issues, concerns and recommendations raised in Hiawatha First Nation's interventions.

CNSC staff and Hiawatha First Nation continue to be committed to strengthening the relationship through on-going respectful dialogue to share knowledge, information on culture, history and perspectives that help CNSC staff and Hiawatha First Nation learn from each other and improve collaboration and communication. CNSC staff are committed to continuing to have discussions regarding areas of interest and issues or concerns related to existing and proposed CNSC-regulated nuclear activities of interest to Hiawatha First Nation. Hiawatha First Nation would like to see real change in the CNSC's regulatory and consultation processes. This includes the implementation of the 2018 Williams Treaties Settlement Agreement, which would in effect uphold the Inherent and Treaty rights of the First Nation. The Williams Treaties Settlement Agreement was signed in 2018 and recognized the pre-existing treaty harvesting rights for the First Nations members and included both federal and provincial apologies for the negative impacts of the Williams Treaties on the First Nations. CNSC staff and Hiawatha First Nation are committed to working together to ensure Hiawatha First Nation's rights and interests are protected and reflected in the CNSC's regulatory process and documents.

Métis Nation of Ontario - CNSC Long-term Engagement Terms of Reference

As committed to with the Métis Nation of Ontario as part of the terms of reference (ToR) for long-term engagement with the CNSC, the update below was prepared in collaboration with Métis Nation of Ontario representatives.

Following the licence renewal hearing for the Bruce Nuclear Generating Station in 2018, a ToR was agreed upon and signed on December 18, 2019, between CNSC staff and the MNO, which formally documents the engagement with their Nation. As the MNO is a province-wide organization, a specific engagement plan under the Terms of Reference was also signed in December 2019 with MNO Region 7.

In 2023, the engagement plans included:

- Participation in the CNSC's IEMP
- Sharing information on NWMO's Adaptive Phase Management initiative
- Sharing information on the NPD project
- Sharing information on SMRs, and GFP's MMR project
- CNSC to support MNO capacity building through new Indigenous and Stakeholder Capacity Fund (ISCF), including the hiring of a community liaison to work with CNSC directly
- Communication with MNO citizens

As per the engagement plan, in 2023, CNSC staff continued to meet with MNO representatives CNSC staff worked with MNO to update the work plan to identify areas of collaboration, including environmental monitoring through the IEMP, providing information relating to UNSPF facilities and ongoing regulatory monitoring, Impact Assessments and Small Modular Reactors.

Appendix O: Participant Funding Recipients for the 2023 UNSPFs, Research Reactors and Class IB Accelerators Regulatory Oversight Report

Recipients
Algonquins of Pikwàkanagàn First Nation
Prince Albert Grand Council
Mississaugas of Scugog Island First Nation
Kebaowek First Nation
Nuclear Transparency Project

Further information on the CNSC's participant funding program can be found on the CNSC website.

Appendix P: Summary table of the status of issues, concerns, and requests from intervenors in the 2022 UNSPFs ROR

In direct response to the Commission's action from the 2021 RORs, CNSC staff has established an internal CNSC issues, concerns, and comments tracking table for each intervening Indigenous Nation or Community. These tables also summarize and track CNSC's efforts to respond to and address intervenor requests concerns and comments, where feasible. In the 2022 ROR meeting, the Commission noted the concerns raised by several intervenors that comments and recommendations made regarding past RORs had not been addressed directly by CNSC staff. As a result, the Commission expects to be updated on the status of CNSC staff's efforts to address and track intervenor recommendations across all RORs moving forward. The Commission has directed CNSC staff to provide an update on whether and how comments and recommendations made by Indigenous Nations and communities in particular have been, or will be, addressed, including where there are disagreements.

The purpose of this appendix is to provide a summary of information and data from the CNSC's issues tracking tables to the Commission. The tables below provide an overview of the issues raised in interventions in relation to the previous year's UNSPF ROR, and the proposed path forward to address them. Table A outlines the number of specific issues and concerns raised by each intervening Indigenous Nation and community and their related themes, as well as CNSC responses and proposed path forward. Table B provides an overview of the key thematic categories raised by each intervening Indigenous Nation and community and the total number of times each theme or topic was raised by all intervenors in their interventions. Tracking this thematic information will provide a baseline to help direct CNSC staff to focus their efforts on future engagements and consultations to areas that generate the most concerns.

The following Table P-1 provides details regarding the number of specific issues and concerns raised in the interventions by Indigenous Nations and communities in relation to the 2022 UNSPF ROR, the number of thematic categories the issues and concerns are grouped by, and the status of the CNSC's approach to responding to and addressing each issue, concern or request raised in the interventions to date.

CNSC staff are committed to responding to and following up with the intervenors below with regards to their interventions and working collaboratively to identify options for a path forward to address the comments, where possible. For Indigenous Nations and communities that have a ToR for long-term engagement with the CNSC, requests, concerns and comments raised in relation to the ROR have been integrated into the engagement work plan and regular meetings with each Indigenous Nation or community, including sharing the specific issues and concerns

tracking table with each Indigenous Nation and community in order to verify the data and discuss a path forward for addressing their comments.

In addition, CNSC staff have also followed up with Indigenous Nations and communities who the CNSC does not currently have a ToR for long-term engagement with, in order to follow up on or set a path forward on responding to and addressing their comments and issues.

Table P-1 Issues and concerns raised in interventions from the 2022 UNSPFs ROR tracking and response table.

2022 UNSPF's ROR Interventions from Indigenous Nations and Communities	The number of Request /Concerns/Comments raised in the 2022 ROR Intervention	Request/Concerns /Comments responded to by CNSC staff	Notes
Hiawatha First Nation	9 (Across 6 categories)	9	The issues, concerns and recommendations raised by Hiawatha First Nation in their intervention for the 2022 UNSPF ROR are being addressed and discussed with Hiawatha First Nation through an issues tracking table managed by CNSC staff, as well as through regular meetings as part of HFN and CNSCs TOR. CNSC staff reached out to **Hiawatha First Nation** to offer to have a specific meeting and discussions to address their concerns, comments, and recommendations in relation to the 2022 UNSPF ROR. CNSC staff looks forward to working with **Hiawatha First Nation** to address their comments and recommendations. The themes of the issues and concerns raised span from impacts to rights, legacy impacts and more.

Algonquins of Pikwàkanagàn First Nation	7 (Across 5 categories)	7	The issues, concerns and recommendations raised by Algonquins of Pikwàkanagàn First Nation in their intervention for the 2022 UNSPF ROR are being addressed and discussed with Algonquins of Pikwàkanagàn First Nation through an issues tracking table designed by CNSC staff, as well as through regular meetings as part of AOPFN and CNSCs TOR. CNSC staff reached out to the Algonquins of Pikwàkanagàn First Nation to offer to have a specific meeting and discussions to address their concerns, comments, and recommendations in relation to the 2022 UNSPF ROR. This meeting is scheduled for July 8th 2024. The themes of the issues and concerns raised span from CNSC regulatory oversight, funding programs and more.
Kebaowek First Nation	8 (Across 6 categories)	8	The issues, concerns and recommendations raised by Kebaowek First Nation in their intervention for the 2022 UNSPF ROR are being addressed and discussed with Kebaowek First Nation through an issues tracking table designed by CNSC staff, as well as through regular meetings. CNSC staff reached out to Kebaowek First Nation to offer to have a specific meeting and discussions to address their concerns, comments, and

			recommendations in relation to the 2022 UNSPF ROR. CNSC staff looks forward to working with Kebaowek First Nation to address their comments and recommendations. The themes of the issues and concerns raised span from environmental monitoring, CNSC regulatory oversight, waste management and more

Table P-2 provides an overview of the key thematic categories raised in interventions from Indigenous Nations and Communities in relation to the 2022 UNSPF ROR and the number of times each theme or topic was raised in total. In total for this ROR last year there were 5 Indigenous intervenors. The categories included in Table P-2 have been ordered from most frequently raised to least. The thematic categories are derived from the review of the 2022 interventions and CNSC staff's analysis of the issues and topics raised.

CNSC staff are committed to continuing to follow up and work with each Indigenous Nation in Table P-1, as well as other repeat individuals and civil society organizations who intervened to continue discussions on how best to address these themes and areas of interest identified in their interventions.

Table P-2: Overview of key thematic categories

Request/Concerns/Comments Category in the intervention for the 2022 UNSPF ROR	Number of times the topic category was raised across 2022 UNSPF's ROR Interventions	Number of interventions who raised the topic in intervention
CNSC's Consultation and Engagement activities (Indigenous and Stakeholder) (e.g., suggestions for improvements to the approach to consultation and engagement and request for meaningful responses to issues raised)	8	3
CNSC Regulatory Oversight Activities in Relation to Proponents (e.g., suggestions for strengthening regulations and	6	2

engagement requirements for proponents)		
Other (some examples: Nation-specific concerns, comments relating to waste, UNDRIP, access to information etc.)	4	2
Proponent activities and Engagement (e.g., suggestions for improving proponent's engagement with Indigenous Nations and communities)	3	2
Environmental Monitoring (e.g., requests to be included in the development of monitoring plans and for additional monitoring to occur)	3	3
Improvements to ROR process and ROR content(e.g., requests related to: improving accessibility, providing additional information or clarification in specific sections of the report, providing information about the performance rating system and improving the format of the report)	2	1
Participant Funding Program, Indigenous and Stakeholder Capacity Fund, General Funding (e.g., requests for more funding to support participation in regulatory activities)	2	2
Indigenous Knowledge (e.g., requests to clarify how Indigenous Knowledge has been considered and incorporated)	2	2
Impacts on Indigenous Treaty Rights	2	2

(e.g., concerns about lack of consent from Indigenous Nations and communities in the initial establishment of nuclear operations on traditional territories)		

Conclusion

CNSC staff take the issues and concerns raised by intervenors seriously and CNSC staff will continue to work with each intervenor identified in Tables P-1 who have raised issues and concerns on identifying approaches to addressing the different topic areas, requests and comments raised as appropriate. Furthermore, the CNSC is committed to continuously improving the quality of data included in RORs, and the ROR reporting process. CNSC acknowledges that the two main themes of issues raised in the 2022 UNSPF ROR were “CNSC’s Consultation and Engagement activities (Indigenous and Stakeholder)” and “CNSC Oversight Activities” and has made it a priority to further discuss and address these issues, where feasible. As part of this commitment, CNSC staff have included appendices in all 2023 RORs with information on the issues and concerns raised by intervenors and the status of the CNSC’s work to follow-up, respond to and address each intervention as appropriate, and are working towards the continued expansion and enhancement of reporting to the Commission on issues tracking and engagement efforts.

The CNSC is dedicated to continuous improvement, and actively works to identify meaningful ways and approaches for addressing the concerns, comments and recommendations made by intervenors identified in the RORs, where appropriate. In instances where issues and concerns are raised that the CNSC and the intervenor may disagree the CNSC is open to having dialogue and working towards finding solutions and building consensus around key issues within the CNSC’s mandate and authority.