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Written submission from Cameco Corporation

Mémoire de Cameco Corporation

In the Matter of the

À l'égard de

Blind River Refinery

Raffinerie de Blind River

Application to renew licence for Cameco Corporation's Blind River Refinery

Demande de renouvellement de permis pour la raffinerie de Blind River appartenant à Cameco Corporation

Commission Public Hearing

Audience publique de la Commission

November 24-25, 2021

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CNSC COMMISSION MEMBER DOCUMENT (CMD)

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Cameco Corporation

Blind River Refinery

One-Day Public Hearing

Scheduled for:
November 24 and 25, 2021

Request for a Licensing Decision:

Regarding:
Renewal of Operating Licence FFOL-3632.0/2022 for the Blind River Refinery

Submitted by:
Cameco Corporation

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Executive Summary

Cameco Corporation (Cameco) is a major supplier of uranium processing services required to produce fuel for the generation of safe, clean and reliable electricity around the world. Cameco's Fuel Services Division supplies the world's reactor fleet with fuel to generate one of the cleanest sources of electricity available today.

Cameco operates the Blind River Refinery (BRR) under Canadian Nuclear Safety Commission (CNSC) operating Licence FFOL-3632.0/2022 (the Licence) and produces uranium trioxide (UO_3). Almost all of the UO_3 produced is shipped to Cameco's Port Hope Conversion Facility (PHCF), where it is converted into either uranium dioxide (UO_2) or uranium hexafluoride (UF_6). A small quantity of UO_3 is also shipped to other customers who are licensed by the CNSC or the equivalent authority in another country in accordance with international agreements.

The Licence expires on February 28, 2022. Cameco submitted an application on September 30, 2020 to request the renewal of this operating licence for a period of 10 years. This application and supporting documents provided after September 30, 2020 serve as the licensing basis for the renewal.

Cameco's request for renewal of the operating licence includes:

- Current annual production limits of 18,000 tonnes of uranium as uranium trioxide (UO_3);
- Continued authorization to possess, transfer, use, process, import, manage, store and dispose of the nuclear substances that are required for, associated with, or arise from the production of UO_3;
- As circumstances warrant, to modify the BRR and commission equipment for the purpose of increasing the annual production capacity for UO_3; and,
- Approval of the proposed financial guarantee of $57.5 million, based on the 2020 update to the Preliminary Decommissioning Plan (PDP).

This CMD describes BRR's performance over the current licence period for each of the 14 Safety and Control Areas (SCAs) that comprise the CNSC regulatory framework. Included in the discussion of each SCA are BRR's commitments, including alignment with relevant Canadian Standards Association (CSA) standards and CNSC Regulatory Documents (REGDOCs). BRR will continue to work closely with CNSC staff throughout the proposed licence period to implement additional standardized requirements under the regulatory framework in a manner that ensures operations remain safe, clean and reliable during any applicable implementation phase.

BRR's strong performance in the current licence period, as described in this document, demonstrates that Cameco is qualified to carry on the activity that the requested licence will authorize Cameco for. Further, that Cameco will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

1.0 INTRODUCTION

1.1 Background

Cameco Corporation (Cameco) is a major supplier of uranium processing services required to produce fuel for the generation of safe, clean and reliable electricity around the world. Cameco's Fuel Services Division (FSD) supplies the world's reactor fleet with fuel to generate one of the cleanest sources of electricity available today. FSD comprises the Blind River Refinery (BRR), the Port Hope Conversion Facility (PHCF) and Cameco Fuel Manufacturing Inc. (CFM) and a divisional head office located in Port Hope Ontario.

Cameco operates BRR under Canadian Nuclear Safety Commission (CNSC) operating Licence FFOL-3632.0/2022 (the Licence) and produces uranium trioxide (UO_3). Almost all of the UO_3 produced is shipped to the PHCF, where it is converted into either uranium dioxide (UO_2) or uranium hexafluoride (UF_6). A small quantity of UO_3 is also shipped to other customers who are licensed by the CNSC or the equivalent authority in another country in accordance with international agreements.

The BRR is located about 5 km to the west of the Town of Blind River and south of the Mississauga First Nation. The property is 257.6 hectares in total, which includes a secured area of 11.3 hectares, where the BRR is located and where the CNSC licensed activities are carried out. An aerial photograph of the site is shown in Figure 1.

Figure 1 – Blind River Refinery

The facility receives natural uranium ore concentrates from mines located around the world and also receives and processes small quantities of scrap natural uranium-bearing materials. Activities to support uranium processing, including maintenance, waste management, laboratory services, utilities and materials handling are operated within the licensing basis, as will be described in each safety and control area (SCA) detailed below.

1.2 Summary of Application

BRR's current operating licence was granted by the CNSC on February 28, 2012, for a ten-year period and the Licence is set to expire on February 28, 2022. On September 30, 2020, an application was submitted to the CNSC for the renewal of the Licence for a period of 10 years. Additional information was provided in subsequent months to fulfil CNSC staff requests for information regarding the application, the supporting studies and programs that comprise the licensing basis.

For the renewal of FFOL-3632.0/2022, Cameco makes the following licensing requests of the Commission:

- Renewal for a 10-year licence term;
- maintaining the current production limit of 18,000 tonnes of uranium as UO_3;
- Continued authorization to possess, transfer, use, process, import, manage, store and dispose of the nuclear substances that are required for, associated with, or arise from the production of UO_3;
- As circumstances warrant, to modify the BRR and commission equipment for the purpose of increasing the annual production capacity up to 24,000 tonnes of uranium as UO3; and
- Approval of the proposed financial guarantee of $57.5 million, based on the 2020 update to the Preliminary Decommissioning Plan (PDP).

Other changes to the licensing basis described in the application, supporting studies and programs from the current licence period are as follows:

- Derived Release Limits (DRLs) have been updated to meet the requirements of CSA N288.1-14 *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*. This study was accepted by CNSC staff in 2019; and
- An increase of $9.5 million to a total of $57.5 million for the financial guarantee for decommissioning based on the cost estimate developed as part of the PDP that was updated in 2020 in accordance with CSA N294-09 *Decommissioning of facilities containing nuclear substances*, G-219: *Decommissioning planning guide for licensed activities* and G-206: *Financial guarantees guide for the decommissioning of licensed activities*. The PDP was accepted by CNSC staff in 2020.

Cameco is committed to the safe, clean and reliable operation of all of our facilities and continually strives to improve safety performance and processes to ensure the safety of both our workers and the people in neighbouring communities. BRR maintains the required programs, plans and procedures in the areas of management systems, health and safety, radiation protection, environmental protection, emergency response, fire protection, waste management, and training.

The performance of this facility over the current licence period demonstrates that Cameco is qualified to carry out the activities permitted under the Licence. The application and supporting documents reaffirm Cameco's commitment to protect the environment, the health and safety of employees and the public, to maintain security and safeguards obligations. These documents describe key improvements made in the current licence period, such as emissions reduction activities, enhancement of the environmental protection program, training program improvements, management of legacy waste, operational reliability improvements, and the implementation of new and updated CSA standards and REGDOCs.

Within the requested licence period of 10 years, BRR expects to continue with current licensed operations.

The application for licence renewal submitted on September 30, 2020, serves as the licensing basis for consideration in the renewal of FFOL-3632.00/2022 for a period of 10 years.

2.0 BUSINESS PLAN

Cameco is committed to the safe, clean and reliable operation of BRR. Objectives and targets for the facility are set and reviewed regularly. Cameco anticipates UO_3 production operations will continue to operate at similar production levels and within the existing capacity limits during the next licence period. FSD operations will continue to provide vital services for the nuclear industry and ultimately the energy-consuming public.

3.0 SAFETY AND CONTROL AREAS (SCAs)

3.1 Management System

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

3.1.1 Relevance and Management

Pursuant to the Licence, BRR is required to have a management system that establishes the processes and programs required to ensure BRR operates safely; continuously monitors its performance; and fosters a healthy safety culture. BRR's management system has been developed to meet the requirements of CSA N286-12 (R2017) *Management system requirements for nuclear facilities* (Management System) and REGDOC 2.1.1 *Management System*. The management system describes how licensed activities are controlled and references the supporting program documents required to ensure safe, clean and reliable production at the facility.

Cameco's corporate management system focuses on governance, promoting quality and a strong safety culture. Corporate policies, programs and guidance influence site management systems and programs to ensure accountability, consistency and oversight at all operations. Divisional oversight and collaboration enhance FSD safety culture through consistency, management system enhancements and/or divisional program development, to improve safety and environmental performance.

The organizational structures of BRR and FSD are shown in Figures 2 and 3. The general manager, BRR has the overall responsibility and authority to ensure that management system and related program documents are maintained and properly implemented and is accountable for ensuring conformance. The responsibilities for these programs and procedures have been delegated amongst the management team at BRR and their respective personnel. Support for aspects of the management system is provided by divisional and corporate personnel.

Figure 2 - BRR Organizational Structure

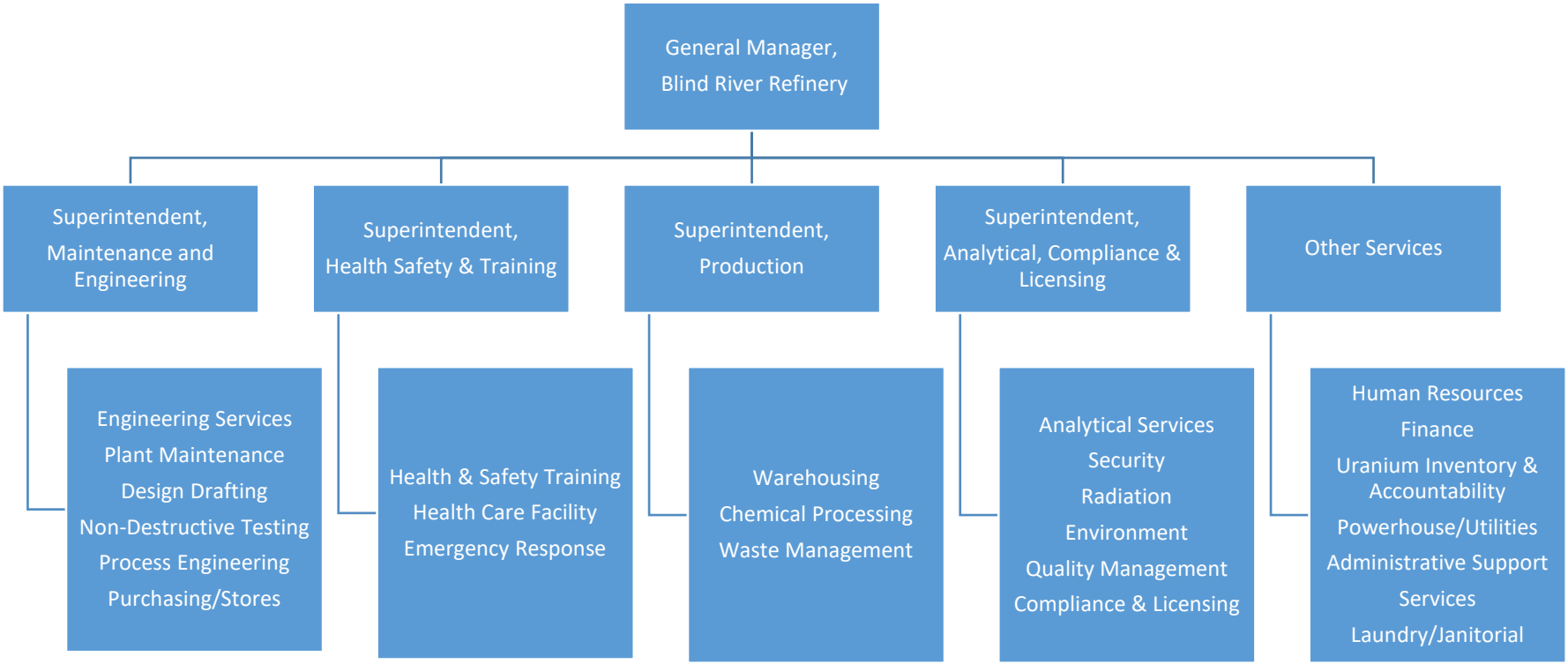
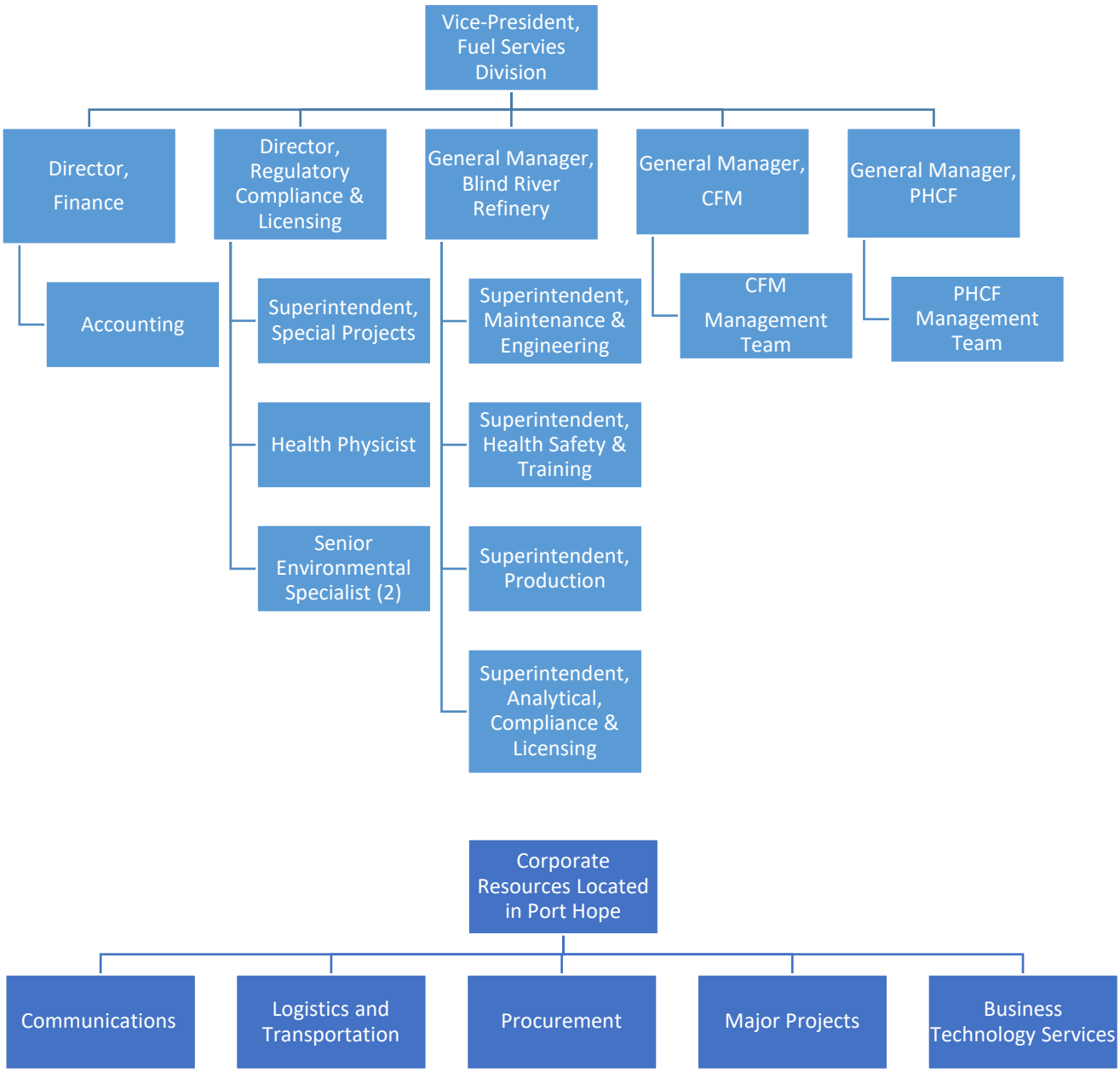


Figure 3 - Fuel Services Division and Corporate Support for BRR



3.1.2 Past Performance

Cameco is committed to the safe, clean and reliable operation of all of our facilities and continually strives to improve safety performance and processes to ensure the safety of both our workers and the people in neighbouring communities. The management system is the framework that guides the processes and programs required to ensure safety objectives are achieved, performance is monitored, and a healthy safety culture is maintained during production, maintenance, materials handling, waste management and other onsite activities. This includes, but is not limited to, requirements for work planning, change control, corrective action processes, document control, audits, and management review. The application of requirements under the management system is scaled according to the complexity and hazard potential of a particular activity.

Routine inspections by CNSC staff continue to confirm that BRR remains in compliance with these requirements. Findings made by CNSC inspectors and specialists are reviewed by BRR and are used to strengthen existing programs and controls to ensure safety, security and the environment are not compromised. BRR continued to strengthen its management system during the current licence period.

BRR uses audits to evaluate various aspects of site operations related to the licensed activities. The program requires an audit of compliance with all applicable federal and provincial environmental legislation at least once every three years. Results of all audits are reported in Cameco's Incident Reporting System (CIRS) to ensure findings, identified opportunities for improvement, and areas of concern are reviewed by site management and processed accordingly. There were no significant issues identified in audits completed during the current licence period.

BRR conducts annual management reviews of the site management system and all associated programs and performance to evaluate the effectiveness of the system and to identify opportunities for improvement. In the current licence period, BRR has made significant investment into site programs and related infrastructure and resources, including the following:

- Development and implementation of a Cameco laboratory information management system;
- Development and implementation of a Cameco document management system;
- Development and implementation of a Cameco radiation protection database;
- Implementation of operational reliability initiatives in the areas of materials management, work management and operations improvement. Through this program, a number of business processes have been developed, documented, and implemented. Key performance indicators have also been created and are routinely reported; and,
- Progressing a number of projects to reduce the volume of legacy wastes.

Further information will be provided in the relevant SCAs.

BRR has a mature change control program that ensures changes are assessed consistently and any proposed changes provide an equivalent or greater level of safety and are subjected to the same level of review and approval as was originally obtained to ensure the safety case for the facility is maintained. The change control process covers several areas: process layout(s), material design, regulatory, personnel, training and document change.

Cameco conducts safety culture assessments approximately every five years at all sites within the FSD. These assessments gauge the perception of employees in relation to safety culture in a scientifically meaningful way. The most recent assessment was carried out in 2018 and indicated that the employee group is engaged on safety issues and has a high degree of confidence and trust in site management. The BRR and FSD leadership teams are committed to enhancing a sustainable safety culture and will continue to work diligently to ensure that all employees remain engaged to the extent possible.

3.1.3 Future Plans

To continue to improve our management system, Cameco has committed to the full implementation of REGDOC 2.1.2 *Safety Culture* at the next scheduled safety culture assessment, which will be completed prior to June 1, 2022.

3.1.4 Challenges

As the regulatory framework continues to develop, changes in existing standards and regulatory documents as well as new standards and documents will require assessment, planning and implementation for any gaps identified. A challenge for all licensees will be prioritizing and/or reprioritizing the documents to be implemented as well as coordinating implementation of related regulatory requirements. Cameco will continue to work closely with CNSC staff to implement the standardized requirements under the regulatory framework in a manner that ensures operations remain safe, clean and reliable during any applicable implementation phase.

3.1.5 Requests

BRR has no requests at this time.

3.2 Human Performance Management

Human performance management addresses the activities that enable effective human performance through the development and implementation of processes that ensure there are sufficient workers in relevant areas who have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties.

3.2.1 Relevance and Management

The regulatory requirements for this SCA in the current licence period have primarily been focused on training. BRR's systematic approach to training applies a robust, risk-informed system to analyze and track training requirements and to develop and deliver appropriate training. This process covers initial training, routine re-qualification and re-qualification after an employee's extended absence.

BRR maintains processes to support human performance in its operations. Aspects of human performance have been considered in the development and continual improvement of site management system programs, work instructions, engineering and operations activities, change control and the corrective action process.

3.2.2 Past Performance

Over the current licence period, BRR has formalized and/or strengthened a variety of tools to develop and reinforce behaviours that support human performance. These tools are associated with the various programs and systems that support the quality management program. Additionally, at the corporate level, Cameco continues to develop and implement human performance tools in accordance with Cameco's continual improvement processes and in accordance with all proposed changes in CSA standards and/or REGDOCs developed for this SCA. Cameco actively participates in CSA standard development and responds to requests for comments during the development of the REGDOCS.

Various risk assessment tools are used as part of continual improvement, project design and implementation and change control to identify and control error-likely situations.

Work control tools are used to support strong worker performance. These include:

- Change Control Processes
- Work Instructions and Operating Documents
- Routine Operating Practices
- Operator care rounds, regular crew meetings, inspections and job task observations

These tools are intended to engage employees; promote awareness of operational status; correct issues; improve communication within and between crews; and drive consistent performance and behavior.

The worker training and qualification program is well established using a systematic approach to training, which is described in the site training plan and supporting documents. The BRR training program meets the requirements of REGDOC 2.2.2 *Personnel Training, Version 2*. Operation of the refinery requires both professional and non-professional workers for which on-the-job training is required. BRR continues to enhance the training program by addressing opportunities identified through routine audits and inspections.

BRR operates on a 24-hour basis, 365 days a year. In accordance with the requirements of Part II of the *Canada Labour Code*, BRR has defined maximum hours of work in a shift cycle for all employees onsite. In addition, to ensure qualified personnel are available to carry out licensed activities in a safe manner, minimum crew complement for UO_3 operations has been defined.

Cameco has a range of programs and procedures in place to address human resource matters and to ensure employees are fit for duty. These include programs or procedures addressing alcohol and substance abuse, violence in the workplace, respectful workplace, medical surveillance and radiation protection monitoring.

3.2.3 Future Plans

In the upcoming licence period, the development and implementation of human performance management tools will continue as CNSC staff develop and publish additional guidance through applicable REGDOCs and Cameco establishes its corporate framework to meet these requirements. BRR will review and incorporate the applicable aspects of a human performance management program as part of the CNSC regulatory framework improvements.

3.2.4 Challenges

Cameco will continue to improve human performance management across its operations and does not see any additional challenges in the implementation of this SCA.

3.2.5 Requests

BRR has no requests at this time.

3.3 Operating Performance

Under its current operating licence, BRR is required to have a program in place that ensures the safe operation of the facility. The Facility Licencing Manual (FLM) defines the programs in place at BRR to ensure ongoing performance is maintained and continuous improvement is achieved. This provides an overview of how licensed activities are performed and how supporting activities enable effective performance.

3.3.1 Relevance and Management

BRR has robust systems in place to ensure both the ongoing performance is maintained and continuous improvement is achieved as described within the FLM, management system and associated programs. The FLM describes how BRR operates within its licensing basis and documents the various programs that BRR maintains to ensure the facility is operated in a manner that supports safe, clean and reliable production while complying with applicable federal and provincial legislation. Many of these programs will be discussed in greater detail in other SCAs.

The FLM and associated programs establish safe, uniform and efficient operating practices and processes within the facility to ensure safety of the public, the environment, as well as the safety of the plant personnel and plant equipment. Ongoing operational performance and continual improvement is achieved using the "plan, do, check, act" model. Finally, operational reviews are held at all levels of the organization through production, leadership and management review meetings.

3.3.2 Past Performance

Throughout the current licence period, annual production targets were achieved for UO_3 operations. BRR continues to operate in a manner that supports safe, clean and reliable production in compliance with applicable legislation.

The management system and other program level documents have parameters that are monitored, measured and tracked to ensure the facility is operated as intended. Quarterly and annual compliance reports and a fire program review are being submitted to the CNSC as required by the LCH. The CNSC and other regulatory agencies have conducted inspections of the facility during the licence period, verifying compliance with applicable acts and regulations.

Cameco reports unplanned events as required by the *Nuclear Safety and Control Act* (NSCA), its regulations, REGDOC 3.1.2 *Reporting Requirements, Volume 1: Non-Power Reactor Class 1 Nuclear Facilities and Uranium Mines and Mills* and the licence conditions. During the licence period, 33 incidents related to transportation, plant operations, health and safety, radiation protection and environmental performance were promptly reported. The majority of the reported events were relatively minor in nature. BRR investigated each incident in accordance with Cameco's corrective action process and corrective actions taken as appropriate. As per the Public Disclosure Protocol for Ontario Operations, the following events are also posted to the FSD community website:

- Unusual operational events that may have off-site consequences or that would be of interest to our target audience;
- Environmental events that trigger a notification to the CNSC under Section 29 of the *General Nuclear Safety and Control Regulations* (GNSCR)*;* and,
- Summaries of non-routine environmental incidents that are required to be reported to the Ontario Spills Action Centre

There was one event reported to the Commission during the current licence period.

The event occurred in June 2012 and was presented to the Commission as an Event Initial Report (EIR). This event occurred when an employee attempted to open a drum of uranium concentrate that had become pressurized. The employee received a uranium uptake as a result. The employee was placed on restricted status but eventually was able to return to work. Cameco conducted a full investigation into this event and implemented a number of corrective actions, including informing all of the uranium producers about

the event, so they could review their uranium concentrate processing and packing procedures. A full report on the incident was prepared and submitted to CNSC staff.

Noteworthy accomplishments during the current licence period include:

- Implementation of the systematic approach to training;
- Achieving full compliance with REGDOC 2.2.2;
- An Environmental Risk Assessment (ERA) completed in accordance with the requirements of CSA N288.6-12 *Environmental risk assessment at class I nuclear facilities and uranium mines and mill*;
- A DRL assessment completed in accordance with the requirements of CSA N288.1-14 (Derived Release Limit);
- Implementation of an Operational Reliability program;
- Installation of a berm around the refinery to mitigate risks due to flooding;
- Installation of whole body monitors at the refinery entrance; and,
- Going the entire licensing period without a lost time accident. BRR reached 15 years without a lost time accident in June 2021.

3.3.3 Future Plans

In line with Cameco's focus on continual improvement, BRR will continue to improve the performance of its operations. To achieve this, BRR develops budget plans based on the FSD strategic plan. The strategic plan and budget set the priorities and direction for the division and site for the coming years ensuring the operations achieve safe, clean and reliable production.

3.3.4 Challenges

Cameco does not have any specific challenges associated with this SCA.

3.3.5 Requests

BRR has no requests at this time.

3.4 Safety Analysis

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 preventative measures and strategies in reducing the effects of such hazards.

3.4.1 Relevance and Management

BRR has a safety analysis report (SAR) that summarizes the systematic review of site operations to identify and assess hazards and potential risks to the public and

environment from the refinery. A hazards and operability (HAZOP) methodology was used to systematically assess risk and safety measures in all areas of the facility. The SAR incorporates all HAZOP assessments as well as more recent changes assessed through the design control process and an analysis of the probable worst-case release event. The 2020 version of the SAR incorporated information from other supporting studies of the facility to better align with the guidance provided in the International Atomic Energy Agency (IAEA) standard SSR-4 *Safety of Nuclear Fuel Cycle Facilities*.

Additional risk analyses maintained for the facility under federal or provincial regulatory requirements include:

- A site-specific spill prevention and contingency plan under Ontario Regulation 224/07;
- An environmental aspects registry to meet the requirements of ISO 14001:2015 *Environmental Management System Standard*;
- A fire hazards analysis (FHA) that meets the requirements of CSA N393-13 *Fire protection for facilities that process, handle or store nuclear substances*;
- An ERA completed in accordance with the requirements of CSA N288.6-12 *Environmental Risk Assessment*. The ERA is used to ensure the adequacy of the monitoring program; and
- A DRL assessment completed in accordance with the requirements of CSA N288.1-14 *Derived Release Limit*.

These assessments provide additional analysis specific to the respective SCAs and support the conclusions of the Safety Report that the facility is operated in a manner that is protective of people and the environment.

3.4.2 Past Performance

Safety analyses for the facility are reviewed at least every five years to ensure changes to the facility, recommendations from CNSC staff, industry best practices, new scientific literature, recent operating experience and/or new or updated regulatory documents and standards are incorporated to enhance the robustness of the analysis. During the current licence period, the SAR was updated and submitted to CNSC staff in 2012, 2016 and 2020. Other risk assessments are periodically reviewed and updated on the frequency prescribed in their respective standards or REGDOCs.

In 2015 a berm was installed around the facility, outside the perimeter fence, to mitigate any potential risks from flooding.

3.4.3 Future Plans

REGDOC 2.4.4 *Safety Analysis for Class 1B Facilities* is expected to be published in the next licence period. There is an established process for review of new standards and REGDOCs and their incorporation as Compliance Verification Criteria (CVC) or as

guidance in the LCH. As per the process, BRR will identify and address any gaps in the facility safety analysis on a schedule accepted by CNSC staff.

3.4.4 Challenges

Cameco does not have any specific challenges associated with this SCA.

3.4.5 Requests

BRR is not requesting any changes at this time.

3.5 Physical Design

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

3.5.1 Relevance and Management

BRR maintains a program for physical design as described in the FLM. BRR contains numerous types of conventional industrial equipment including storage tanks, conveyors and associated piping, as well as specialized equipment for the uranium refining processes. The plant equipment is designed, installed, operated and modified with materials suitable for the service and hazards of each area. The aspects of the physical design program are as follows:

- Facility and process changes – All changes to the physical design of equipment, processes and the facility are evaluated from project planning to the completion of the project through the design control procedure described in the management system. The design control process identifies impacts and potential impacts to the environment and health and safety. It also triggers review by appropriate subject matter experts and process or area owners to ensure all applicable codes and legal requirements are observed. For some changes, third party review and/or CNSC notification is also required.
- Third party review for fire protection – Modifications for which the initial assessment indicates a potential impact on fire protection design basis, goals, or criteria are subject to a qualified third-party review as per CSA N393-13 (R2018). All third-party reviews are conducted by qualified personnel from organizations whose management and financial operations are independent of the design organization. As required by the licence and LCH, all third-party reviews are submitted to CNSC staff.
- Pressure boundary program – This program meets the requirements of CSA B51-14 *Boiler, pressure vessel and pressure piping code*, and establishes the infrastructure and defines the activities necessary to maintain a sustainable process that allows BRR

to perform activities associated with repairs, replacements, modifications and alternations to pressure retaining items, components, and systems including installation of new systems. As required by the Licence, BRR maintains an agreement with an Authorized Inspection Agency (AIA) for the registration, inspection and other activities related to pressure systems.

As part of Cameco's budgeting process, plant improvements related to physical design are identified and prioritized so that capital expenditures for these improvements can be budgeted.

3.5.2 Past Performance

During the current licence period, BRR made many improvements to the process and design change control procedure to address weaknesses identified in audits and inspections. These included improved document control and traceability of design changes, enhanced review by additional subject matter experts and better alignment with the FLM and corrective action processes.

The quality control manual for the Technical Standards and Safety Authority (TSSA) certificate of authorization governs the shop fabrication, field installation, assembly, repairs, and erection of piping systems in accordance with the applicable boiler, pressure vessel, pressure piping and mechanical refrigeration codes as well as repairs and alterations of boilers and pressure vessels, piping and fittings in accordance with the applicable codes. The quality control manual was most recently updated in April 2021.

BRR maintained its authorized inspection agency agreement with TSSA during the current licence period. The agreement is renewed periodically and was last renewed in 2019 for a three-year period. This agreement ensures oversight of pressure retaining components and systems continues to be carried out by a third-party expert. As part of this process, BRR uses non-destructive examination techniques to assess the integrity of pressure vessels and related systems. These examinations are primarily done in-house by qualified staff, though qualified third-party experts are used when necessary.

Within the pressure boundary program, BRR maintains Certificates of Authorization with the TSSA to confirm the quality program for pressure systems is in accordance with the applicable acts, regulations and standards.

BRRF has recently implemented the most updated version of the standard, CSA B51-19 *Boiler, pressure vessel and pressure piping code*.

3.5.3 Future Plans

In line with Cameco's focus on continual improvement, BRR will continue to improve the performance of its operations in this SCA.

3.5.4 Challenges

Cameco does not have any specific challenges associated with this SCA.

3.5.5 Requests

BRR has no requests at this time.

3.6 Fitness for Service

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

3.6.1 Relevance and Management

BRR has programs and procedures that ensure the facility is operated in a safe, clean and reliable manner. These programs and procedures address the following areas that comprise this SCA: a preventative maintenance program (PM), an in-service inspection program, an operational reliability program and other testing and review systems.

BRR has an established PM program as defined in the site PM plan. All PM tasks are initiated and documented through the work notification functions of the corporate-wide enterprise application software for asset management, maintenance management, accounting and purchasing functions. PM plans are issued, reviewed and updated periodically to ensure the PM routines continue to be effective and adequate. Key performance indicators (KPI) are in place to monitor the effectiveness of the program.

BRR has an in-service inspection program, which applies to both registered and non-registered piping and vessels, including those related to safety significant systems. Technicians performing radiographic, ultrasonic, magnetic particle and liquid penetrant inspections are certified in accordance with the Canadian General Standards Board. Test methods have been selected based on historical operating records and equipment inspections, which are the best indicators for detecting potential problems and for revealing the type of deterioration most likely to occur as a result of the service conditions to which the equipment is subjected.

Early in this licencing period, Cameco implemented an Operational Reliability program to detect early warning signs of aging infrastructure and to prescribe rehabilitation programs or pro-active replacement strategies. The refinery improved its performance under this program from an emerging program to a proactive program based on a 3-year assessment. The program is evaluated by the same means as the overall maintenance program and is considered to be effective.

Fire protection systems are tested according to an established schedule developed using the National Building Code and the National Fire Code. Reviews of aspect of the fire protection systems are completed as required by CSA N393-13 (R2018) *Fire protection for facilities that process, handle, or store nuclear substances.*

Several methods are used to ensure equipment is functioning within design specifications:

- Process monitoring through product and intermediate quality control testing (such as chemical analysis);
- Monitoring of environmental systems (i.e., conductivity probes in cooling water to detect leaks, in-plant continuous air monitors for uranium and real-time stack monitoring for oxides of nitrogen; and,
- Operator and specialist (i.e., health and safety officer and radiation safety officer) inspections.

3.6.2 Past Performance

BRR tracks KPIs to monitor the effectiveness of these programs. Overall, the KPIs reflect strong performance with improvements to the site uptime availability and overall equipment effectiveness, improvements in preventive maintenance schedule compliance and a decrease in the amount of reactive maintenance work. Detailed information on KPIs is considered proprietary and are not made publicly available.

BRR conducted in-house and third-party testing for fire protection systems, as required, in the licence period. All fire inspection reports are entered into CIRS so that corrective actions can be identified and tracked to completion.

3.6.3 Future Plans

BRR plans to make improvements to this SCA through the Operational Reliability Program and recommendations developed during management review of KPIs.

3.6.4 Challenges

No additional challenges for this SCA.

3.6.5 Requests

BRR has no requests at this time.

3.7 Radiation Protection

Radiation protection covers the implementation of a Radiation Protection Program (RPP) in accordance with the *Radiation Protection Regulations*. This program must ensure contamination and radiation doses received are monitored and controlled.

3.7.1 Relevance and Management

BRR has an extensive RPP in place to meet the requirements of the *Radiation Protection Regulations.* The RPP describes the controls to ensure the facility operates in a safe, clean and reliable manner and is protective of employee and public health. It also keeps radiation exposures as low as reasonably achievable, social and economic factors taken into account (ALARA).

The RPP documents the radiological hazards found at the facility and the controls in place to manage these hazards and ensure dose to workers and the public remains ALARA. The controls and programs for worker and public protection include:

- External dosimetry – personal monitoring;
- Internal dosimetry – urine analysis and lung counting programs;
- Radioactive contamination control;
- Radioactive waste handling;
- Radioisotope control;
- ALARA program;
- Radiation protection training;
- Respiratory protection program; and
- Radiation exposure control and monitoring.

Performance of the RPP is assessed through annual target setting, the internal audit program and annually during management review.

3.7.2 Past Performance

During the current licence period, BRR has not exceeded any CNSC limits with respect to radiation protection. Though the RPP has been demonstrated to be effective, BRR has also made improvements to aspects of the program as part of its continual improvement program:

- An ALARA committee was formed with representation from both employees and management to look at ways of reducing employee exposure;
- Continuous air monitoring systems were installed in key processing areas;
- An enterprise-wide database to house all health physics data was implemented across Cameco sites;
- The DRL was updated and accepted by CNSC staff; and
- Improvements to the RPP and associated procedures were made throughout the licensing term to address changes at the facility, audit and inspection findings or other opportunities for improvement.

In September 2012, the CNSC issued an Order to BRR with respect to the handling and storage of uranium concentrate received from Uranium One's Willow Creek operation in the United States. Cameco complied with the Order, which was closed by the CNSC on

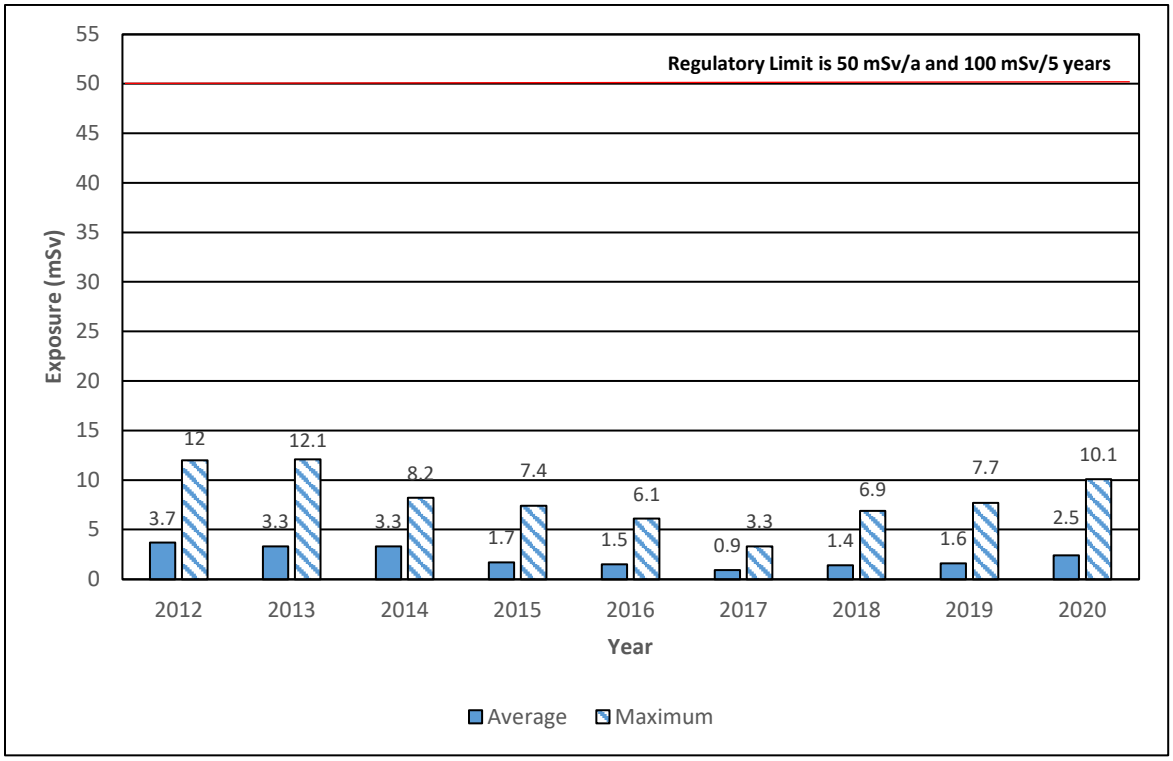
October 29, 2012. The Order was tied to an incident involving a pressurized drum of uranium concentrate that resulted in an employee receiving an update of uranium.

There were fifteen reported radiation protection action levels exceeded during the current licence period. Twelve of these occurred in the 2012-2014 period. Four were for exceeding the monthly whole body exposure action level, one for exceeding the quarterly whole body exposure action level, six for exceeding the monthly skin exposure action level and one was related to an elevated uranium in urine result. Investigations were conducted for all events and corrective actions taken as appropriate.

Since 2014 there have only been three reported action level exceedances (2017, 2019 and 2020) and these were related to either a whole body or skin dose result. In each case however, the investigation revealed that the reported exposure was non-personal in nature and the CNSC accepted Cameco's proposed dose adjustment for the individual.

Figures 4 through 9 summarize employee and public exposure results over the current licence period, through the end of 2020. These results show BRR's RPP and associated procedures are effective at controlling the dose to employees and the public.

Figure 4 – Effective Dose to Workers for the Licence Period

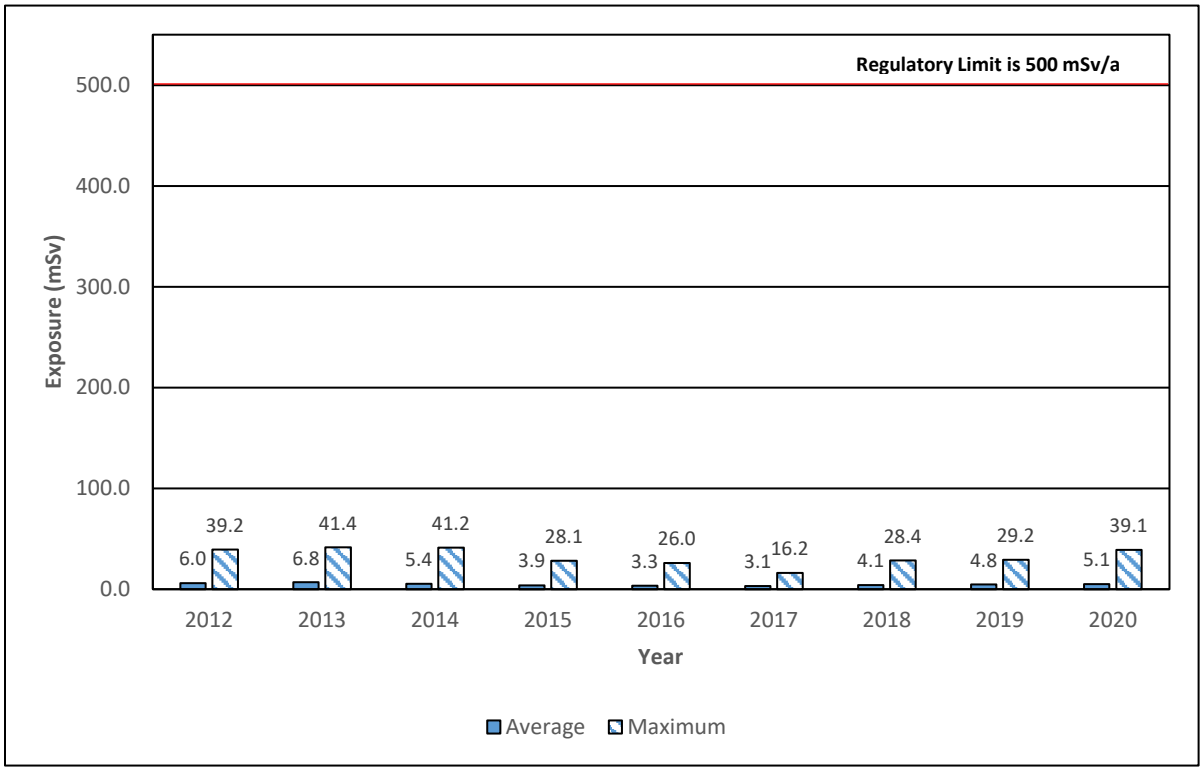


The total effective dose consists of three components: external whole body dose, internal dose to the lung and internal dose to the kidney. Based on how the internal dosimetry

program for lung counting is set up, the total effective dose for workers for 2021 cannot be calculated until after the first campaign of lung counting in 2022. The annual effective dose to Nuclear Energy Workers (NEWs) remains well below the regulatory limit. The highest annual individual effective dose to an employee over the licence period from 2012 – 2020 was 12.1 mSv, which is 24% of the regulatory limit.

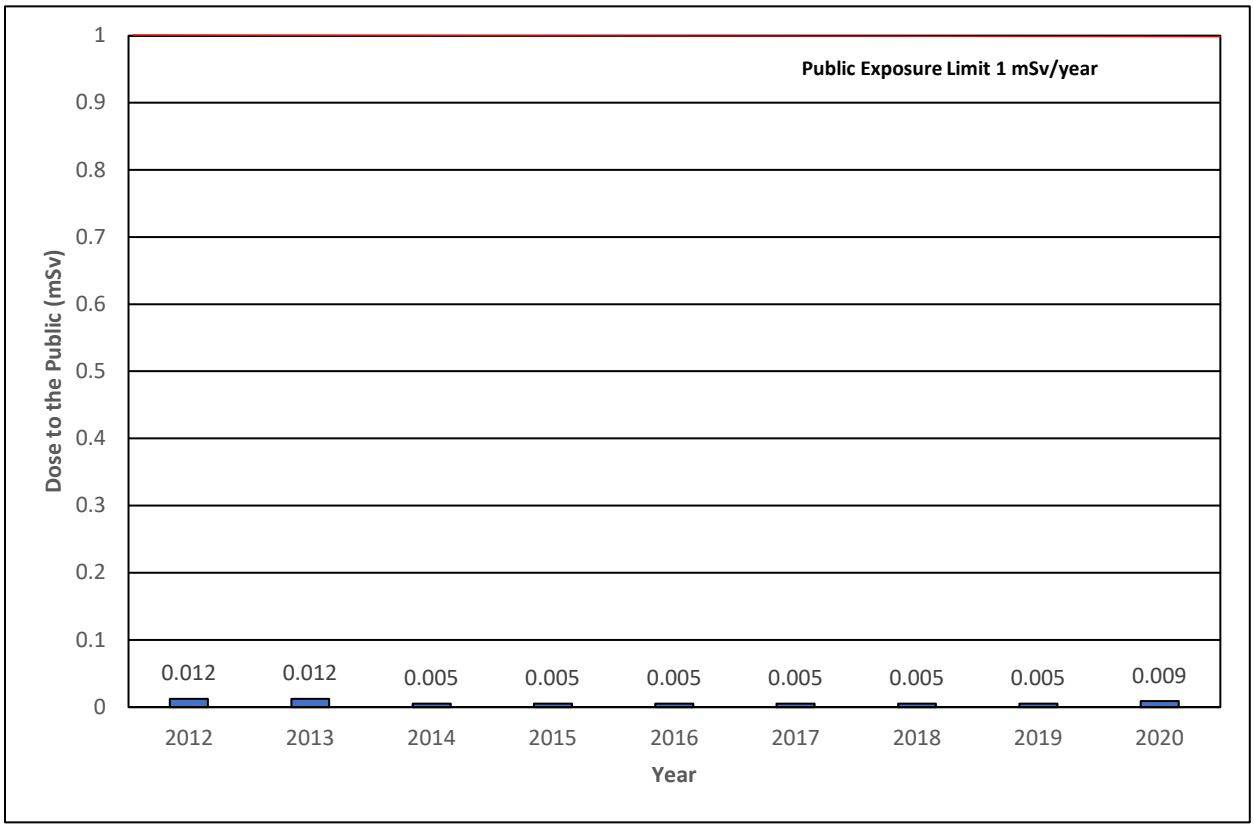
There is also a five-year regulatory limit of 100 mSv established in the *Radiation Protection Regulations*, which applies to unique five-year periods of time. The periods relevant to the current licence period are from January 1, 2011 to December 31, 2015 and from January 1, 2016 to December 31, 2020. For the first five-year period, the maximum total effective dose for an individual was 41.0 mSv. For the second five-year period, starting January 1, 2016, the maximum total effective dose was 31.7 mSv. Total effective dose information for 2021 is not yet available.

Figure 5 – External Skin Dose to Workers for Licence Period



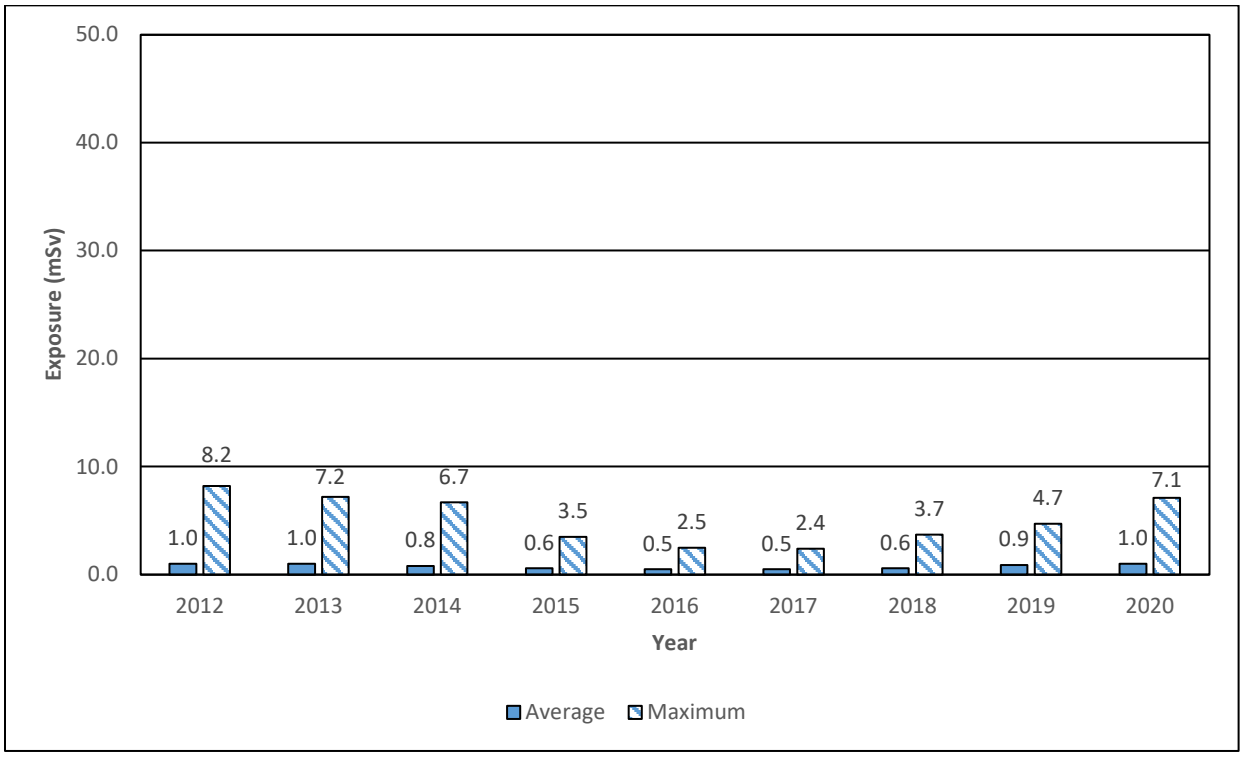
The highest annual skin dose recorded in the current licence period was 41.4 mSv, which is approximately 8% of the regulatory dose limit. The data show that the RPP is maintaining skin doses to workers ALARA.

Figure 6 – Dose to the Public for Licence Period



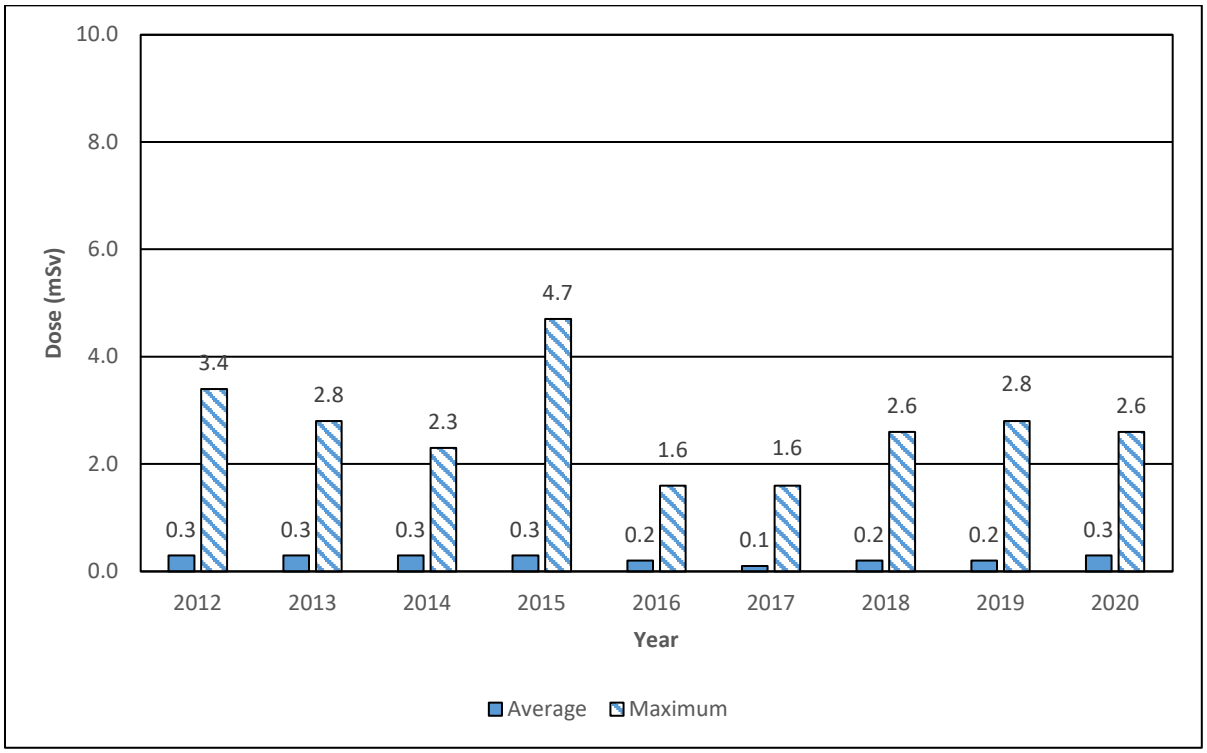
The dose to the public from BRR is calculated from the DRL for the facility and is based on three components: dose to the public from air emissions, dose from water discharges and dose from gamma radiation. For the refinery, dose to the public from air and water emissions is a small fraction of the public dose limit, typically <0.001 mSv for each component. Therefore, the gamma component represents virtually all the estimated public dose. As can been seen from Figure 6, the dose to the public is typically below 1% of the public dose limit and in fact has not exceeded 1% since 2013.

Figure 7 – Effective Dose Component – External Whole Body Dose to Workers



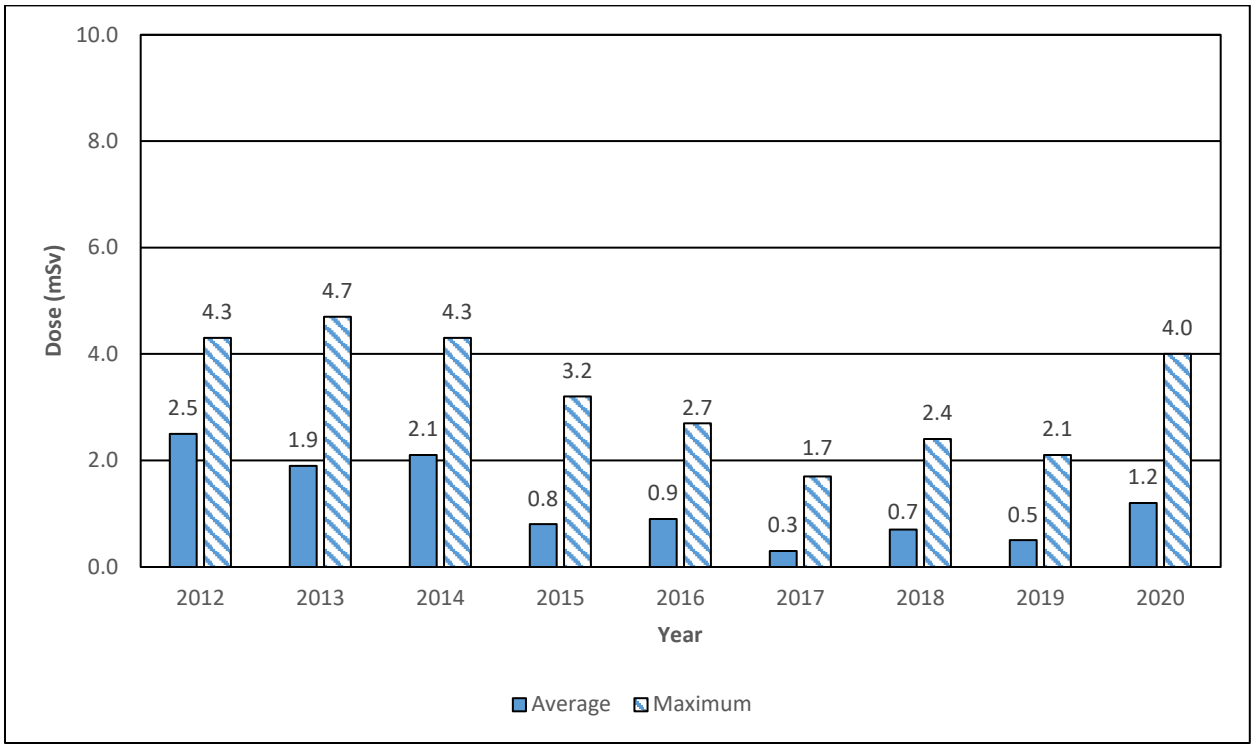
The average annual whole body dose for NEWs did not exceed 1.0 mSv at any time during the current licensing period. Managing external exposure dose at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

Figure 8 – Effective Dose Component – Internal Whole Body Dose (Urine Analysis)



The average individual internal dose based on urine analysis did not exceed 0.3 mSv at any time during the current licensing period. Managing external exposure dose at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

Figure 9 – Effective Dose Component
– Internal Whole Body Dose (Lung Count) to workers



As part of the licensed internal dosimetry program, Cameco employs the use of a lung counter to monitor and assess uranium exposure in the lungs of NEWs working at BRR. The average annual internal dose based on lung counting remained at or below 2.5 mSv throughout the licensing period. Managing the internal dose component from lung counting at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

Cameco's audit program includes audits of the BRR RPP at least once every three years. An independent third-party also conducts annual audits of the FSD internal dosimetry program. In the licence period, no significant issues were identified during these audits, opportunities for improvement and minor findings were investigated with appropriate action taken and documented in CIRS.

3.7.3 Future Plans

The site RPP is mature and enables BRR to keep radiation exposures ALARA. The current dose levels are at the point where it becomes increasingly difficult to achieve further reductions in a meaningful and cost-effective manner.

BRR will continue to enhance the program through physical, procedural and monitoring improvements as identified by the ALARA Committee, the audit and corrective action processes, and new regulatory requirements.

3.7.4 Challenges

No additional challenges for this SCA.

3.7.5 Requests

BRR has no requests at this time.

3.8 Conventional Health and Safety

Conventional health and safety SCA covers the implementation of a program to manage workplace safety hazards and to protect personnel and equipment.

3.8.1 Relevance and Management

A key element of a safe, clean and reliable operation is a comprehensive and well-established worker protection program, which is in place at BRR. The regulations made pursuant to the NSCA and Part II of the *Canada Labour Code* prescribe specific health and safety requirements that are met by BRR. In addition, Cameco's safety, health, environment and quality policy and corporate health and safety program provide direction for site programs and procedures. Cameco has five key principles that form the framework of how safety is managed. These are:

- Safety is our first priority;
- We are all accountable for safety;
- Safety is part of everything that we do;
- Safety leadership is critical to Cameco; and
- We are a learning organization.

The health and safety of workers at BRR is assured through a site-specific safety and health management program. Key components of the program include:

- Compliance with all safety and health-related legal and regulatory requirements;
- Setting site safety and health objectives;
- Implementation of corporate safety standards;
- Development and maintenance of a formal hazard recognition, a risk assessment and a change control process; and
- Documenting health and safety significant incidents in CIRS from the start through to the verification of completion of corrective actions.

The requirements to have both a policy and workplace health and safety committee under Part II of the *Canada Labour Code* are met by the Facility Health and Safety Committee

(FHSC). The FHSC has representatives from both management and the employee group. The committee participates in the implementation and monitoring of the occupational health and safety programs.

3.8.2 Past Performance

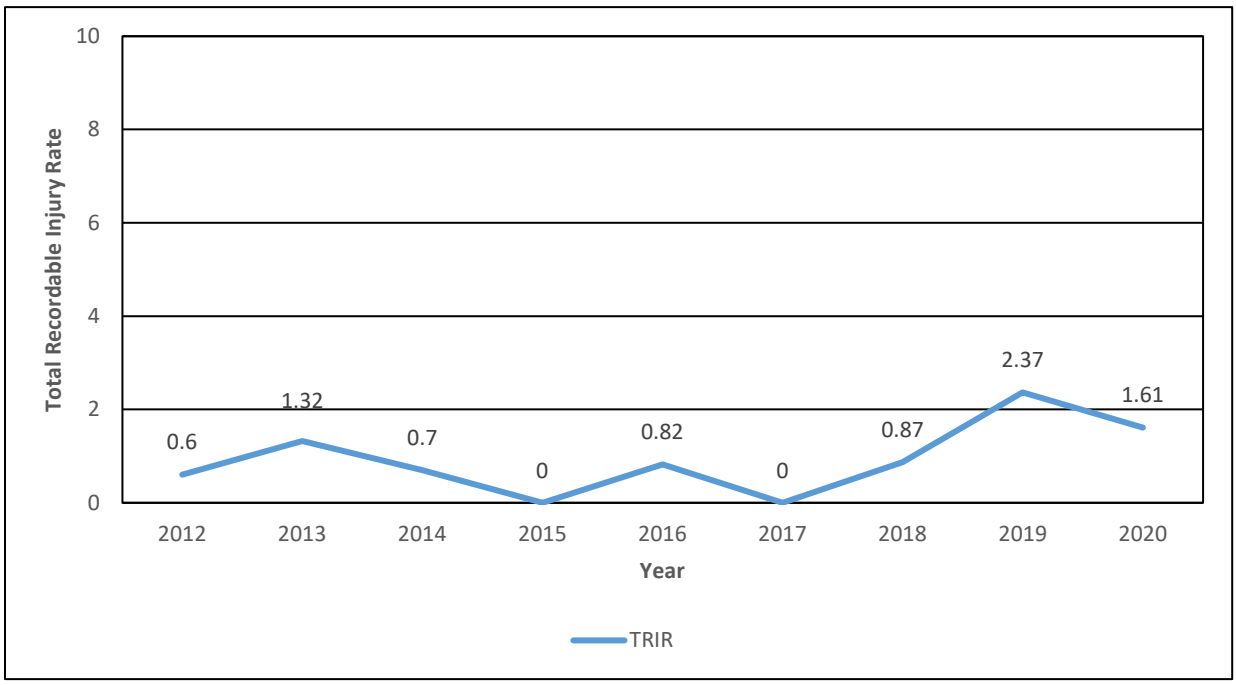
Table 1 and Figure 10 summarize the site safety performance during the current licence period. BRR has had no lost time injuries during the current licencing period and achieved 15 years without a lost time accident in June 2021. This is the second time in the refinery's history it has gone more than 10 consecutive years without a lost time accident.

Total recordable injury rate (TRIR) is a tool to measure the frequency of less severe injuries in the workplace – specifically the number of injuries requiring medical treatment or restricted work per 100 employees per year. This gives a number that can compare safety performance year to year – the lower the TRIR the better the safety performance. BRR's TRIR does show some variance from year-to-year but remains quite low overall.

Table 1 – Lost Time Injuries

Year / Parameter	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lost Time Injuries	0	0	0	0	0	0	0	0	0

Figure 10 – Total Recordable Injury Rate



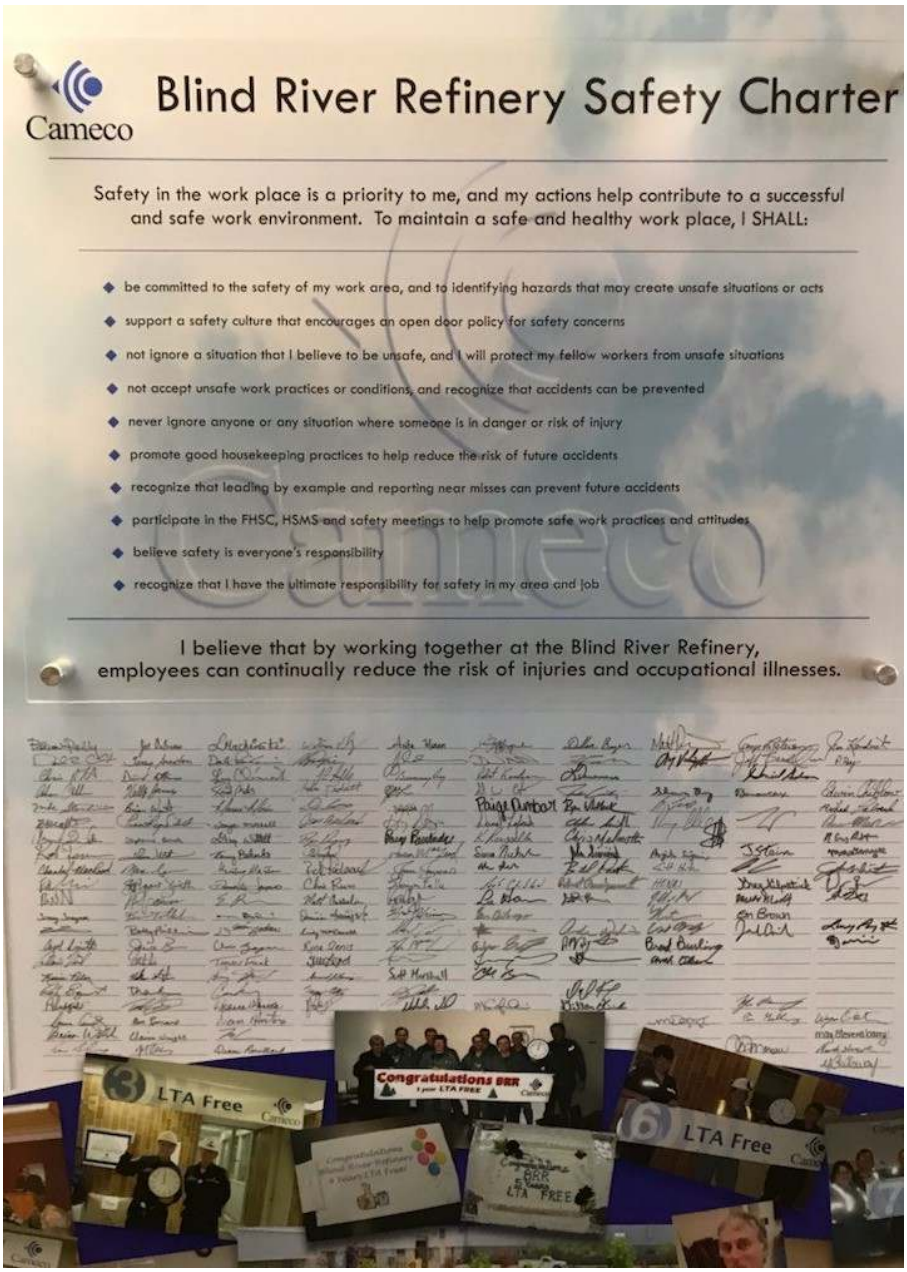
Other activities to support improved safety performance in the licence period include:

- Prompt investigation into all safety-related incidents, documenting all investigations and corrective actions in CIRS;
- Continued use of BRR's Safety Charter by the employees for all employees as shown in Figure 11. This expresses BRR employee's collective sense of safety values and direction and our general commitments to health and safety. It is a cornerstone for health and safety planning and permeates our work ethic on site and – ideally – at home as well;
- Implementation of various corporate safety standards, including ones for control of hazardous energy (lock-out/tag-out), confined space, hoisting and rigging, safeguarding of machines, tire and rim safety and fall protection;
- BRR was recognized for its 2015 and 2017 safety performance with the corporate Mary-Jean Mitchell Green Safety Award presented annually to a Cameco site in recognition of its safety performance. BRR has now won this company award a Cameco-record nine times; and,
- Completion of corporate safety culture assessments in 2013 and 2018, which reaffirmed the refinery's strong commitment to safety.

BRR employees have demonstrated that they can work safely in any environment, if they have the right training, proper personal protective equipment and, most importantly, the right attitude.

Cameco's audit program includes audits of the BRR health and safety program at least once every three years. In the licence period, no significant issues were identified during these audits, opportunities for improvement and minor findings were investigated with appropriate action taken and documented in CIRS.

Figure 11 – Safety Charter at BRR Main Entrance



3.8.3 Future Plans

BRR will continue to implement new corporate safety standards as well as maintain and enhance its safety program where opportunities are identified during the upcoming licence period. We continue to strive for zero injuries throughout our operation.

3.8.4 Challenges

This SCA is a challenging area because it requires continual oversight and legislation, best practices, and safety technology is ever changing and improving. Maintaining high safety standards and a high degree of employee awareness of safety is always a challenge at any industrial operation. Until there are no injuries to any employees on the job, there will always be a need to strive for improvement. BRR is committed to maintaining a high level of safety performance and is always looking at ways to continually improve all aspects of our operation, including in the area of health and safety.

3.8.5 Requests

BRR has no requests at this time.

3.9 Environmental Protection

Environmental protection covers programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as a result of licensed activities.

3.9.1 Relevance and Management

BRR maintains an appropriate environmental protection program (EPP) that meets the requirements of the ISO14001 standard and Cameco's corporate requirements. Environmental protection is regulated by both federal and provincial regulatory authorities at BRR. Requisite provincial approvals are in place for the various discharges from the facility. BRR monitors air and liquid discharges to ensure they meet applicable provincial and federal requirements. The documents that comprise the EPP identify all emissions to the air, water and land, the programs that are in place to monitor them, what is measured, the legal requirements and the reporting requirements.

Air emissions monitoring consists of source and ambient monitoring. Uranium emissions from the two process stacks, the DCEV and Absorber, as well as the incinerator stack, are sampled continuously during operations using a TSI sampler. The Absorber stack is also continuously sampled for oxides of nitrogen (NOx) using an on-line analyzer. Additional monitoring from the incinerator stack as required by the Environmental Compliance Approval (ECA) includes continuous emissions monitoring for oxygen, carbon monoxide and nitrogen oxides.

The ambient air program has been established to measure the quality of the air surrounding the facility using high volume samplers (uranium). This is used to support BRR operations in the event of an upset condition, to support validation of existing air dispersion models and for periodic review of the ERA.

Liquid effluent from the process and powerhouse, as well as treated effluent from the onsite sewage treatment plant (STP) is collected and transferred to a lagoon system on

site. There is also a stormwater collection lagoon to collect surface water run-off from the paved areas on site. Once the liquid effluent has been monitored and deemed to meet release criteria, the water from the lagoon system is discharged to the north channel of Lake Huron via an outfall pipe and diffuser. The diffuser is designed to ensure a minimum 100-fold dilution at the point of entry into the lake. Effluent pumped to the lake is sampled as it is discharging by a flow proportional sampler.

In 2015, a Plume Modelling, Delineation and Sediment Study was carried out which confirmed the effectiveness of the liquid effluent outfall diffuser in Lake Huron and also confirmed that there is no adverse impact on sediment concentrations in the Lake as a result of refinery operations.

The ambient water quality program is intended to collect data to monitor the impact of the aqueous discharges into offsite receiving waters. In addition to surface water sampling, there are also 35 borehole locations, both inside and outside of the perimeter fence line, used for groundwater sampling.

3.9.2 Past Performance

BRR environmental performance during the current licence period has been provided in the compliance reports submitted to the CNSC.

Source Monitoring

In 2012, BRR received both a site-wide comprehensive amended ECA and an amended ECA specific to the incinerator. These are the most recent changes with respect to provincial approvals.

The results from the air emissions monitoring are set out in Figures 12 through 16. The current licence limit, as well as any current action level, if one exists, is shown in each figure. The data shows that air emission discharges continue to be well below the emissions limits. There have been no action levels or licence limits exceeded during the current licensing period.

Figure 12 – DCEV Stack Uranium Emissions

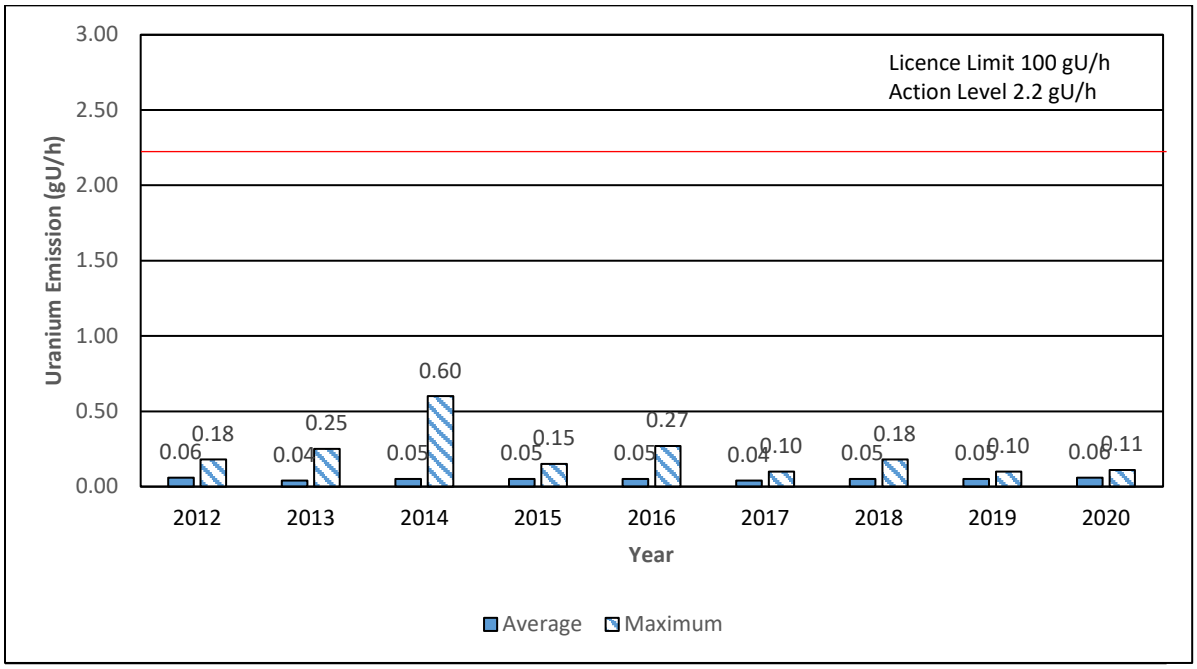


Figure 13 – Absorber Stack Uranium Emissions

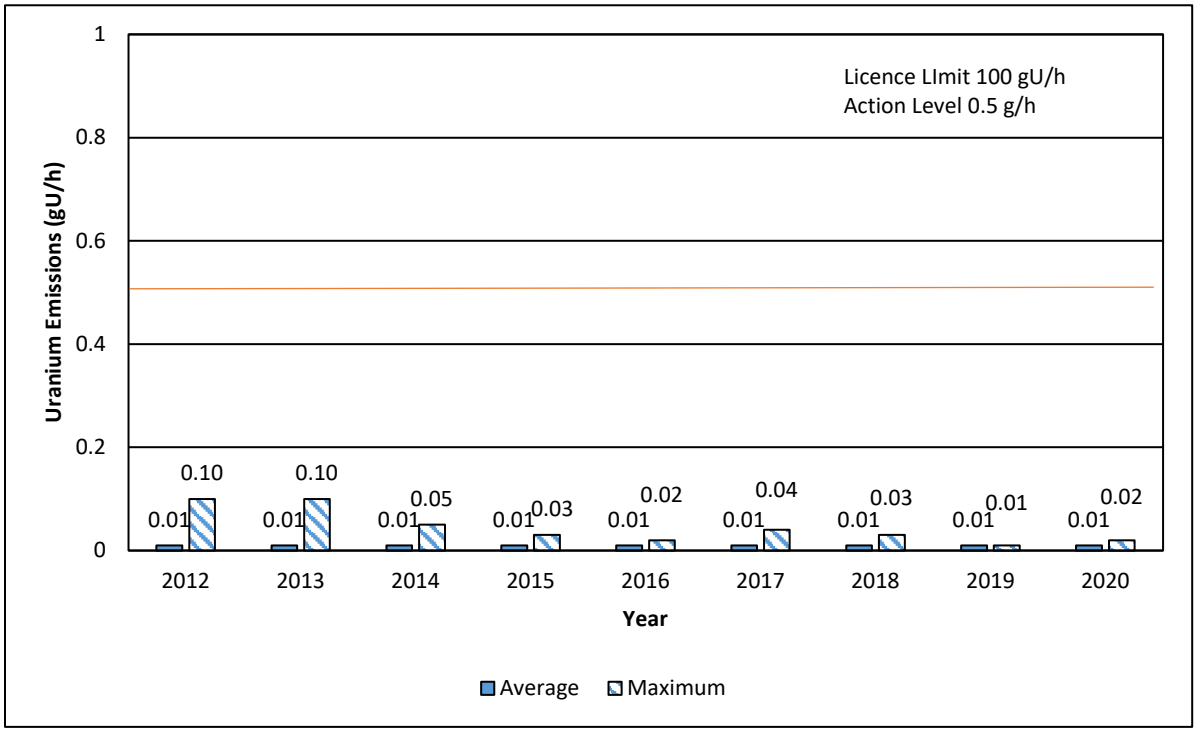


Figure 14 – Incinerator Stack Uranium Emissions

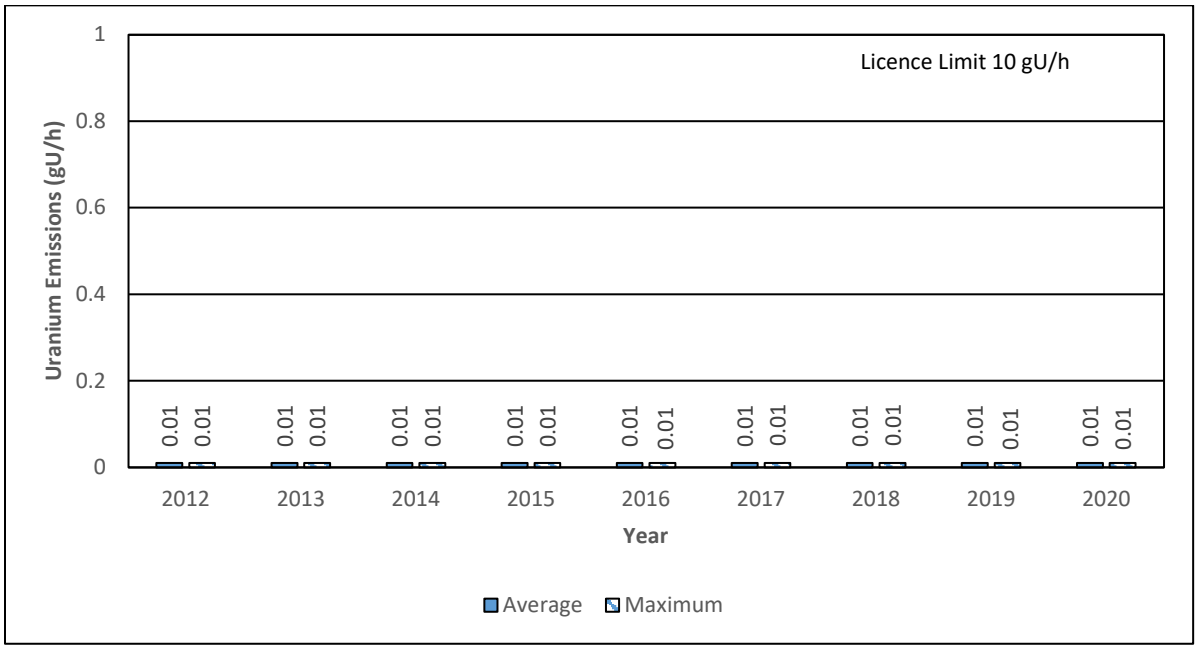


Figure 15 – Absorber Stack Nitrogen Oxides Emissions

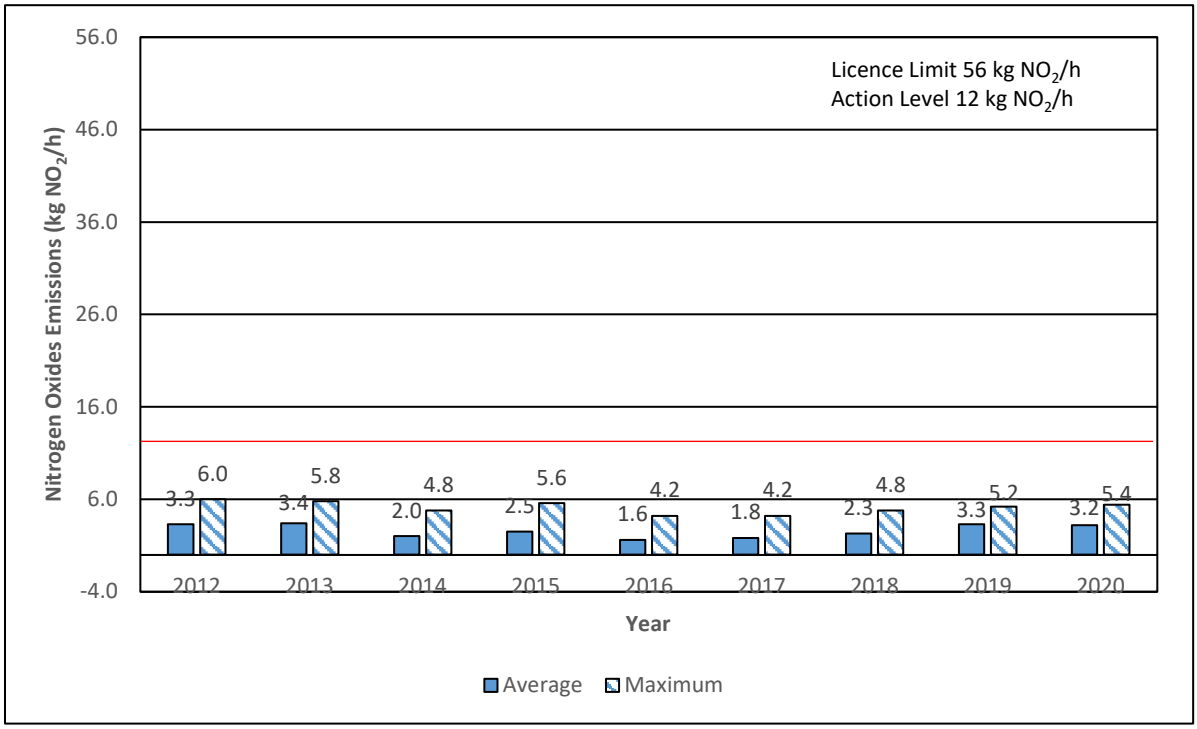
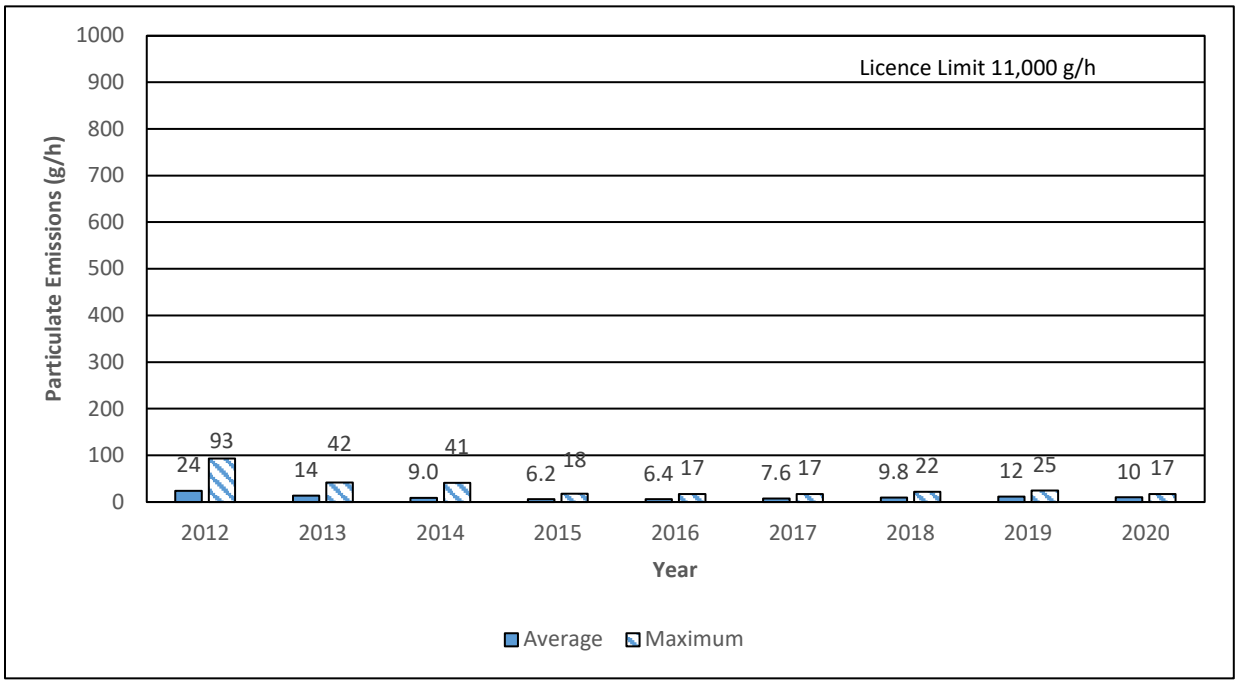


Figure 16 – Combined Stack Particulate Emissions



Ambient Monitoring

The ambient air monitoring and terrestrial monitoring programs supported the stack monitoring program with results being a small fraction of the applicable federal and/or provincial objectives, guidelines and criteria as illustrated in Figures 17 through 19.

Figure 17 – Ambient Air Quality (Uranium)
as Measured by Hi-Volume Samplers 2012 - 2015

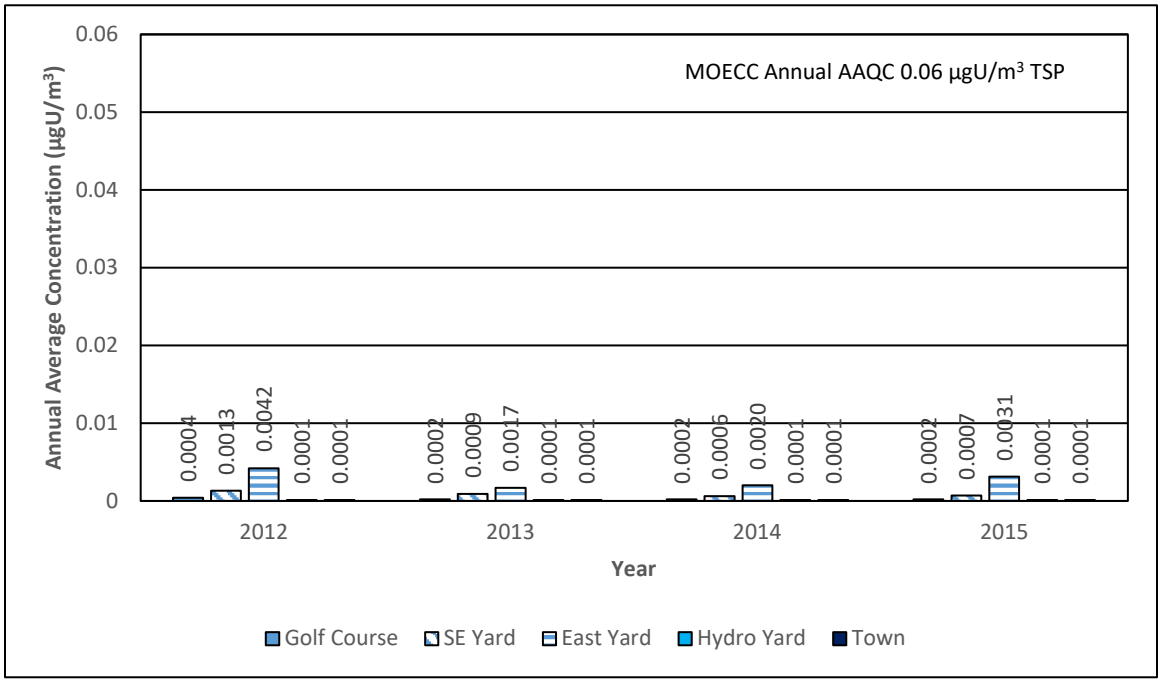


Figure 18 – Ambient Air Quality (Uranium)
as Measured by Hi-Volume Samplers 2016 – 2020

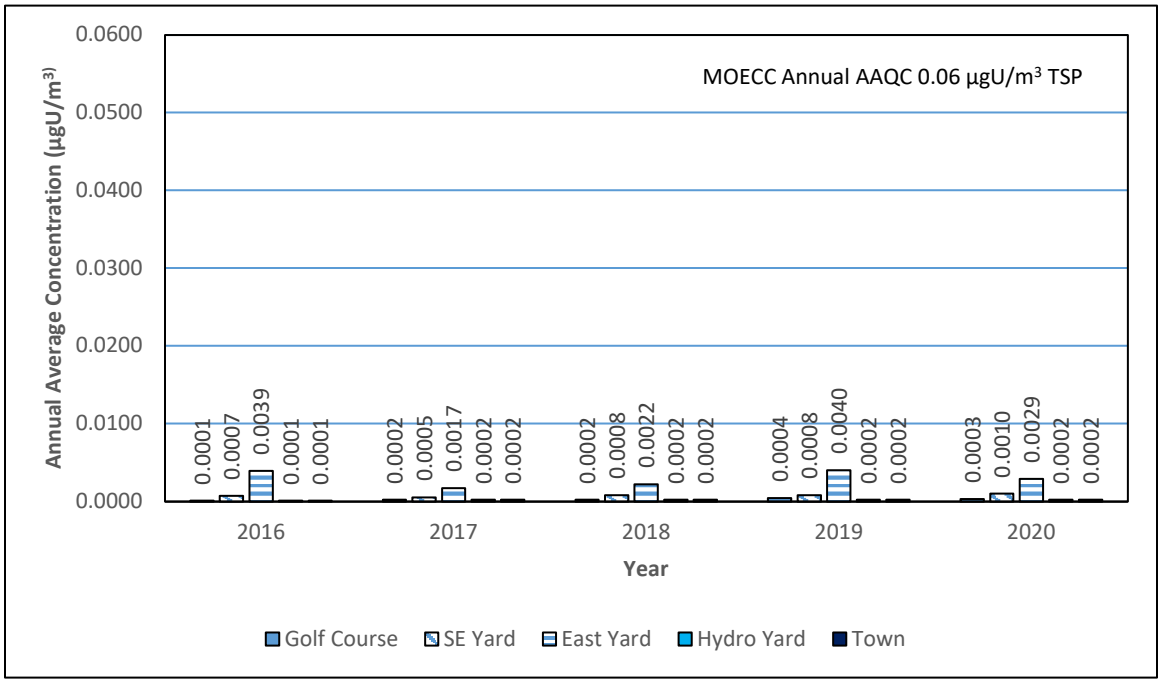
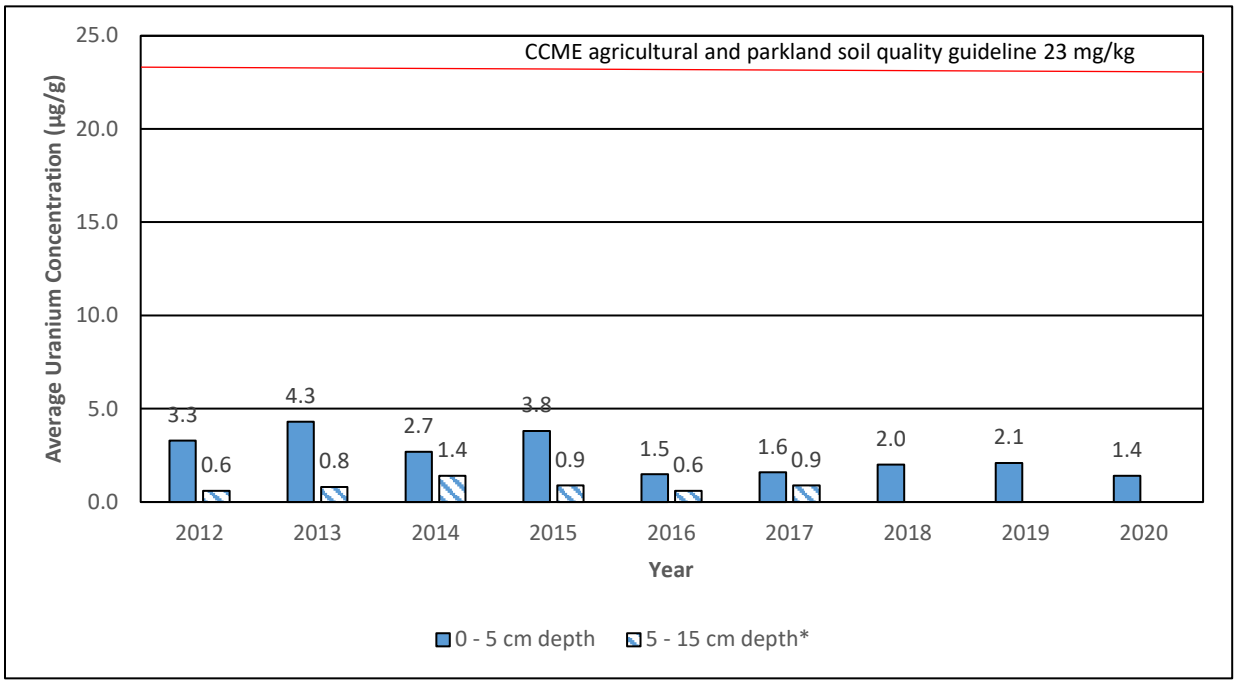


Figure 19 – Uranium in Soil Concentration Within 1000 m of Facility



* Annual sampling at the 5-15 cm depth was discontinued starting in 2018. It is now done once every 5 years.

Water Monitoring

The results from liquid effluent emissions monitoring are set out in Figures 20 through 24. The current licence limit, as well as any prescribed current action level, is shown in each figure. The data shows that air emission discharges continue to be well below the emissions limits. There have been no action levels or licence limits exceeded during the current licensing period.

Figure 20 – Average Uranium Concentration in Lake Huron at Diffuser

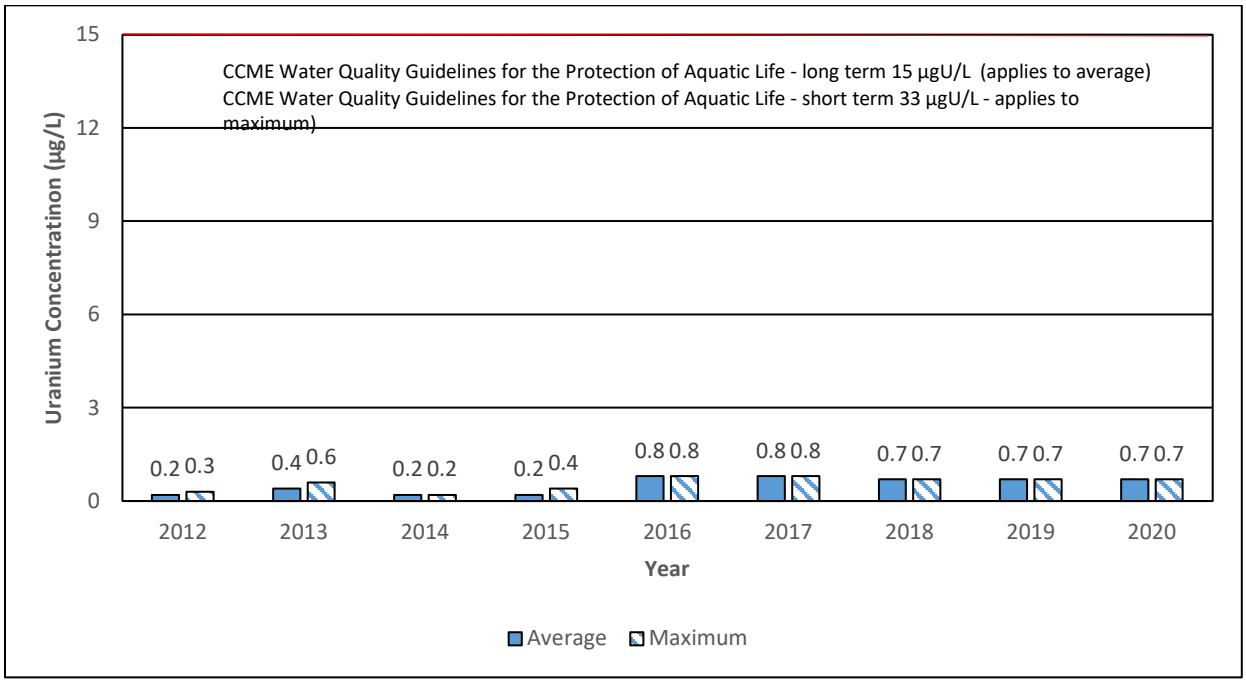


Figure 21 – Average Uranium Concentration in Effluent Discharge

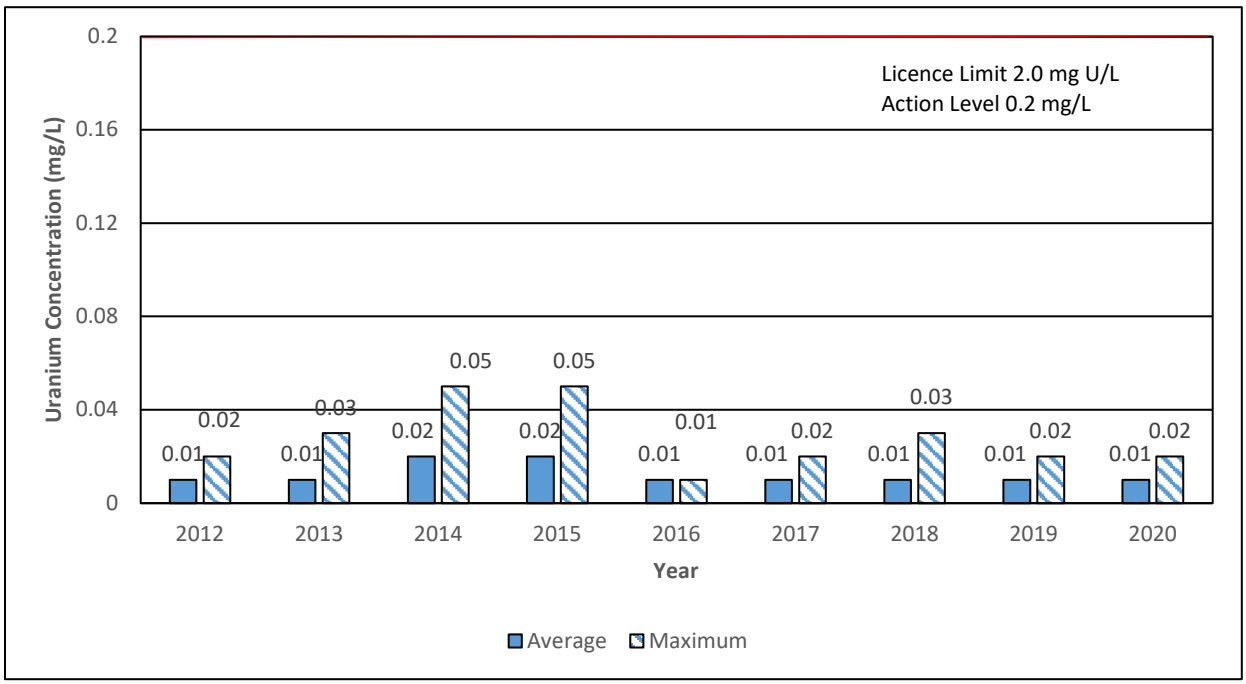


Figure 22 – Average Nitrate Concentration in Effluent Discharge

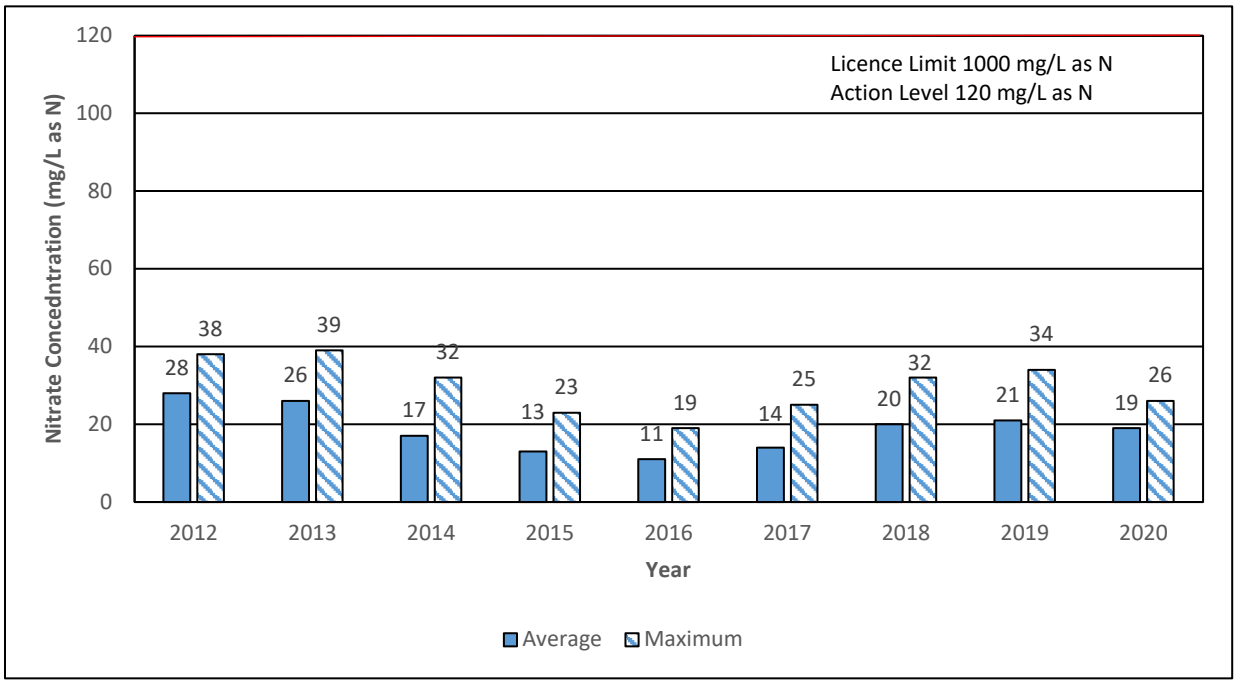


Figure 23 – Average Radium-226 Concentration in Effluent Discharge

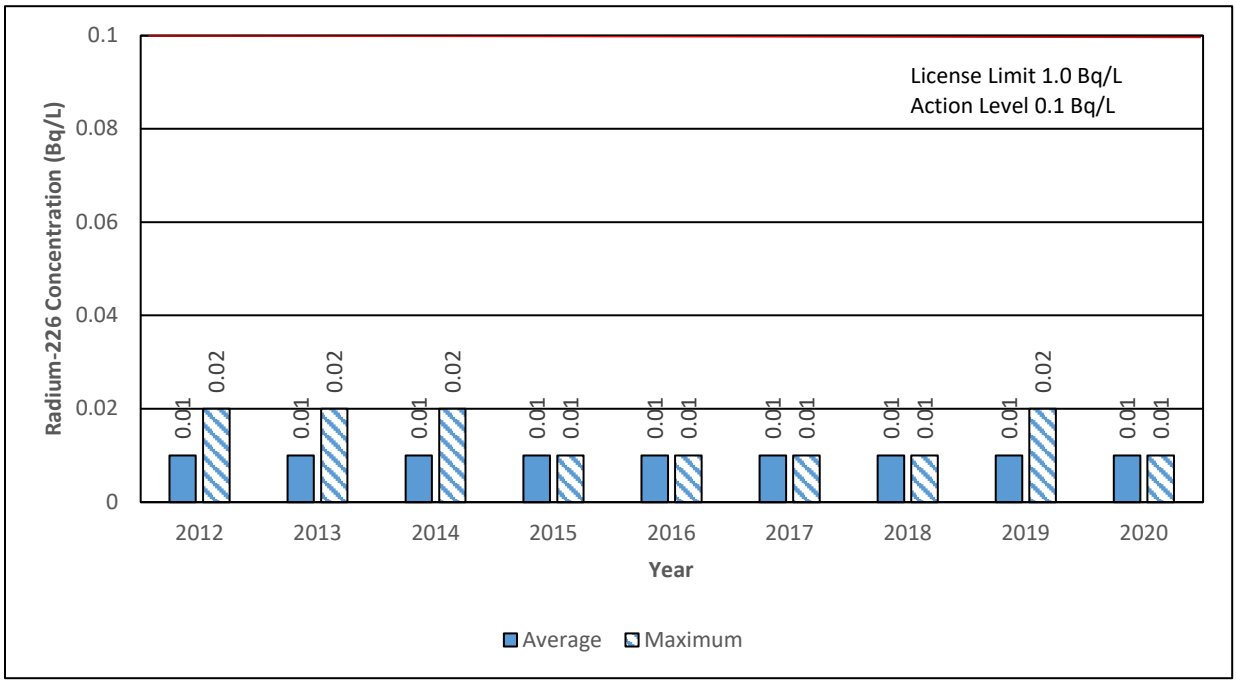
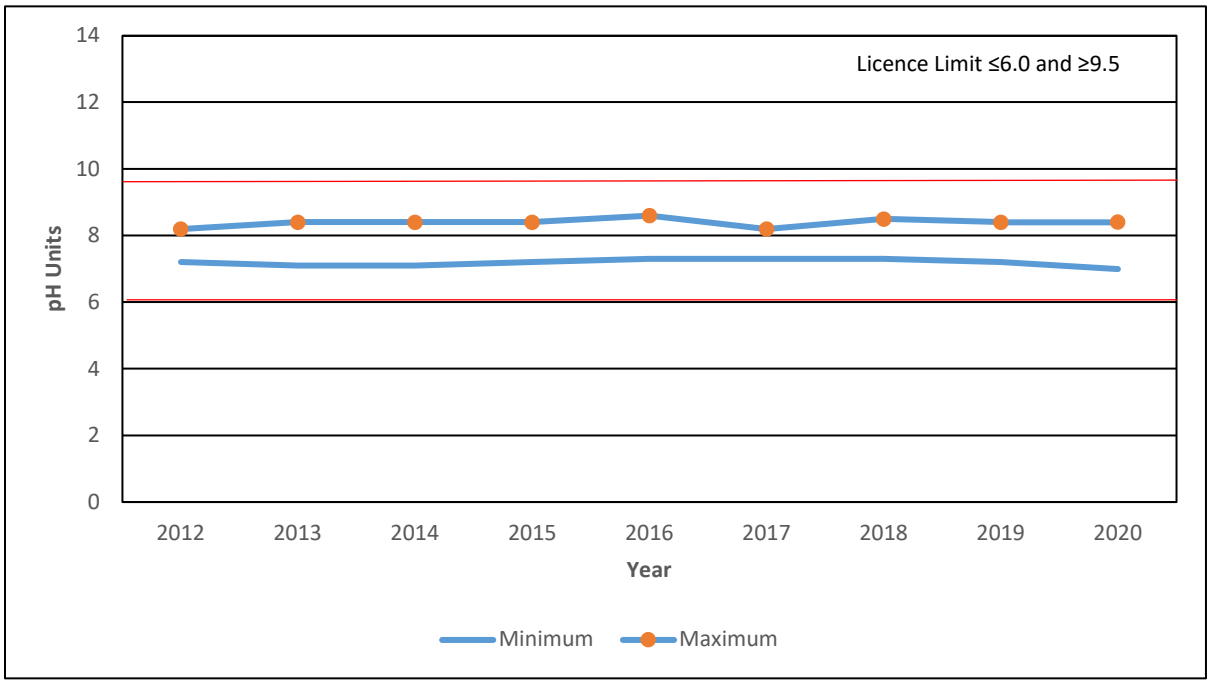


Figure 24 – Maximum and Minimum Daily pH Values in Effluent Discharge



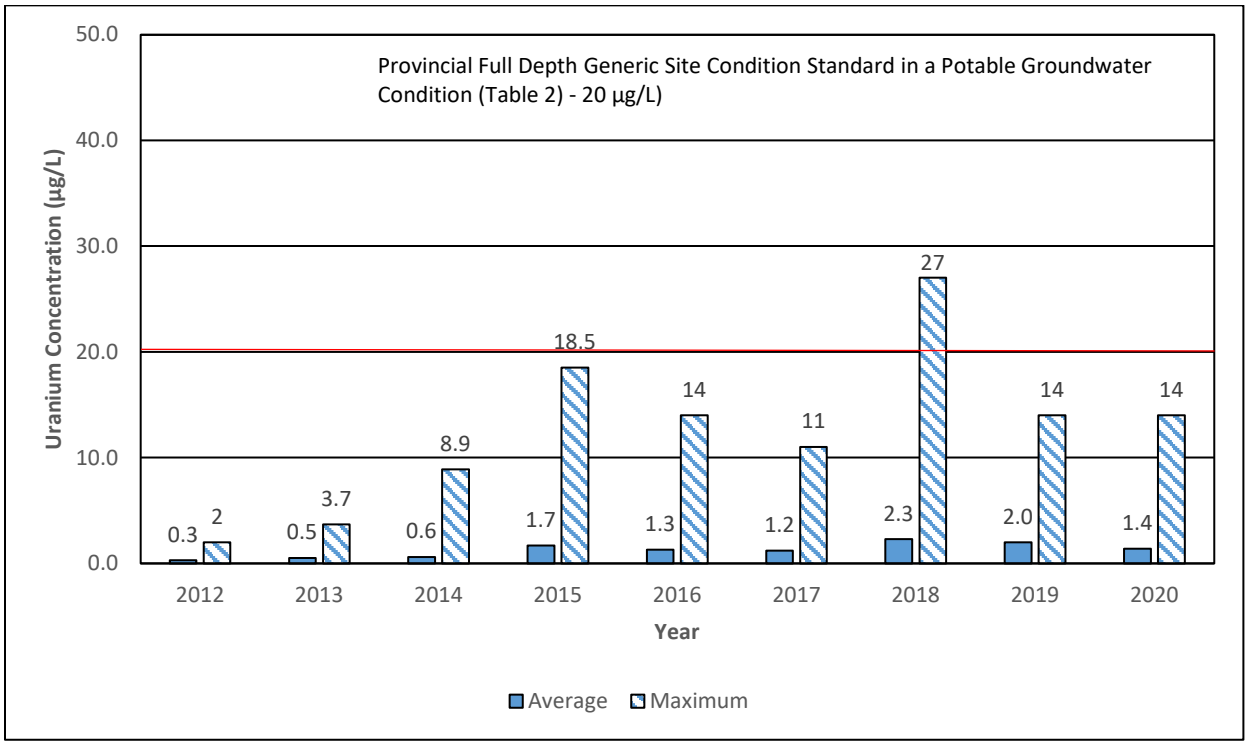
Groundwater

BRR has an extensive groundwater monitoring program in place with 35 monitoring wells, or boreholes: 14 inside the perimeter fence and 21 outside the fence line. Monitoring at each borehole varies from once to three times per year depending on the location of the monitoring well. Figure 25 summarizes the annual average and maximum uranium in groundwater results for the current licensing period.

Groundwater results at all but one borehole (in 2018) were below the Provincial Full Depth Generic Site Condition Standard in a Potable Groundwater Condition (Table 2) value of 20 µg/L uranium. Cameco continues to monitor results from this location. Given the location of the refinery and the direction of groundwater flow in the area, there is no possible impact to drinking water sources from supply wells downstream.

In 2020, BRR's groundwater monitoring program was assessed by a qualified third party against the CSA standard N288.7-15 *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*. The review was completed as a gap analysis. The key finding is that there is currently a groundwater monitoring program that meets the majority of the requirements of CSA Standard N288.7-15. This document will be submitted to CNSC staff by the end of August 2021 and Cameco will be implementing corrective actions to address the issues identified.

Figure 25 – Uranium in Groundwater



Cameco's audit program includes audits of the BRR EPP at least once every three years. In the licence period, no significant issues were identified during these audits, opportunities for improvement and minor findings were investigated with appropriate action taken and documented in CIRS.

Throughout the licensing period, the EPP has been demonstrated to be effective and environmental releases from the refinery in general continue to be very low compared to regulatory limits and guidelines. However, as part of our commitment to continual improvement, BRR will continue to look for ways to improve the performance of the operation.

Activities carried out in support of the EPP in the current licence period include:

- Implementing an ERA following the requirements of N288.6 *Environmental risk assessments at Class 1 nuclear facilities and uranium mines and mills*;
- Updating the site Derived Release Limit (DRL) following the requirements of N288.1 *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*;
- Revising the EPP to implement CSA N288.5: *Effluent monitoring programs at Class 1 nuclear facilities and uranium mines and mills* and CSA N288.6 *Environmental risk assessments at Class 1 nuclear facilities and uranium mines and mills*; and

- Development of action levels in accordance with CSA N288.8 *Establishing and implementing action levels for releases to the environment from nuclear facilities*.

BRR's EPP also meets the requirements of the ISO14001 standard and Cameco's corporate requirements.

3.9.3 Future Plans

REGDOC 2.9.2 *Environmental Protection: Controlling Releases to the Environment* is expected to be published in the next licence period. There is an established process for review of new standards and REGDOCs and their incorporation as CVC or guidance in the LCH. As per the process, BRR will identify and address any gaps in the environmental protection program on a schedule accepted by CNSC staff. It is expected that BRR will continue to maintain and enhance, if necessary, its EPP during the next licencing period.

3.9.4 Challenges

The regulatory framework for environmental protection is expected to be further developed over the next licence period. Cameco will continue to work closely with CNSC staff to determine the appropriate priority of implementing new standardized requirements across all SCAs.

3.9.5 Requests

BRR has no requests at this time.

3.10 Emergency Management and Fire Protection

Emergency management and fire protection covers emergency plans and emergency preparedness programs that exist for emergencies and for non-routine conditions. This also includes any results of participation in emergency response exercises.

3.10.1 Relevance and Management

Emergency planning for nuclear facilities is a requirement of the NSCA, the *Class I Nuclear Facilities Regulations* and the Licence. During the current licensing period, REGDOC 2.10.1 *Nuclear Emergency Preparedness and Response* and CSA N393-13 *Fire Protection for facilities that process, handle or store nuclear substances* were published and incorporated into license requirement.

In addition to the CNSC licensing requirements, ECCC and the MOECP have requirements related to emergency planning and spill prevention. The federal *Environmental Emergency Regulations* identify specific chemicals and quantity levels that require the facility to develop release scenarios and conduct drills at prescribed frequencies as part of an environmental emergencies plan. Provincial regulations require the site to maintain a site-specific spill prevention and contingency plan as a resource for

preventing, detecting and responding to spills. These federal and provincial plans complement the site Emergency Response Plan.

BRR has well-established measures to prevent or mitigate the effects of accidental releases of nuclear and other hazardous substances. The measures and response actions are documented in the current versions of the site emergency response plan and supporting documents. These plans and procedures outline the actions to be taken to minimize the worker and public health hazards and environmental hazards, which may result from fires, explosions, or the release of hazardous materials. Interaction with off-site authorities is also addressed in the plans.

Emergency preparedness and response training is provided on an ongoing basis to ensure responders have the knowledge and skills necessary to provide for an effective emergency response. The facility maintains qualified emergency response personnel onsite, 24-hours a day when the facility is operating to immediately respond to incidents at the facility with an entry team and a rapid intervention team. In off-shift hours, additional emergency response personnel can be recalled to the site if required.

The fire protection program establishes provisions to prevent, mitigate and respond to fires such that fire risk to workers, the public, the environment and BRR property is acceptably low and controlled. It meets internal Cameco requirements and the requirements of the *National Fire Code of Canada*, 2005, the *National Building Code of Canada*, 2005 and CSA 393-13 *Fire protection for facilities that process, handle, or store nuclear substances*. The purpose of this program is to define management responsibilities, program objectives, program elements and program controls required to achieve the fire safety objectives. It applies to all existing buildings at the facility and to the design and construction of new buildings and facilities, to the modification of existing facilities, and through their different operational stages, including shutdown and decommissioning.

The emergency response organization comprises of the local emergency response team, which deals with the event at the site level, and the divisional Local Crisis Management Team, which is supported by the Cameco Corporate Crisis Management Team. These multiple layers of support ensure any emergencies within the organization are dealt with appropriately.

3.10.2 Past Performance

Each year, BRR conducts a number of internal drills and training exercises to test the effectiveness of the site and the emergency response organization. This includes off-shift hazmat drills (held annually since 2014) and full-scale emergency response exercises, including local emergency services and hospital (2012, 2015 and 2018). The next full scale emergency response exercise is scheduled for the fall of 2021. Each year, more than 2000 person-hours of emergency response training is completed at the refinery.

On April 24, 2020, the refinery experienced a fire in the yard when containers of contaminated combustible materials designated for the BRR's incinerator ignited. The fire was extinguished by members of the site Emergency Response Team (ERT), with

assistance from the local fire department. There was no loss of material and no effect on the environment, the health and safety of persons or national or international security. A report on the incident was prepared and submitted to CNSC staff.

Facility fire inspections are carried out for every area of the facility in accordance with the requirements in the applicable CSA standards and REGDOCs. Any areas for improvement are documented and tracked in CIRS to ensure the corrective actions are taken.

3.10.3 Future Plans

It is expected that BRR will continue to maintain and enhance, if necessary, its Emergency Management and Fire Protection programs during the next licence period.

3.10.4 Challenges

BRR has not identified any challenges associated with this SCA.

3.10.5 Requests

BRR has no requests at this time.

3.11 Waste Management

Waste management covers the internal waste-related programs, which 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. It also covers the planning for decommissioning.

3.11.1 Relevance and Management

The waste management program meets the requirements for management of radioactive waste in solid, liquid or gaseous states as defined by CSA N292.3-14 *Management of low and intermediate level radioactive waste*, CSA N292.0-14 *General principles for the management of radioactive waste and irradiated fuel* and for hazardous waste as defined by Ontario Regulation 347 *General – Waste Management.*

The BRR waste management program has two aspects to meet the requirements of this SCA. These aspects are described below and include:

- Routine waste management of radioactive, conventional, hazardous and mixed waste (Waste Management Plan); and,
- Decommissioning strategy and planning (Preliminary Decommissioning Plan).

Waste Management Plan

This plan describes the waste-related programs that form part of the BRR's operations and describes how waste is managed throughout its lifecycle to the point of disposal. It includes waste generation, storage, processing, recycling and removal/transfer to an appropriate waste management or other facility.

The waste management plan has the following objectives:

- To manage and dispose of wastes in accordance with applicable laws and generally accepted industry practices so as to minimize the potential adverse impact to personnel and to the environment;
- To minimize and reduce the quantity of stored onsite waste through recycle, re-use and recovery to the extent possible;
- To segregate radioactively contaminated and non-contaminated waste materials;
- To maintain an inventory of waste material produced, received, disposed of and stored, including quantities and locations on site;
- To store waste materials only when re-use, recycle or recovery is not possible and then to do so with proper management systems and controls in place; until an acceptable method has been identified for their eventual disposal; and,
- To continually evaluate disposal alternatives and new technologies for waste reductions.

Preliminary Decommissioning Plan

Cameco maintains a PDP and financial guarantee for BRR. These documents meet the requirements of CSA N294-19 *Decommissioning of facilities containing nuclear substances* and G-206 (*Financial Guarantees*). The PDP is reviewed and revised as appropriate every five years and will be reviewed and updated at least twice in the proposed licence period. This is also discussed in Section 4.5.

3.11.2 Past Performance

Solid wastes contaminated by uranium are reprocessed, recycled and re-used to the extent possible. Waste materials that cannot be reprocessed, recycled or re-used are safely stored onsite until appropriate disposal options are available.

In the current licence period, BRR significantly reduced the inventory of scrap drums and other stored wastes through several projects. Approximately 24,000 drums or marginally contaminated materials were disposed of at a permitted hazardous waste landfill site in the United States between 2012 and 2020. Over the same period approximately 256,000 scrap drums were decontaminated and released as clean scrap metal.

The refinery routinely shipped secondary products (calcined and regeneration product) to licenced facilities for uranium recovery. In the current licensing period, approximately 40,000 drums of secondary products have been shipped.

The BRR incinerator is considered a central processing operation for FSD and processes contaminated combustible materials (CCM) from PHCF, CFM and BRR. Receipt of

material from CFM began in 2014. Approximately 755,000 kg of CCM has been processed in the incinerator in the current licence period.

3.11.3 Future Plans

REGDOC 2.11.1 *Waste Management, Volume 1: Management of Radioactive Waste* and REGDOC 2.11.2 *Decommissioning* are expected to be published in the next license period. There is an established process for review of new standards and REGDOCs and their incorporation as CVC or guidance in the LCH. As per the process, BRR will identify and address any gaps in the waste management program on a schedule accepted by CNSC staff.

3.11.4 Challenges

Cameco has not been able to find any commercially viable low-level radioactive waste management facilities in Canada. Cameco intends to meet this challenge through continued recycling initiatives and by using foreign disposal opportunities to reduce the waste inventory at BRR when appropriate.

3.11.5 Requests

Cameco has no requests at this time.

3.12 Security

This SCA covers the programs required to implement and support the security requirements stipulated in the GNSCR the *Nuclear Security Regulations* and other CNSC requirements, such as those prescribed in REGDOC 2.12.3 *Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2*.

3.12.1 Relevance and Management

Cameco's Security Plan presents an overview of the security operations at the BRR and identifies the systems and processes in place to meet security program objectives. Accordingly, this document is considered prescribed information and is subject to the requirements of the GNSCR. The objective of the security plan is to ensure safe and secure operation of the facility, by maintaining protection through use of equipment, personnel, and procedures. The BRR Security Plan has continued to evolve to meet all regulatory requirements and commitments over the current licence period.

3.12.2 Past Performance

During the licence period, the CNSC's Nuclear Security Division reviewed the BRR's security program. BRR used the findings and recommendations of CNSC staff to improve the overall security program.

3.12.3 Future Plans

BRR will continue to maintain enhance, if necessary, it's Security Plan during the upcoming licence period.

3.12.4 Challenges

At this time, Cameco foresees no challenges with respect to maintaining an effective security program during the next licence period.

3.12.5 Requests

Cameco has no requests at this time.

3.13 Safeguards

Safeguards cover the programs required for the successful implementation of the obligations arising from the Canada/International Atomic Energy Agency (IAEA) Safeguards Agreement, as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons*.

3.13.1 Relevance and Management

Cameco complies with REGDOC 2.13.1 *Safeguards and Nuclear Material Accounting*.

The site maintains a natural uranium inventory system in which receipts and shipments are recorded. Monthly inventory reports are distributed to the CNSC that include safeguarded natural uranium as well as the inventory of non-safeguarded material.

BRR completes an annual Physical Inventory Taking (PIT) as part of the safeguards program, which is followed by a Physical Inventory Verification (PIV) with the IAEA or a Physical Inventory Taking Evaluation with the CNSC. Short Notice Random Inspections (SNRIs) of the facility are conducted by the IAEA periodically throughout the year to ensure compliance to safeguard obligations.

3.13.2 Past Performance

During the current licensing period a total of twenty-seven Short Notice Random Inspections, seven Physical Inventory Verifications and three Physical Inventory Taking Evaluations have been carried out by the IAEA and CNSC as part of safeguards activities.

3.13.3 Future Plans

BRR will continue to maintain and enhance, if necessary, the Safeguards Program during the upcoming licensing period.

3.13.4 Challenges

Over the current licence period, the scope of IAEA inspections and demands made during these inspections have continued to increase. The resource requirements for Cameco to meet the demands of the IAEA have grown without clear linkage to a safety or security benefit. BRR will continue to comply with the Integrated Safeguards requirements within Canada and will continue to work to ensure future inspections, verifications and new requirements proceed in a manner that brings value and efficiency to all organizations involved.

3.13.5 Requests

Cameco has no requests at this time.

3.14 Packaging and Transport

Packaging and transport SCA addresses the programs that cover the safe packaging and transport of nuclear substances and radiation devices to and from the licensed facility.

3.14.1 Relevance and Management

The site has procedures related to the handling, storing, loading, transporting and receipt of nuclear substances and other dangerous goods.

Nuclear substances are packaged and transported on public roadways, railways and marine transport around the world in accordance with the *Transportation of Dangerous Goods Regulations* (TDGR) and the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR). As described in the FSD Packaging and Transportation Program, Cameco maintains corporate standards and site procedures that cover the safe packaging and transport of nuclear substances to and from licensed facilities.

Employees are trained in the safe handling, packaging, marking, labelling, shipping (placard and documentation) and receipt of dangerous and/or radioactive goods commensurate with their responsibilities. Detailed work instructions are documented, and employees are trained in the safe handling of nuclear substances and dangerous goods, as required by the TDGR, PTNSR and the *Canada Labour Code,* Part II.

If required by the *Nuclear Non-proliferation Import and Export Control Regulations*, an import or export licence is obtained from the CNSC prior to shipment and corresponding import, or export permits are also obtained if required from Global Affairs Canada.

3.14.2 Past Performance

UO_3 is produced, packaged in purpose-built totes and transported by road to the PHCF. UO_3 is also packaged into drums and transported by road and marine to other customers

worldwide. These containers meet the Type IP-1 packaging requirements as specified in the PTNSR.

BRR receives scrap uranium material and contaminated combustible material transported by road from other FSD facilities in Port Hope. Recoverable uranium wastes and other uranium bearing materials that cannot be processed at the refinery are transported by road or rail to appropriately permitted facilities in Canada and the United States.

Between 2012 and 2020, fourteen minor transportation events were reported by BRR. These were investigated, corrective actions put into place and no environmental impacts occurred as a result.

3.14.3 Future Plans

BRR will continue to comply with all existing and new regulatory requirements in this SCA in the next licensing period.

3.14.4 Challenges

Cameco does not foresee any challenges with respect to this SCA during the next licence period.

3.14.5 Requests

Cameco has no requests at this time.

4.0 OTHER MATTERS OF REGULATORY INTEREST

4.1 Environmental Assessment

BRR does not have any active projects in the environmental assessment (EA) process under the *Canadian Environmental Assessment Act, 2012* or the federal *Impact Assessment Act*.

4.2 Aboriginal Engagement

Cameco is committed to provide opportunities to engage with Indigenous communities regarding the BRR's ongoing operations.

In Blind River, Cameco has built a meaningful relationship with the Mississauga First Nation as its nearest neighbor but also acknowledges that there may be interest in the facility by other surrounding Indigenous groups. The FSD Public Information Program (PIP) that replaced the site PIPs in 2020 includes details of specific Indigenous outreach

activities undertaken by Cameco. Cameco will continue outreach to the local Indigenous communities throughout the licensing process and subsequent licence period as per its PIP described in Section 4.7.

As part of this licence renewal, Cameco initiated additional outreach to the following Indigenous groups to advise them of the submission of the licence application and to invite their participation in the process:

- Mississauga First Nation
- Serpent River First Nation
- Thessalon First Nation
- Sagamok Anishnawbek Nation
- Métis Nation of Ontario Region 4

4.3 Other Engagement

Cameco has nothing to report in this section.

4.4 Cost Recovery

Cameco is current on its cost recovery payments.

4.5 Financial Guarantees

The BRR maintains a PDP, which is prepared based on guidance provided in *CSA N294-09 Decommissioning of facilities containing nuclear substances*. The current financial guarantee, maintained in the form of an irrevocable letter of credit totaling $48 million reflects the PDP accepted by the Commission during the previous licensing proceedings.

The PDP was updated and accepted by CNSC staff in 2020 in support of the current licence renewal. The PDP outlines the general requirements for returning the site to the status of unrestricted use and outlines the controls required for the protection of the environment during the decommissioning process. As part of this process the financial guarantee was re-evaluated in accordance with the criteria set out in CSA N294-19 (*Decommissioning of Nuclear Facilities*), G-219 (*Decommissioning Planning*) and G-206 (*Financial Guarantees*). The associated cost estimate has been increased to $57.5 million. Once the value of the financial guarantee has been approved by the Commission, Cameco will secure an irrevocable letter of credit to cover the full amount required by the updated cost estimate.

4.6 Other Regulatory Approvals

During the current licence period, the BRR received amendments to the following approvals from the MOECP:

- ECA for air emissions (comprehensive)
- ECA for the incinerator
- ECA for its water treatment and lagoon system

During the current licence period, the BRR maintained the following approvals from the MOECP:

- Permit to Take Water (PTTW) for its well water system
- PTTW for its irrigation system
- Certificate of Authorization (C of A) for its well water system
- C of A for its sewage treatment plant

During the current licence period, the BRR renewed the following with the TSSA:

- Authorized inspection agency agreement with the TSSA as required by the Licence and LCH.
- Certificates of Authorization for activities under the pressure boundary program

4.7 Licensee's Public Information Program

The objective of the FSD PIP is to ensure local target audiences with an interest in Cameco's FSD CNSC-licenced facilities are informed on a timely basis about operations, activities and potential effects on the environment and the health and safety of persons, and thereby build the trust and support of stakeholders. This includes a commitment to and protocol for ongoing, timely communication of information related to the licensed activities during the licence periods. The PIP has been fulfills the requirements of the CNSC's REGDOC 3.2.1 *Public Information and Disclosure*.

Cameco remains committed to ensuring that information is made available to the communities in which we operate and to and other interested stakeholders. The following information is made available to all members of the public through Cameco's corporate and/or community websites:

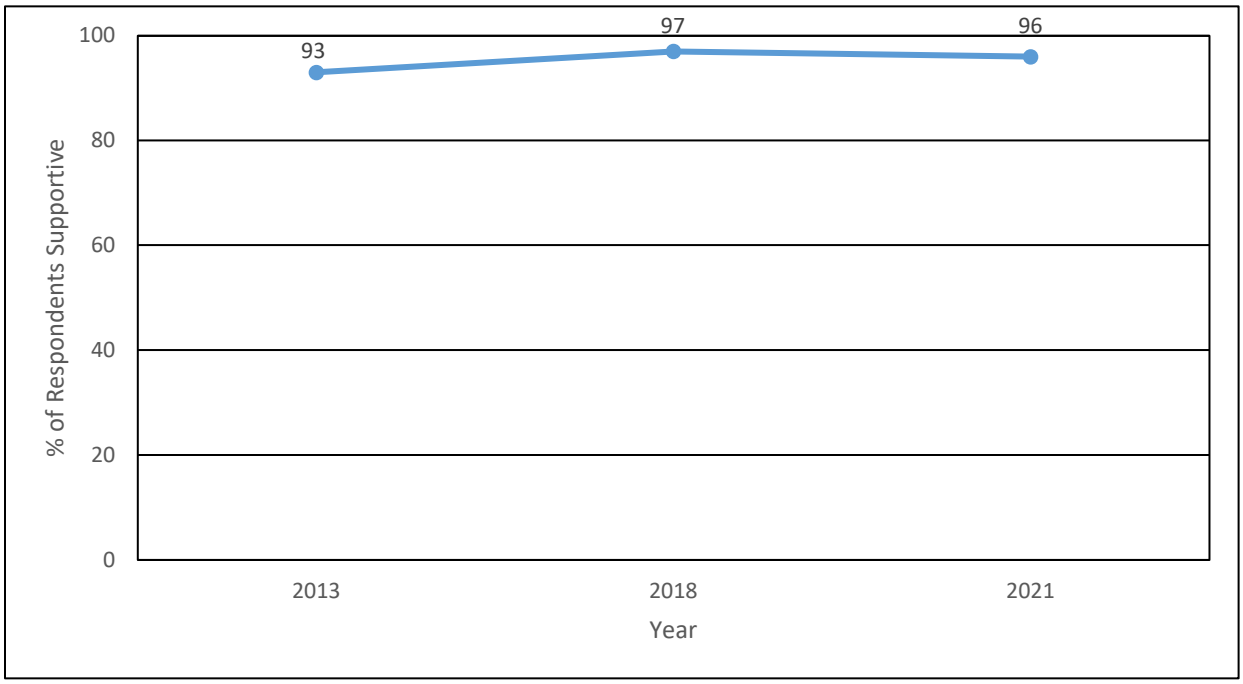
- Technical reports or summaries (e.g., environmental risk assessment, derived release limit assessment, safety analysis and preliminary decommissioning plan) are available on the dedicated community website, as are documents supporting licencing activities.

- CNSC Quarterly Monitoring and Operational Performance Reports and Annual Compliance Reports are also posted on the community website. These reports are also sent to the Town of Blind River, Mississauga First Nation and to the Serpent River First Nation.
- Cameco may choose to develop and deploy videos to help highlight various aspects of its operations and/or community activities. These videos may be utilized on its website and/or social media or used at off-site events.
- Print material is available for all visitors to Cameco facilities and made available at off-site information sessions. Other information products are made available through the community website, which is promoted through online, social media, print and/or radio advertisements.
- Cameco may choose to use information boards to help highlight various aspects of its operations and community investment activities. These boards may be deployed at community or Cameco-led events.

In the current licence period, Cameco has adapted its PIP to include social media (Twitter, LinkedIn, Instagram and Facebook), and further developed the FSD website to make information on local operations easier to access for the community. Conventional media and public disclosure tools such as advertisements, newsletters, and press releases, as well as outreach activities such as presentations to town council, involvement in community activities and facility tours (pre-COVID-19) have also been maintained. Indigenous engagement has been maintained as described in section 4.2

Cameco has retained outside expertise for more than a decade to measure public opinion in Blind River to help determine the effectiveness of its PIP. The results of this public opinion research carried out during the current licensing period, as shown in Figure 26, confirm that Cameco's public information program is seen as effective and appropriate by the vast majority of Blind River area residents. Cameco will continue to enhance its PIP as needed in the next licence period to maintain the very strong levels of support demonstrated by the community of support of Cameco's operation.

Figure 26 – Public Support for Cameco's Operations in Blind River



4.8 Nuclear Liability Insurance

BRR has no nuclear liability insurance as the facility only stores, handles and processes natural uranium materials.

4.9 Additional/Other Matters

Cameco has nothing to add at this time.

REFERENCES

The following documents have been posted on Cameco's website to provide information in support of the licence renewal.

1. Cameco Corporation. 2021. *Blind River Refinery Licence Renewal Briefing Guide*.
2. Cameco Corporation. 2021. *Blind River Refinery Derived Release Limits Public Summary.* July 2021.
3. Cameco Corporation. 2021. *Blind River Refinery Licence Renewal presentation.* February 2021.
4. Cameco Corporation. 2020. *Licence Renewal Application for the Blind River Refinery Facility*. September 30, 2020.
5. Cameco Corporation. 2020. *Review of the Environmental Risk Assessment for the Blind River Refinery.* September 30, 2020.
6. Cameco Corporation. 2020. *Facility Licensing Manual Blind River Refinery.* August 31, 2020.
7. Cameco Corporation. 2018. *Environmental Risk Assessment for the Cameco Blind River Refinery (Redacted).* November 9, 2018.
8. Cameco Corporation. 2018. *Blind River Refinery - ERA Public Summary.* November 5, 2018.
9. Cameco Corporation. 2018. *Blind River Refinery – Public Summary – Safety Report.* March 28, 2018.
10. Cameco Corporation. 2017. *Fuel Services Division – Waste Management Overview.* November 7, 2017.
11. Cameco Corporation. 2017. *Blind River Refinery - Public Summary – Preliminary Decommissioning Plan.* September 25, 2017

The following CNSC REGDOCs and CSA standards are applicable to this licence renewal.

12. Canadian Standards Association (CSA). 2014. B51-14 *Boiler, pressure vessel, and pressure piping code*
13. Canadian Standards Association (CSA). 2012 (R2017). N286-12 *Management system requirements for nuclear facilities*
14. Canadian Standards Association (CSA). 2014 (R2019). N288.1-14 *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*
15. Canadian Standards Association (CSA). 2010 (R2015). CSA N288.4-10, *Environmental monitoring programs at class I nuclear facilities and uranium mines and mills*
16. Canadian Standards Association (CSA). 2011 (R2016). CSA N288.5-11, *Effluent monitoring programs at class I nuclear facilities and uranium mines and mills*
17. Canadian Standards Association (CSA). 2012 (R2017). CSA N288.6-12 *Environmental risk assessment at class I nuclear facilities and uranium mines and mills*

18. Canadian Standards Association (CSA). 2015. CSA N288.7-15 *Groundwater protection programs at class I nuclear facilities and uranium mines and mills*

19. Canadian Standards Association (CSA). 2017. CSA N288.8 E*stablishing and implementing environmental action levels to control emissions from nuclear facilities*

20. Canadian Standards Association (CSA). 2013 (R2018). CSA N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*

21. Canadian Standards Association (CSA). 2014. CSA N292.3-14 *Management of low- and intermediate-level radioactive waste*

22. Canadian Standards Association (CSA). 2014. CSA N292.0-14 *General principles for the management of radioactive waste and irradiated fuel*

23. Canadian Standards Association (CSA). 2019. CSA N294-19 *Decommissioning of facilities containing nuclear substances*

24. Canadian Standards Association (CSA). 2011. Z94.4-11 Selection, use and care of respirators

25. Canadian Nuclear Safety Commission (CNSC). 2000. G-206: *Financial guarantees guide for the decommissioning of licensed activities*

26. Canadian Nuclear Safety Commission (CNSC). 2018. REGDOC 2.1.2 – Safety Culture

27. Canadian Nuclear Safety Commission (CNSC). 2016. REGDOC 2.2.2 – *Personnel Training*

28. Canadian Nuclear Safety Commission (CNSC). 2020. REGDOC 2.9.1 – *Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.2*

29. Canadian Nuclear Safety Commission (CNSC). 2016. REGDOC 2.10.1 – *Nuclear emergency preparedness and response*

30. Canadian Nuclear Safety Commission (CNSC). 2020. REGDOC 2.12.3 – *Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material Accountancy*

31. Canadian Nuclear Safety Commission (CNSC). 2018. REGDOC 2.13.1 – *Safeguards and Nuclear Material Accountancy*

32. Canadian Nuclear Safety Commission (CNSC). 2018. REGDOC 3.1.2 – *Reporting Requirements, Volume 1: Non-Power Reactor Class 1 Nuclear Facilities and Uranium Mines and Mills*

33. Canadian Nuclear Safety Commission (CNSC). 2018. REGDOC 3.2.1 – *Public Information and Disclosure*

GLOSSARY

AAQC	ambient air quality criteria
ALARA	as low as reasonably achievable
BRR	Blind River Refinery
Cameco	Cameco Corporation
CANDU	Canada deuterium–uranium
CCME	Canadian Council of Ministers of the Environment
CFM	Cameco Fuel Manufacturing Inc.
CIRS	Cameco Incident Reporting System
CMD	Commission Member Document
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DRL	Derived Release Limit
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EIR	Event Initial Report
EPP	environmental protection program
ERA	Environmental Risk Assessment
FFOL	Fuel Facility Operating Licence
FHA	fire hazards analysis
FLM	Facility Licensing Manual
FSD	Fuel Services Division
GNSCR	*General Nuclear Safety and Control Regulations*
HAZOP	hazards and operability
HEPA	high efficiency particulate arresting
ISO	International Organization for Standardization
IAEA	International Atomic Energy Agency
KPI	key performance indicator
LCH	Licence Conditions Handbook
Licence	FFOL-3632.0/2022
MOECP	Ministry of the Environment, Conservation and Parks (Ontario)
NFPA	National Fire Protection Association
NSCA	*Nuclear Safety and Control Act*
OH&S	Occupational health and safety
PDP	Preliminary Decommissioning Plan

PHCF	Port Hope Conversion Facility
PM	preventative maintenance
PIP	public information program
PTNSR	*Packaging and Transport of Nuclear Substances Regulations, 2015*
PTTW	Permit to Take Water
REGDOC	CNSC Regulatory Document
RPP	radiation protection program
Safety Report	the safety analysis for the BRR
SCA	Safety and Control Area
SuperCUP	a campaign under the Clean-Up Program
TDGR	*Transport of Dangerous Goods Regulations*
TRIR	total recordable injury rate
TSSA	Technical Standards and Safety Authority
UO_2	Uranium dioxide
UF_6	Uranium hexafluoride
WAC	waste acceptance criteria