



**2022 Annual Compliance Monitoring
&
Operational Performance Report**

**Reporting Period January 1 – December 31, 2022
Revision #1**

**Cameco Fuel Manufacturing Inc.
Operating Licence
FFL-3641.0/2043
200 Dorset Street East
Port Hope, Ontario
L1A 3V4**

Submitted to:
The Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
280 Slater Street
Ottawa, Ontario
K1P 5S9

Submitted on August 4, 2023

Executive Summary

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

CFM operates a Class IB nuclear facility in Port Hope, Ontario under Canadian Nuclear Safety Commission (CNSC) fuel facility operating licence FFL-3641.0/2043 employing approximately 140 workers. In addition, approximately 120 employees work at a metal manufacturing plant located in Cobourg, Ontario, which does not handle uranium products. CFM is licensed to produce nuclear fuel bundles using uranium dioxide (UO₂); those fuel bundles are primarily used in domestic CANDU reactors. On February 17, 2022, CFM was granted a 1 year licence, FFL-3641.00/2023, and on January 18, 2023 CFM was granted a twenty year licence, FFL-3641.00/2043, after a licensing hearing on November 23, 2022.

Cameco is committed to the safe, clean, and reliable operations of all of its facilities and continually strives to improve safety performance and processes to ensure the safety of its employees, local residents, and the environment. Corporate policies and programs, including the Safety, Health, Environment and Quality (SHEQ) policy provide guidance and direction for the development of site-based programs and procedures that are defined in CFM's Management Systems Program Manual (CFM-MS).

In 2022, CFM continued to be included in Cameco's registration of the ISO14001:2015 Environmental Management System. CFM has a Safety Analysis Report (SAR) that documents the detailed safety analysis carried out for the facility. The SAR, which was updated in May of 2021, describes the hazards, preventative measures and mitigating controls associated with the licensed activities at CFM. The report summarizes major assessments for the facility and is updated to incorporate facility changes and improvements since the last version.

At CFM, changes to the physical design of equipment, processes, and the facility with the potential to impact safety are evaluated using the internal change and design control process from project planning through to completion of the project. This process is used to help identify potential impacts to the environment and health and safety. In 2022, CFM continued to use the electronic Management of Change (MOC) format to evaluate design and change control projects. There were no modifications undertaken that required written approval from the Commission or a person authorized by the Commission during the year.

CFM maintains a number of programs, plans and procedures in the areas of health and safety, radiation protection, environment protection, emergency response, fire protection, waste management, and training. As a result of these programs, plans and procedures, CFM's

operations have maintained radiation exposures and environmental emissions well below regulatory limits.

For various radiological and environmental parameters, CFM has established internal action levels, accepted by the CNSC, that may be indicative of a potential loss of control for that specific parameter. These action levels serve as an early warning of a condition that warrants further investigation. In 2022, there were no action level exceedances in the radiological or environmental monitoring program.

CFM maintains a comprehensive uranium inventory system to demonstrate compliance with safeguard requirements. In 2022, periodic audits of this inventory system were conducted jointly by the International Atomic Energy Agency (IAEA) and the CNSC. All audits were completed to the satisfaction of both regulatory bodies.

The scope of transportation activities at CFM includes the transport of Class 7 radioactive materials outlined in the *Transportation of Dangerous Goods Act SOR/2008-34*. There were no reportable transportation events involving CFM produced material in 2022.

Cameco works to build and sustain the trust of local residents by acting as a responsible corporate citizen in the communities in which it operates. A key element of building and sustaining that trust is a commitment to provide those in the community with accurate and transparent reporting of environmental practices and performance. Cameco continued its strategic approach to community outreach in 2022 with the continuation of newsletters. In 2022 Cameco continued to expand the use of social media into the overall communication strategy.

Table Of Contents

EXECUTIVE SUMMARY	2
1. INTRODUCTION	5
1.1 General Introduction	5
1.2 Facility Operation	10
1.3 Production or Utilization.....	13
1.4 Facility Modification.....	14
2. SAFETY AND CONTROL AREAS.....	15
2.1 Management	15
2.1.1 Management System.....	15
2.1.2 Human Performance Management	21
2.1.3 Operating Performance	24
2.2 Facility and Equipment	26
2.2.1 Safety Analysis	26
2.2.2 Physical Design.....	29
2.2.3 Fitness for Service	31
2.3 Core Control Processes	33
2.3.1 Radiation Protection	33
2.3.2 Conventional Health and Safety	63
2.3.3 Environmental Protection	69
2.3.4 Emergency Management and Response	95
2.3.5 Waste and By-product Management.....	98
2.3.6 Nuclear Security	100
2.3.7 Safeguards and Non-proliferation.....	101
2.3.8 Packaging and Transport of Nuclear Substances.....	102
3. OTHER MATTERS OF REGULATORY INTEREST	103
3.1.1 Public Information Program	103
3.1.2 Site-Specific	121
3.1.3 Improvement Plan and Future Outlook	122
3.1.4 Safety Performance Objectives for Following Year.....	123
4. CONCLUDING REMARKS.....	124

1. INTRODUCTION

1.1 General Introduction

Cameco Corporation (Cameco) is a major supplier of uranium processing services required to produce nuclear fuel for the generation of safe, clean, and reliable electricity around the world.

Cameco's Fuel Services Division (FSD) is comprised of the Blind River Refinery (BRR), the Port Hope Conversion Facility (PHCF), Cameco Fuel Manufacturing Inc. (CFM), and a divisional head office located in Port Hope, Ontario.

CFM operates a Class 1B nuclear facility in Port Hope, Ontario under Canadian Nuclear Safety Commission (CNSC) fuel facility operating licence FFL-3641.00/2043 that is valid until February 28, 2043. The Port Hope facility employs approximately 140 workers. In addition, approximately 120 employees work at a metal manufacturing facility located in Cobourg, Ontario, which does not handle uranium products. CFM (Figure 1) is located at 200 Dorset Street East in the Municipality of Port Hope, Ontario and operates a fuel manufacturing facility. The facility is currently licensed to produce nuclear fuel bundles using uranium dioxide (UO₂) primarily for domestic CANDU reactors. The licence also provides continued authorization to process, and store depleted and enriched UO₂.

At the beginning of 2022, CFM was operated under licence FFOL-3641.00/2022. On February 17, 2022, CFM was granted a 1-year licence, FFL-3641.00/2023, that was valid until February 28, 2023. Requesting a one year licence was a strategic decision to stagger the licence renewals of other FSD facilities. By deliberately staggering licensing activities for the future, no two Ontario Cameco facilities are applying for licensing in the same year. This is beneficial due to resource requirements in the organization. On October 4, 2021, CFM formally applied to renew its operating licence for a 20 year period. This licence application requested an increase to the production limit from 125 Megagrams (Mg) of UO₂ as pellets during any calendar month to 1,650 tonnes of uranium (tU) as uranium dioxide (UO₂) pellets annually. This move from a monthly production limit in Mg to an annual limit in tonnes allows for variation in production from month to month. The licensing hearing occurred on November 23, 2022 and the licence was granted by the Commission early in 2023.

Figure 1 - Cameco Fuel Manufacturing (Port Hope)



Cameco is committed to the safe, clean, and reliable operation of all of its facilities and continually strives to improve safety performance and processes to ensure the safety of its employees, local residents and the environment.

CFM maintains the required programs, plans and procedures in the areas of health and safety, radiation protection, environmental protection, emergency response, fire protection, waste management, and training.

As a result of these actions, CFM maintained radiation exposures to the workforce well below dose limits. Environmental emissions and public radiation exposures are being controlled to levels that are below regulatory limits.

The submission of this report fulfills the requirement of Section 2.2 in the fuel facility operating licence FFOL-3641.00/2022 and FFL-3641.00/2023. CFM's annual report is structured according to *REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills*. The purpose of this report is to summarize operating performance and provide a summary of the Safety and Control Areas for the calendar year of 2022 to demonstrate that CFM has met the regulatory requirements of the *Nuclear Safety and Control Act (NSCA)*.

Cameco is committed to reducing the frequency and significance of all events at site, including loss of primary containment (LOPC) events. Therefore, most events ranked level two or higher are investigated and resulting actions are tracked through Cameco's Incident Reporting System (CIRS).

Action levels are referenced in the LCH under the Radiation Protection section for worker dose and the Environmental Protection section for emissions. There were no action level exceedances in the radiation protection or environmental protection program in 2022.

In addition to the CNSC, CFM is regulated by other federal and provincial agencies, such as the Ontario Ministry of the Environment, Conservation and Parks, Environment and Climate Change Canada, Employment and Social Development Canada, and Transport Canada. CFM is compliant with applicable federal, provincial, and municipal regulations.

The acronyms in the following table are used in this report.

Table 1

Acronyms Used in This Report	
Acronym	Description
AACQ	Provincial Ambient Air Quality Criteria
ACGIH	American Conference of Governmental Industrial Hygienists
ACL	Administrative Control Limit
ALARA	As Low As Reasonably Achievable
BRR	Blind River Refinery
Bq	Becquerel
CAM	Continuous Air Monitor
Cameco	Cameco Corporation
CFM	Cameco Fuel Manufacturing Inc.
CIRS	Cameco Incident Reporting System
CFM-MS	Cameco Fuel Manufacturing-Management System document
CCM	Contaminated Combustible Material
CCME	Canadian Council of Ministers of the Environment
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Safety Association

DRL	Derived Release Limit
EBRL	Exposure Based Release Limits
E/OH&S	Environmental Occupational Health & Safety
ERA	Environmental Risk Assessment
ERAP	Emergency Response Assistance Plan
FHA	Fire Hazard Analysis
FPP	Fire Protection Program
FSD	Fuel Services Division
g	Gram
HPP	Hazard Prevention Program
hr	Hour
IAEA	International Atomic Energy Agency
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
JHSC	Joint Health & Safety Committee
kg	Kilogram
KPI	Key Performance Indicator
L	Litre
LCH	Licence Conditions Handbook
Mg	megagram
m³	cubic metres
µg	micrograms
µSv	microsievert
mSv	millisievert
MECP	Ministry of the Environment Conservation and Parks
MOC	Management of Change
CFM-NC	Nuclear Criticality Safety Program Manual
NEW	Nuclear Energy Worker
NDR	National Dose Registry

NFPA	National Fire Protection Agency
OSLD	Optically Stimulated Luminescence Dosimeters
PDP	Preliminary Decommissioning Program
PHCF	Port Hope Conversion Facility
PHFES	Port Hope Fire and Emergency Services
PP2	Powder Preparation and Powder Receiving Area
PPE	Personal Protection Equipment
PSSR	Pre Start Safety Reviews
QA	Quality Assurance
RP	Radiation Protection
SAP	corporate wide enterprise application software for asset management, maintenance management, accounting and purchasing functions
SAR	Safety Analysis Report
SAT	Systematic Approach to Training
SCA	Safety and Control Area
SCI	Site Condition Inspection
SHEQ	Safety/Health/Environment & Quality
SSC	Systems Structures and Components
TLD	Thermo Luminescent Dosimeters
TED	Total Effective Dose
TRIR	Total Recordable Injury Rate
UO2	Uranium Dioxide
yr	Year

1.2 Facility Operation

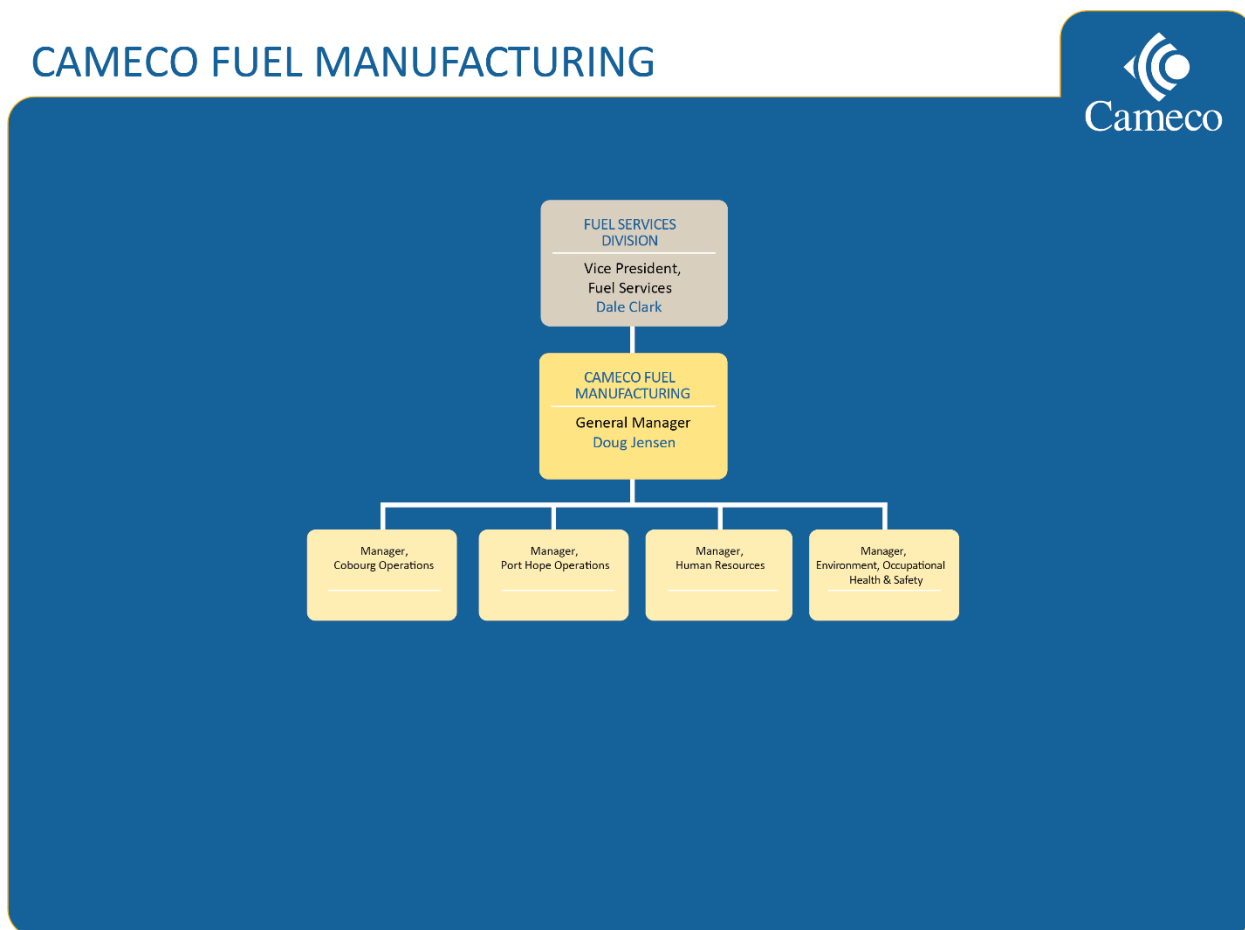
Cameco continues to strive for operational excellence at all of its facilities through consistent application of management systems to ensure that they operate in a safe, clean, and reliable manner. Corporate policies and programs, including Safety, Health, Environment and Quality (SHEQ) provide guidance and direction for all site-based programs and procedures that define the site management system.

The General Manager at CFM has overall accountability for safely operating and maintaining the facility. The responsibilities for supporting programs and procedures have been delegated among the management team at CFM and their respective personnel. All members of the site's management team are accountable for their roles and responsibilities.

In 2022 there were no changes in management positions at CFM's Port Hope facility. The organization chart for the management structure currently in place at CFM is provided in Figure 2.

The Manager, Environment/Occupational Health and Safety (E/OH&S) acts as the primary site radiation safety officer and reports directly to the General Manager. This position is responsible for the radiation and environmental protection programs in place at the Port Hope facility. As specified in CFM's Radiation Protection Program, there is an alternate Radiation Safety Manager position held by the Radiation Safety Coordinator which is the alternate site contact for the CNSC. This position reports to the Manager of E/OH&S.

Figure 2: CFM Organizational Chart



In 2022, CFM continued to be included in Cameco’s registration of the ISO14001:2015 Environmental Management System.

CFM is issued a Licence Conditions Handbook (LCH) by the CNSC. This handbook establishes, in a consolidated document, the compliance framework related to the CFM licence. The LCH outlines CNSC expectations by defining the licensing basis, explaining the regulatory context related to each licence condition, and identifying the verification criteria for each licence condition.

CFM also has a Facility Licensing Manual (FLM) that describes the commitment by CFM to operate a safe and efficient nuclear facility which meets the requirements of the CNSC.

CFM schedules and conducts internal audits to assess the organization’s level of conformance to management systems. In addition, independent third-party experts conduct compliance audits in the areas of health, safety, environment, and radiation protection legislation to help ensure that CFM continues to meet all applicable legal

requirements. Cameco's corporate office also performs periodic audits of the site management systems programs to ensure the site complies with corporate expectations.

Changes to the physical design of equipment, processes, and the facility with the potential to impact safety are evaluated using an internal change and design control process from project planning through to project completion. This process is used to help identify potential impacts to radiation protection, the environment, health and safety, security, and fire protection.

CFM underwent two planned shutdown events during the course of the year to conduct maintenance and project activities.

CFM maintains the required programs, plans, and procedures in the areas of health and safety, radiation protection, environment, emergency response, fire protection, waste management, and training. As a result of these actions, CFM's operations have maintained radiation exposures well below regulatory limits. Environmental emissions are being controlled to levels that are a fraction of the regulatory limits, and public radiation exposures are well below the established limits.

The global pandemic for COVID continued strong during the early parts of 2022 but began to ease toward the end of 2022. CFM continued to update HSI 419 – *Hazard Prevention for COVID-19 Response* throughout the year based upon changing local, provincial, and federal health guidelines. Starting in November of 2021, all employees, contractors and visitors were required to be fully vaccinated in order to access the site. This continued in 2022 along with on-site voluntary rapid testing. At the start of the year, communication around individual employee cases ceased and was replaced with a weekly summary. Eventually, all reporting of COVID cases came to end. The COVID weekly newsletter ended just prior to the summer shutdown period.

The performance of the facility in 2022 demonstrates that CFM is qualified to carry out the activities permitted under the operating licence. CFM is committed to take all reasonable precautions to protect the environment and the health and safety of employees and the public, to maintain the security of the facility and the nuclear substances associated with the facility as well as the necessary measures to facilitate Canada's compliance with international safeguard obligations.

1.3 Production or Utilization

CFM's operating licence in 2022 permitted the production of up to 125 Mg of UO_2 as pellets, during any calendar month. There were no major changes to the production loading of the facilities in 2022. On October 4, 2021, CFM formally applied to renew its CNSC operating licence for a 20 year period. This licence application requested an increase to the production limit from 125 Megagrams (Mg) of UO_2 as pellets during any calendar month to 1,650 tonnes of uranium (tU) as uranium dioxide (UO_2) pellets annually. This move from a monthly production limit in Mg to an annual limit in tonnes allows for variation in production from month to month. The licensing hearing occurred on November 23, 2022 and the licence was granted by the Commission and came into effect on February 28, 2023.

Production rates for 2022 were within the monthly limit. Detailed plant production information is considered "confidential" and is submitted to CNSC staff on an annual basis under a separate cover.

1.4 Facility Modification

In 2022, there were no modifications undertaken that required written approval from the Commission or a person authorized by the Commission. Several projects, both capital and expense were worked on in 2022. A small sample of some of that work includes the following items:

- Racking and lifting of UO₂ in PP2 - Project investigation and design were conducted in 2022 with implementation planned early in 2023. This change will allow for the material to be stacked to free up floor space.
- Roll Compactor Mezzanine - this mezzanine and hoist will provide an easier and safer way to conduct work on this equipment. Project design was completed in 2022 with implementation early in 2023.
- Drum Tipper - The new drum tipper unit which was installed during the winter shutdown is more robust and has improved safety features.
- Blender roof – project implemented from the JHSC to enclose the blender to prevent powder release if there were an upset condition.

Overall, the electronic process continues to be a better means to track the flow of the design change steps, but it remains a cumbersome list of questions to capture all types of changes beyond the physical ones on site. Additionally, several years into this new system, few people know how to maneuver within it and there are some operational issues that require subject matter expert intervention.

Bi-weekly meeting were initiated in early 2022 to address questions from the SMEs that the project managers would have to address individually. This has been helpful; follow up outside of the meeting is still required in some cases to ensure timeliness of completion of the various sections.

The LCH references core CFM documents that form the licensing basis of the facility in each safety and control area. In 2022, there were 6 documents that were updated and required to be submitted to the CNSC:

- Management System Program Manual (CFM-MS), version #5
- Nuclear Criticality Safety Program Manual (CFM-NC), version #9
- Physical Security Manual (MSP 30-01), version #9
- Change and Design Control Procedure (MSP 13-02), version #22
- Fire Protection Program (MSP 30-07), version #5
- Sealed Source (HSI 048), version #8

2. SAFETY AND CONTROL AREAS

2.1 Management

2.1.1 Management System

This safety and control area covers the framework which establishes the processes and programs required to ensure that the organization achieves its safety objectives and continuously monitors its performance against these objectives, as well as fostering a healthy safety culture.

CFM's Management Systems Program Manual (CFM-MS) is designed to meet the requirements of *CSA N286-12 Management System Requirements for Nuclear Facilities*. The CFM-MS provides the controls necessary to ensure all processes are conducted in a safe manner and processes that apply to licensed activities are conducted in accordance with applicable CNSC and other regulatory requirements. The application of management system requirements is scaled according to the complexity and hazard potential of a particular activity. There were no significant changes to the Management Systems Program in 2022. The CFM-MS was revised in 2022 to update section 11.2 Work Activities, to clarify construction, commissioning and turnover documentation references and edit the commissioning definition.

A site management review meeting is held annually to review the suitability, adequacy, and effectiveness of the management system at CFM. The site programs and procedures that support the policy and ensure conformance to both Cameco and CNSC requirements are reviewed in adequate detail to demonstrate effectiveness. The review is conducted in alignment with of the SCAs contained within the CNSC regulatory framework outlined in CFM's LCH. The 2022 annual site management review meeting was held on March 2, 2023 to review the suitability, adequacy, and effectiveness of the management system at CFM. The site management systems, which cover all site programs, were reviewed and sufficient information was provided to demonstrate effectiveness.

Overall, the conclusion of the site is that the Management System program manuals: CFM-MS - Management Systems Program Manual N286, CFM-QA - Quality Assurance Management System, QA 002 - Nuclear Quality Assurance Manual, FSD-PGR-EMS-001 FSD Environmental Management System and the Licence Conditions Handbook (LCH) are adequate, suitable and effective for the following reasons:

- Adequate – The identified Management System Programs fully meet the requirements of all the standards required by our customers and regulatory organizations.
- Suitable – The CFM-QA (N299.1) and QA-002 (N285) quality programs capture the needs of our customers, including our regulatory customers. The Quality

Manual QA 002 is a separate manual required by our customers who require ASME code work. There are several common procedures and work instructions that apply to both programs and these are referenced in the manuals as required.

- Effective – The internal and external audits are identifying non-conformances and opportunities for improvement; the results are showing that the systems are effectively implemented.

Overall, it is recommended that the conclusion be that the CFM Management Systems, adhering to the N286, N299.1 and N285.0 standards, and the CFM License Conditions (LCH) are suitable, adequate, and effective.

Engagement of all teams at CFM in continual improvement for all 4 pillars of success continued in 2022. Sources of continual improvement activity included:

- Daily huddle meetings. The daily huddle meetings adopted a hybrid in-person/Microsoft Teams approach at CFM Port Hope in 2022. The same overall structure was maintained although an opportunity for improvement was identified to return to a format that is standard across the CFM facilities and evaluate the feasibility of combining the meetings into one daily huddle. The huddle continued to involve all departments in a review of previous day performance and the identification and implementation of improvement activities.
- Monthly Performance Review. CFM continued with a standardized approach for a monthly review of business performance to identify performance gaps and improvement opportunities.
- Continual Improvement review. Supervisors and support staff provide an update to the leadership group regarding performance in the areas of quality, OEE, production and maintenance system performance. Additionally, areas for improvement are identified.
- Monthly Operating Review. The extended leadership team (all people leaders) meet monthly to review performance to operational objectives, report on analysis of those results as well as other themes of importance. Themes covered in 2022 included:
 - follow up self-reflection on workplace violence survey
 - effective written communication
 - communicating across difference
 - safety culture assessment
 - work conduct rules (Personal Accountability standard)
 - relicensing update and intervention strategies
 - ‘my worst leadership moment’
- Kaizen (Green) Cards. CFM targeted participation of all employees in at least one continual improvement activity in their work area. Improvements could be

suggested via the CFM Newspaper process, via the local supervisor led continual improvement meetings or data driven via the Daily Huddle or Monthly Continual Improvement review. 215 (88%) of employees were able to participate in completion of at least one green card in 2022. In total 735 green card participations (1 person participating in 1 green card is deemed a green card participation event) took place. This continues to be strong utilization of the tool.

- Continual Improvement Community of Practice. As recommended in the 2020 Lean Assessment, a Lean Community of Practice group continued to assist advancing and consolidating the various lean systems that are already in place at CFM. Barriers to standardization were reviewed and work was started on common communication templates to be used as part of organizational change management.
- Implementation of SHEQ ergonomic standard. CFM completed its implementation of a new ergonomic program in the fourth quarter of 2022 with the development of a new procedure and the presentation of a general ergonomic awareness session to all employees. The focus of the ergonomic program is on the design stage of new equipment as well as performing ergonomic assessments on high ergonomic risk job tasks. Reports completed by a third party consultant have been reviewed with action items being developed to address identified ergonomic risks.

The last safety culture assessment at CFM was completed in 2021. Overall, when comparing to the 2016 assessment, progress has been made in improving the safety culture. The assessment indicates that the previous focus areas surrounding clarity of safety standard expectations and improving what was noted in some groups as an ‘overly negative’ culture have improved. New areas of focus that have been identified in the assessment include improving communications of all types including safety communication and including the rationale behind business decisions that are made. In addition, there is a notion that leadership field presence, although improved, does not accomplish the goal of identifying gaps to standards and facilitating adherence. With respect to clarity of safety standards and adherence, work continued in 2022 through the following initiatives:

- An agreed to framework was developed in support of the Management System SCA alignment activity completed in 2020 to map all lower level health and safety documents under their respective Health and Safety Programs. When completed, this will provide separation and clarity between procedural and Work instruction/Job Aid level documents to further clarify responsibilities and expectations. In 2022, three new Safety Health Procedure (SHP) documents were published aligning with the Canada Labour Code and providing guidance on the

CFM safety programs related to Medical Services, Confined Space, and the Safety and Health Committee. Seven (7) other programs have been identified and will have SHP documents written in 2023.

- The CoHE Improvement team continued to meet throughout 2022 to identify areas of the CoHE program that could be clarified to eliminate confusion and ambiguity when performing lockouts. This included a pre-shutdown review session with CFM trades, supervisors, and process engineering employees that focused on the completion of isolation lists, partial isolation conditions, and verification requirements. A CoHE scenario exercise was also conducted to highlight areas where gaps in training / knowledge might be occurring. The results of the scenario exercise will be used in the preparation of additional situational training materials over and above the CoHE standard training.
- The development of materials in support of a Systematic Approach to Training continued on a risk priority basis. The scope of this work includes integrating shop floor instruction documents with the training materials in order to further clarify responsibilities and expectations.
- CFM Managers continued to perform in-person monthly process inspections using a standardized check sheet to compare ‘work as done’ to ‘work as imagined.’

There were no organizational changes in 2022 or changes in the roles and responsibilities at the facility that would affect the facility, prescribed information, or nuclear substances.

In 2022, CFM continued to be included in Cameco’s registration to the ISO 14001:2015 Environmental Management System, which is an internationally recognized standards for quality and environmental management through the corporate certificate. Being a part of the corporate certificate provides consistency among the Cameco sites with specific cost benefits being realized, reduction in audit frequencies and better corporate program oversight.

All documents that support the licensed activities are subject to the site document control process. Documents that support the licensed activities are maintained in electronic format on a database available to all site personnel. This includes, but is not limited to, procedures for operating and maintaining the facility, as well as environmental, health and safety, radiation protection and quality assurance documentation.

A listing of management program documents that were revised in 2022 with a short explanation for the reason for the revision is provided below:

- Physical Security Manual (MSP 30-01), version #9 - Information related to the update of the manual is proprietary and confidential.

- Nuclear Criticality Safety Program Manual (CFM-NC), version #9 – The changes in this revision were primarily administrative with clarification regarding Fuel Program Applications and Approvals, correction of cross-referencing errors in and the removal of the reference to the operating licence.
- Management System Program Manual (CFM-MS), version #5 – The changes in this version included an update to the Work Activities section to clarify construction, commissioning and turnover documentation references and edit the commissioning definition.
- Change and Design Control procedure (MSP 13-02), version #22 – The procedure was updated to clarify the definition of change.
- Fire Protection Program (MSP 30-07, version #5) – The program was updated to remove references to NFPA 801 and replace with CSA N393.
- Sealed Source (HSI 048, version #8) – The procedure was updated to reflect the change to an electronic form for the Radioisotope location tracking and remove the reference to paper forms.

In 2022, CFM submitted the *2021 Annual Review Report Metals in Groundwater and Surface Water*, and the *2021 Annual Review Report Volatile Organic Compounds in Groundwater and Surface Water*. Additionally, the CNSC updated and released Revision 0 of the *Licence Conditions Handbook* (LCH) in support of the licence FFL-3641.00/2023.

As part of the management system program, CFM scheduled and conducted internal audits in 2022 to assess the level of conformance to these management systems. In 2022, there were four internal audits conducted by Cameco Corporation and by CFM. The audits focused on Primary Containment, Emergency Response, Threat/Vulnerability Risk Assessment, and Management Systems. All of the audits and inspections that were performed included various aspects of the site training program; however, as a result of an inspection finding in 2021, CFM included the SAT program as a separate element in the internal audit process in 2022. Findings, opportunities for improvement and areas of concern from all audits are entered into CIRS to ensure that they are reviewed by site management and processed accordingly.

There were thirteen external audits or inspections completed in 2022. After being reviewed, all audit findings are entered into CIRS where corrective actions or activities can be assigned, and their progress tracked.

The following is a list of the external audits conducted in 2022:

- General Compliance Inspection focusing on Fitness for Service, Operating Performance, Conventional Health and Safety, Radiation Protection, Training and Waste Management SCA conducted by CNSC staff.

- Compliance Inspection focusing on the Transport and Packaging SCA conducted by CNSC staff.
- Compliance Inspection focusing on Safety Analysis SCA conducted by CNSC staff.
- Compliance Inspection focusing on Emergency Preparedness and Response conducted by CNSC staff.
- Ergonomics Assessment – Final Inspection conducted by ProErgo.
- Stack Flow Assessment conducted by Stantec.
- Air and subject waste compliance inspection by the Ministry of Environment Conservation and Parks.
- Transportation of Dangerous Goods conducted by Transport Canada.
- Liquid Hydrogen Facility Audit conducted by A.V. Tchouvelev & Associates Inc.
- Fire Protection Program audit conducted by PLC Fire Safety Engineering.
- Annual Facility Condition Inspection conducted by PLC Fire Safety Engineering.
- Emergency Response Drill conducted by PLC Fire Safety Engineering.
- Annual FSD Internal Dosimetry Program audit conducted by Arcadis Canada.

The Management System is in place to integrate the requirements for health, safety, environment, security, quality, and finance as described in *CSA Standard N286-12* and in the LCH. Operationally, and as presented to the CFM Board of Directors annually, CFM continues to achieve performance that is in overall compliance with requirements in these areas, including the SCAs and can therefore conclude that the management system is effective at achieving its intended purpose. Resultant improvement actions and opportunities are identified from this management review and are tracked for completion.

The audits described above pertain to other sections of this report; however, the information will not be repeated. Further information regarding CFM's auditing process will be submitted under separate confidential correspondence.

2.1.2 Human Performance Management

This safety and control area covers activities that enable effective human performance, through the development and implementation of processes to ensure that there are sufficient numbers of employees in all relevant job areas and that they have the necessary knowledge, skills, and tools to safely carry out the licensed activities.

CFM has a sufficient number of qualified workers as well as the minimum number of responsible people to carry on the licensed activities safely and in accordance with the NSCA and its Regulations.

CFM has a number of programs, procedures and processes that establish the framework for a safe work environment and foster a sustainable safety culture at the site. All employees are encouraged to maintain a questioning attitude with respect to health, safety, radiation protection and environmental issues.

The Systematic Approach to Training (SAT) method of training applies a robust, risk-informed system to analyze and track training requirements and develop and deliver appropriate training. The SAT process covers the initial training of employees, routine re-qualification, as well as re-qualification of employees after an extended absence. Records are maintained for all training documentation. CFM documents this system in a site procedure titled “Systematic Approach to Training – Training Plan” (CFM-HR-01) to meet the CNSC Regulatory Document 2.2.2 *Personnel Training*”.

Training and employee qualification activities continued through 2022 at CFM amid pandemic related challenges. The global pandemic for COVID began to ease toward the end of 2022. Despite the continued challenges, CFM Training finished with another strong year. The use of Virtual Instructor Led Training, or VILT, continued in 2022 using Microsoft Teams. CFM Emergency Response was delivered using this approach. External vendors like the Canadian Mental Health Association (CMHA) continued to deliver their content through VILT after having paused their training during most of the year. Toward the end of the year, the CMHA was able to deliver an in-person session for a safety presentation. Instructor Led Training, or ILT, continued for safety critical courses. No-Go courses covering lift trucks, elevated work platforms, hoists, and confined space continued throughout the year. As external venues began to open up, first aid training could be offered offsite in a meeting facility.

This year was another strong year for training compliance, with CFM ending 2022 with a 97.5% compliance score. CFM also ended the year with a 99.6% completion of No Go courses. CFM employees completed 6,112 hours of training during the year and completed 200 scheduled in-person courses, which is a 32% increase from 2021.

The training department continued providing No-Go status updates during the weekly morning supervisor meetings.

The Radiation Protection training, which was developed using the Systematic Approach to Training framework continued to be offered in 2022. During the year, 129 employees were assigned and completed the training. By the end of the year, 100% of active employees were compliant. In fact, CFM was 100% compliant for the remainder of the year after the first quarter. In 2021 CFM updated the Radiation Protection training to incorporate changes in the revised *Radiation Protection Regulation* released by the CNSC in 2020. In 2022, additional updates surrounding the urine analysis content were completed. The training provided in 2022 included the required updates.

At the end of 2022 CFM had a very strong year with safety course metrics at 100% compliance in other training programs such as: CoHE – Control of Hazardous Energy, CAM Job Hazard Analysis, and Electrical Safety for non-electrical workers.

Some improvements in the training program advanced in 2022 include:

- SAT Spill Clean Up – SAT for a newly updated Spill Clean Up course began at the end of 2022 with an expected completion for the first quarter of 2023.
- SAT PP2 – work continued updating an SAT compliant package for PP2 operators.
- SAT Radiation Protection - Updated the eLearning based on changes to the content around urine analysis. This involved updating the analysis and design.

CFM complies with Part III of the *Canada Labour Code* as it defines the maximum hours of work for all employees on-site. In addition, CFM has committed to the CNSC that a minimum complement of employees will be available to respond to emergency situations.

Cameco has a range of programs in place to ensure that employees are fit for duty. These programs and procedures cover human resource matters such as a program for alcohol and substance abuse, mental health assistance, violence in the workplace, respectful workplace as well as addressing more general health matters such as routine medical surveillance and radiation protection monitoring.

Updated documents (procedures, work instructions etc.) flow through a Document Review Record (DRR) process. Any document that is identified as impacting an employee's tasks is electronically routed through this process for the employees review and signature. The process documents the changes to the document and that the employee has reviewed the document. The process also allows for feedback from the reviewer to the document owner.

There are no CNSC certified positions at CFM; however, CFM does employ trade staff such as electricians, millwrights, and process technicians (instrumentation technicians).

In 2022, CFM hired a Lead Process Engineering Technologist. This position had formerly been filled by an employee who was promoted in 2021 and was covering both positions. CFM also hired an Occupational Health Nurse in 2022 in preparation for retirement of the current nurse expected in 2023. Two supervisors, one from Cobourg and one from Port Hope were transferred to the other facility for development opportunities. There were no other changes in certification of personnel (including recertification and decertification) or any change in status of certified personnel (e.g., termination, removal from duties, failure to pass a requalification exam, retirements, or transfers).

CFM continues to enhance communication between facility management and employees as this is critical to sustaining a positive safety culture. To support communication with employees and contractors, several methods are utilized to ensure critical/important information is delivered in a timely fashion. Critical/important information may include topics of industrial safety, radiation safety, environmental protection, quality performance, production and project plans, management systems, etc.

CFM Training continued to provide support to employees and long-term contractors on training, qualifications, and requalification at CFM. Through a continuous improvement mindset and attention to course completion, the compliance results for 2022 continued to strengthen throughout the year. Maintaining strong results coincided with SAT development and responding to corrective actions. The training program continues to be effectively implemented, as demonstrated through compliance scores and completion of the training plan.

2.1.3 Operating Performance

This safety and control area includes an overall review of the conduct of the licensed activities and the activities that enable effective facility performance.

In 2022, CFM continued to operate in a manner that supports safe, clean, and reliable production and in compliance with applicable acts and regulations.

Production rates for 2022 were within the monthly limit. Detailed plant production information is considered “proprietary” and is submitted to CNSC staff on an annual basis under a separate cover.

For a three-week period in July of 2022 and one week period in December, the facility underwent planned shutdowns to complete maintenance and project work and to conduct uranium physical inventory activities (in support of CNSC/IAEA requirements).

The main challenge for CFM in 2022 continued to be sustaining ongoing reliable operations and meeting customer commitments while operating throughout the uncertainty caused by the COVID pandemic. Although 2022 represented the third year of the pandemic, there continued to be changing requirements and employee absences to manage. Once again in 2022 CFM employees were able to meet the challenge and continued to perform safely.

During 2022, CFM experienced three reportable incidents. The incidents were thoroughly investigated with corrective action plans developed. There was no risk to the public related to any of these incidents. Cameco is confident that through the corrective actions implemented, the review of the incidents that occurred and robust management systems CFM will continue to operate in a safe, clean, and reliable manner. The incidents were posted to the Cameco’s web site and can be viewed using the following hyperlink.

[Environment & Safety - Fuel Manufacturing: Port Hope & Cobourg - Fuel Services - Businesses - Cameco](#)

On July 6th smoke from roofing tar work was detected by an office area smoke detector which triggers an automatic fire alarm. The alarm activated the emergency response system including a call for response to the PHFES. The PHFES responded to the site and confirmed the conditions that activated the alarm.

On July 21st the Fire Alarm system was enunciated, activating CFM’s Emergency Response Centre. Indications on the fire panel were that the alarm was due to the carbon dioxide fire suppression system on the dust collector at press 1 which is currently idle. Employees on site evacuated to the muster area and were accounted for. The municipality of PHFES responded to alarm and were met/escorted by CFM’s Immediate

Responders. After a review of the area, it was determined that there was no fire and that the alarm was false.

On December 24th after several hours without electricity in the plant, the fire alarm panel annunciated flow in the sprinkler system within the maintenance paint booth. There were no personnel or work occurring on site. PHFES responded to the alarm; one of the responders had knowledge of the system and location which allowed them to quickly ascertain that there was no emergency. They disabled the sprinkler in the paint booth and reset the fire system.

Overall, CFM's Operational Performance remains effective. CFM continued to meet customer requirements safely and at expected quality levels. Continual improvement activities continue to focus on reducing internal defect levels and improving equipment performance. CFM continues to maintain the implemented management system and programs for the safe and effective operation of the facility.

2.2 Facility and Equipment

2.2.1 Safety Analysis

This safety and control area covers the maintenance of the safety analysis, which supports the overall safety case for the facility. The 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.

To operate in a safe, clean, and reliable manner, CFM utilize various programs and procedures including the Safety Analysis Report (SAR), Fire Hazard Assessment (FHA), environmental aspects registry, chemical hazard and other assessments.

The design, construction, operation and maintenance of CFM is intended to eliminate or minimize to the extent possible the potential of radiological, chemical or other physical hazard to facility personnel, the environment and the general public. This is accomplished not by a single approach but rather by a defense-in-depth approach and has been systematically reviewed and documented from several perspectives.

CFM has a Safety Analysis Report (SAR), which was updated in May of 2021, documents the hazards, preventative measures and mitigating controls associated with the licensed activities at the facility. This report summarizes major assessments for the facility and is updated to incorporate facility changes and improvements since the last version.

This safety report is periodically reviewed, on a frequency not to exceed every five years, which includes:

- assessing incidents that have occurred at the facility against the report to confirm the response of safety systems
- assessing all design changes, including those initiated as a result of an incident or accident
- assessing the results of supporting studies and reports
- reviewing the credible accident scenarios and predictive modelling

CFM also has a Safety Risk List as part of the Corporations risk management initiatives. The Safety Risk List is a hazard-based risk register that reviews all trigger/threats for all health and safety hazards (e.g., injury from fall, workplace violence, hazardous energy, contact with objects etc.). For each hazard each trigger is ranked for likelihood and consequence giving the inherent (un-mitigated) risk. Credits are applied based upon protective controls (passive or active) to identify if the control reduces likelihood or consequence. Each control is ranked via the corporation's Risk Management Standard. After ranked controls are applied to the hazard, resulting with a residual (mitigated) risk

is generated. The initial matrix was developed in 2020 with CFM and SHEQ subject matter experts. No hazards at CFM's facilities have been shown to have a residual risk greater than 20.

The facility has a nuclear criticality program, accepted by the CNSC, to address the handling and processing of enriched uranium. The Nuclear Criticality Safety Program Manual (NCSPM) meets the requirements outlined in the CNSC regulatory document *RD-327 Nuclear Criticality Safety*. This document was updated in 2022 to include clarification regarding the Fuel Program Applications and Approvals, correction of cross-referencing errors and the removal of the reference to the operating licence. There were no processing activities of enriched material conducted on site in 2022.

The physical improvements implemented in 2022 did not alter or affect the overall design basis for the facility and therefore, the design basis remains valid.

As required by its operating licence, CFM is subject to third party reviews for verification of the requirements under the current edition of the *National Building Code*, the *National Fire Code*, and *CSA N393 "Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances"* for all modifications. In 2022, there was one third party review report for modification to the Drum Turnover Equipment that was completed in December 2022 and will be submitted to the CNSC.

Other Safety Analysis initiatives include the following:

- ACGIH annual NIC list assessment: in conjunction with corporate personnel, CFM conducted a review of 2022 ACGIH proposed changes. No new limits were identified to be imposed for substances in use at CFM and no actions were determined to be necessary.
- Welding Fume Sampling: Welding fume sampling, specifically targeting aluminum welding, was conducted late in 2022 by a qualified third party. A report was obtained which documented exposure well within permissible limits.
- Silica in Brick Sampling: A third party assessment of silica in brick exposure was performed for the cutting of high-density furnace bricks. The process was conducted as a trial for "wet" brick cutting without extraction. The report indicates no elevated exposure of silica was found.
- Ergonomics: The new corporate ergonomic standard was released to the sites in 2022 and CFM developed and implemented its own ergonomic program by year end. Focus is now being directed to ergonomics at the design stage through MOC as well as ergonomic awareness through training and communications.
- CoHE: The CoHE improvement team continued to meet regularly to find ways to improve application of the current CoHE program and to provide clarity for those who have questions. Issues being addressed range from contractors and CoHE, to

lockout verifications. The 2022 summer shutdown once again included a “town hall” type meeting with employees to go over updated CoHE procedures and the expectations regarding lockout/tagout.

- Confined Space: During the 2020 SHEQ audit some issues were identified on a sample of completed confined space permits. One specific finding was: Documented air tests [atmospheric monitoring] did not comply with the testing plan outlined on the permit. As a result of the finding, confined space permits have been revised to provide clarity on atmospheric monitoring throughout the confined space entry.
- As in 2021, CFM continued to perform safety audits/inspections and implement recommendations through its corrective action process. Job Task Observations (JTOs) were completed at a rate of 98% overall throughout the year while 93% of all required layered inspections were completed.

CFM is maintaining an effective safety analysis program that identifies and assesses hazards and risks, including new and unforeseen risks not initially considered, on an ongoing basis. CFM maintains a Safety Analysis Report and Safety Risk List that considers the hazards associated with CFM’s facilities. These analyses are a systematic evaluation of the potential hazards associated with the specific activities and considers effectiveness of preventative measures and strategies in reducing hazard effects. The risk assessment supports the development and setting of site objectives and targets, as well as the development of preventive and protective measures for personnel and operations.

2.2.2 Physical Design

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

As part of Cameco's budgeting process for capital expenditures, plant improvements related to physical design are identified and prioritized.

Design requirements impact all life cycle phases of CFM facilities, from site selection, construction, operation and through to decommissioning. To ensure ongoing effectiveness of all systems, structures, and components essential to the safe operations at CFM, changes to the physical design of equipment, processes and the facility are managed through the Change and Design Control program (MSP 13-02 - Change and Design Control).

These identified systems, structural, and component changes are subjected to a graded approach to the application of CFM's management systems; taking into account design inputs / requirements such as, but not limited to, regulatory, functional, performance, operational, safety, environmental and quality considerations, and stakeholder impact.

CFM continues to use the SAP Management of Change (MoC) process in 2022 and continued to track compliance. Subject Matter Expert questionnaires and reference documents were updated throughout the year to incorporate any new or changes to the existing regulatory requirements, standards, internal Cameco and CFM procedural changes, etc., as well as to account for any organizational changes.

Once designs are established and approved, equipment and services that are required to permit construction of the design are procured through supply chain management. Activities include but are not limited to, procurement documentation, specification development, vendor selection, receipt and inspection and storage of items.

Improvements to the facility completed in 2022 include the following:

- Racking and lifting of UO2 in PP2 - Project investigation and design was conducted in 2022 with implementation early in 2023 and will allow for the material to be stacked to free up floor space.
- Roll Compactor Mezzanine - this mezzanine and hoist will provide an easier and safer way to conduct work. Project design was completed in 2022 with implementation early in 2023.
- Drum Tipper - The new drum tipper unit which was installed at the winter shutdown is more robust and has improved safety features.

- Blender roof – project implemented from the JHSC to enclose the blender to prevent powder release during an upset condition.

Overall, the electronic process continues to be a better means to track the flow of the design change steps and continues to be improved upon. Bi-weekly meeting were initiated in early 2022 to address the questions by the SMEs that the project managers would have to address individually.

The physical improvements did not alter or affect the overall design basis for the facility and therefore, the design basis was valid and maintained in 2022. The requirement in *REG DOC 3.1.2* requesting a description of validation activities and the results of the validation for any major changes is not applicable at CFM, as there were no major changes.

CFM has a contractual arrangement with the provincial Technical Standards and Safety Authority to ensure that oversight of pressure retaining components and systems continue to be carried out by a third-party expert.

CFM has implemented and is maintaining a design control process that effectively ensures design outputs are reviewed, verified, and validated against the design inputs and performance requirements. CFM ensures that the design inputs selected for safety, performance and dependability of the design item are achieved.

2.2.3 Fitness for Service

This safety and control area cover activities that impact the physical conditions of systems, structures, and components to ensure that 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.

CFM has programs and procedures that ensure that the facility is operated in a safe, clean, and reliable manner.

CFM has an established Planned Maintenance (PM) program as defined in site documentation. All tasks are initiated and documented through the site work notification system. In 2022, CFM continued to utilize SAP for all planned maintenance. Maintenance plans are issued, reviewed, and updated periodically to ensure the routines developed continue to be effective and adequate. KPIs are in place to monitor the effectiveness of the program. Testing and verification activities are integrated into the preventive maintenance strategy for systems, structures, and components.

The asset management program accounts for ageing through a number of processes designed to detect early warning signs and to prescribe rehabilitation programs or proactive replacement strategies. The effectiveness of the program is measured by the same means as the overall maintenance program.

Fire protection systems are tested according to an established schedule as outlined in the Fire Protection Program. Third-party reviews are conducted to confirm that required tests and inspections are completed and these review reports are submitted to the CNSC. In 2022 there was one projects that required a third party reviews that will be submitted to the CNSC in 2023.

Continual improvement within the Fitness for Service Safety Control area is contained within the Operational Reliability Improvement plan. This plan was established early in 2020 based on the results of an Operational Reliability Self-Assessment that was completed at CFM by the Cameco Asset Management and Reliability team together with Fuel Services Division site representatives in October of 2019.

Regular progress reviews continued at the site as well as divisional level. Eight out of 21 actions planned to be completed in 2022 or carried over from the previous years have been completed. Main delays have been experienced in ability to establish / source and complete the required training primarily because of the COVID pandemic.

The KPI's related to Fitness for Service in 2022 included:

1. Continually Improve Overall Equipment Effectiveness (OEE) – Overall OEE was stable in 2022. There were some challenges related to staffing as a result of COVID; however, the production demands were the same and operationally the plant was run in a similar fashion as the previous two years.
2. Improve Efficiency and Effectiveness of Maintenance Activities – The results in 2022 were lower compared to previous 2 years. There has been a significant amount of work completed in the SAP system to align the scheduling of PM work orders around the summer and winter shutdowns, which resulted in the requirement to cancel a significant number of redundant work orders. This negatively affected the KPI results. There also were few weeks throughout the year where completed work orders weren't closed on time resulting in additional negative impact to the KPI results.

Overall CFM Fitness for Service program remains effective. CFM continued enhancing and optimizing Operational Reliability with the goal of improving Overall Equipment Effectiveness while reducing operating costs and overall achieving performance comparable to industry best practices in all aspects of its operation. The main challenges in 2022 were related to Depleted fuel campaign in Port Hope plant and the ongoing technical staffing shortages in both plants.

The maintenance, surveillance and in-service inspection and testing programs continue to be managed effectively at CFM. All safety significant systems continue to operate without serious incident and improvement to overall fitness for service programs continues. All maintenance programs incorporate strategies for assessing the ongoing effectiveness of equipment, including detecting and deleterious effects of aging.

2.3 Core Control Processes

2.3.1 Radiation Protection

This safety and control area covers the implementation of a radiation protection program, in accordance with the *Radiation Protection Regulations*. The program must ensure that contamination and radiation doses are monitored and controlled.

CFM has an extensive Radiation Safety Program in place to meet the requirements of the *Nuclear and Safety Control Act* and the *Radiation Protection Regulations* and to ensure exposures are kept to levels ALARA. The program includes the following components:

- external radiation dosimetry – personal monitoring.
- internal dosimetry – urine analysis and lung counting program.
- workplace air sampling program.
- respirator program.
- contamination surveys; and
- gamma surveys.

The CNSC regulatory limits for total effective dose for Nuclear Energy Workers (NEWs) are 50 millisievert (mSv) per year and no more than 100 mSv over specified five-year periods.

For various radiological parameters, CFM has established action levels, accepted by the CNSC that may be indicative of a potential loss of control for that specific parameter. Action levels pertaining to radiation protection are listed in the Radiation Protection section of CFM's LCH. These action levels serve as an early warning of a condition that warrants further investigation. A result above an action level is investigated and remedial actions taken if necessary.

Radiation protection objectives and targets are established jointly by members of the site management team and site specialists to ensure there is agreement, commitment and awareness of these objectives and targets across all areas of the operation. These objectives and targets can address, among other things, worker dose reduction initiatives and other projects which examine ways to reduce airborne uranium concentrations. The status of these objectives and targets is reviewed by the site management team through KPIs and resources are allocated as required to achieve the targets.

Some of the radiological activities in 2022 included:

- Created an extremity dose assessment program to perform prior to a change that could impact extremity dose NEWs to determine if licensed dosimetry is required after the change is implemented.

- Implemented improvement to continuous air samplers throughout the facility and refined site response to alarm.
- Implemented module accessible to all employees to review results from continuous air monitors that is updated on a daily basis.
- Formalized Radiation Protection section of the onboarding process to ensure timely and consistent message for all new employees.
- Upgraded Hand and Foot monitors operating systems on main computers.
- Purchased new Tennelec counter to ensure seamless counting operations.
- Formalized a routine clean down procedure of CAMheads to improve functionality of the units.
- Developed and deployed CAMHead tracking database to effectively track the location and status of CAMHeads.
- Established an electronic Radioisotope Tracking database.
- Collected and reviewed dose rate data through OSLDs posted throughout the facility.
- Continued oversight for compliance to hand and foot monitoring requirement as well as urine submissions.

Procedural reviews related to radiation protection that were made in 2022 include the following:

- HSI-037 ALARA – Updated to reflect changes in 2020 *Radiation Protection Regulations*.
- HSI-038 Radiation Exposure Control – Updated to reflect changes in 2020 Radiation Protection Regulations (i.e., Pregnant NEWs notification requirements and added breastfeeding NEWs) and added proposed eye dose action levels.
- HSI-039 Internal Radiation Monitoring – Updated procedure reference list, updated actions to take if lung count surface contamination occurs, removed Pregnant NEWs requirement to go for lung count and added wound care if occurred outside of facility.
- HSI-048 Sealed Source - Update include electronic form for Radioisotope tracking, remove reference to paper forms.
- HSI-060 CAM head Amber Alarm - Update to clarify instructions for Security staff when no CFM staff on site to address.
- HSI-544 Alpha Sentry Continuous Air Monitoring CAM System – New work instruction

- HIS-545 Alpha Sentry Continuous Air Sampling Performance Check – New work instruction

CFM is committed to the ALARA concept and is continually identifying and implementing radiation protection improvements. The success of the above initiatives and programs are measured against set ALARA targets.

CFM's performance in 2022 regarding the ALARA targets is summarized below:

- Maintain employee radiation exposures to ALARA levels or below:
 - The average whole body dose for all NEWs was below the public dose limit of 1 mSv which is considered in the region of ALARA.
 - The individual total effective dose ALARA target for 2022 was maintained at 9.5 mSv/year as a maximum dose to an individual. This goal was achieved in 2022 as the maximum total effective dose for the year was 7.2 mSv.
 - The average Whole Body and Skin Dose in 2022 was lower than previous years.
 - The maximum internal dose was lower than previous years except for 2020.
 - The average Effective Dose is comparable to and lower than the previous 4 years. The maximum Effective Dose is lower than previous years except for 2020.
 - The urine results for employees in the program, continued to be low in 2022 with only one exceedance of the screening level.
- Achieve 98% compliance to Urine Analysis schedule
 - Urine sample submissions in 2022 were above the target with 99% of samples submitted and 99% of employees submitting urine samples on time.
- Other ALARA initiatives:
 - weekend furnace banking heat sink material (uranium dioxide pellets) was replaced with brick material. The project removes the need for storage of sintered uranium dioxide pellets near the furnace operators which is expected to reduce external dose exposure. The project also represents an ergonomic improvement as the boat/brick array is lighter and is easier to grip and carry.
 - the development of cages around the sintering furnace boats to help maintain the pellet arrays on the moly slabs to reduce the likelihood of furnace jackknife events and reduces the need for maintenance personnel to interact with pellets during the disassembly of the furnace to clear the product.

- air handling of the pellet grinder line was balanced to minimize/reduce the amount of overspray. This project reduced the likelihood of airborne uranium.
- lead curtains for the pellet carts were adjusted to allow curtains to fully close increase the shielding in the pellet storage area.
- twin-cone blender was enclosed which will contain leak and prevent airborne uranium from entering the operator's work areas.

As part of CFM's audit program, several audits and inspections related to radiation protection were conducted which included legal and regulatory compliance audits as well as procedural use and adherence inspections. Any issues identified during these audits are documented in the CIRS system and appropriate corrective actions were taken.

Radiation Protection training, which was developed using the Systematic Approach to Training framework, continued to be provided virtually. During the year, 129 employees or contractors were assigned and completed the training. By the end of the year, 100% of active employees were compliant. In fact, CFM was 100% compliant for the last three quarters of 2022. An update to the Radiation Protection training content around urine analysis resulted in updating the analysis, design, and eLearning. The updated content was published on the Learning Management System.

In 2022, radiation monitoring instrumentation was maintained as per regular calibration and maintenance schedules. The hardware in the hand and foot monitors was upgraded in 2022 to extend the lifespan of this equipment.

Inventory of sealed and unsealed sources that are used or possessed on-site are referenced in the radioisotope source work instructions. In 2022, this process was upgraded to an electronic system. The inventory completed in 2022 determined the sources are in a state of safe operation and pose no undue risk to workers.

Radiological initiatives planned for 2023 include:

- Commission alpha counter for air sampling system (part of CFM's plan to maintain current and upgrade from planned obsolete equipment).
- Review and identify possible process improvements for monitoring and releasing zone 2 wastes.
- Maintain or reduce radiation dose levels.
- Implement projects that will reduce exposure to radioactive materials.
- reduce the number of CAM head alarms by 5% over 2022.

Full deployment of CAM head technology in the furnace hall and continued use of the CAM heads in other areas of the facility is creating a more proactive response to uranium in air events. The exposure duration to the workforce has been reduced and is demonstrated through the urine analysis program. In 2022, there was one uranium in urine result greater than the screening level of 2.0 µgU/L. The Radiation Protection Program remains effective as evidenced by the low dose results, no action level exceedances, removal of extremity dose requirements as well as the implementation of ALARA projects implemented in 2022.

Dosimetry

At CFM, all employees and contractors working more than 80 hours per year are considered NEWs and are provided dedicated dosimeters to measure external radiation exposure. CFM uses Landauer's Optically Stimulated Luminescence (OSL) dosimeters to monitor whole body, skin, and eye dose. Dosimeters are changed monthly for production related employees and quarterly for all other employees. Landauer, a licensed dosimetry service provider, sends the dosimeter results to the National Dose Registry (NDR) and provides a copy to CFM.

CFM assesses internal dose using lung counting from Cameco's licensed internal dosimetry service. The internal dose program applies to CFM employees who are in direct contact with open uranium dioxide for more than 500 hours per year working in the Pelleting Area. These employees undergo a direct in-vivo (lung counting) measurement twice per year, with campaigns running six months apart. Internal dose for other employees is prorated based on the number of hours that individual worked in the Pelleting Area throughout the reporting year and the average dose from the measured group. For employees and contractors that worked less than 80 hours per year in the Pelleting Area an internal dose is considered insignificant and is not assigned.

In 2022 there were no exceedances of CFM's radiation protection action levels.

The following tables and graphs summarize the 2022 annual dose results for employees:

- whole body dose.
- skin dose.
- extremity dose.
- urine analysis results.
- internal dose; and
- total effective dose.

Whole Body Dose

The action levels for whole body dose for NEWs are 1.6 mSv per month for production staff and 1.0 mSv per quarter for support staff and contractors. The monthly action level applies to NEWs who are monitored on a monthly basis (primarily production employees). The quarterly action level pertains to NEWs who are monitored on a quarterly basis (i.e., office staff, contractors, etc.). These individuals receive lower radiation exposure and therefore a lower action level has been established. Additionally, all individuals that were assigned personal dosimeters and classified as non-NEW received no measurable whole body dose in 2022.

Table 2 and Figure 3 display the distribution, in 1 mSv increments, of whole body dose for all NEWs in 2022. Note that figures with ranges on the horizontal axis identify results that are greater than or equal to the first number and less than the second value. For example, 1 – 2 on the horizontal axis in figure 3 means all results in that range are greater than or equal to 1 mSv (≥ 1 mSv) and less than 2 mSv (< 2 mSv).

As can be seen from the table and figure, approximately 86% of employee external whole body doses in 2022 were 1 mSv or less, with all employees whole body doses less than 5 mSv (100%). Distribution results for 2022 were different when compared to those in 2021 with more individuals in the 0-1 mSv range and less individuals in the remaining bins. In 2022, there was also no individuals greater than 5 mSv whereas in 2021 there was 0.5%.

Table 2

2022 Whole Body Dose Distribution	
Dose Range (mSv)	Percentage of Individuals (%)
0 – 1	86.3
1 – 2	7.5
2 – 3	4.1
3 – 4	1.2
4 – 5	0.8
> 5	0.0

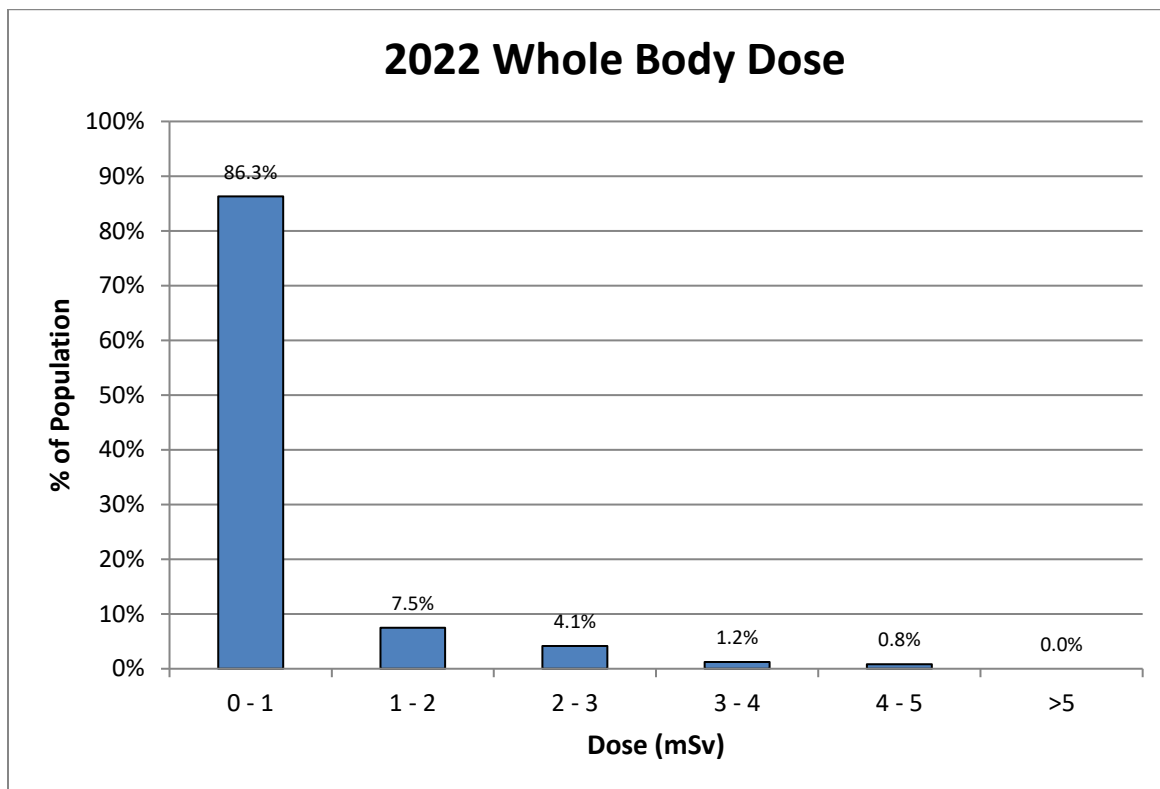
Figure 3


Table 3 shows the annual NEW whole body dose results for three work groups: employees in operations; employees in administration and/or support roles; and outside contractors/visitors. The highest exposures are from the operations work group, consisting of production, maintenance, and quality personnel. The average dose for all NEWs was 0.4 mSv in 2022 and the maximum individual external whole body dose was 4.9 mSv to a Pelleting Area employee.

Table 3

2022 Annual Whole Body Dose				
Work Group	Number of Individuals	Average (mSv)	Minimum (mSv)	Maximum (mSv)
Operations	118	0.8	0.0	4.9
Administration / Support	95	0.0	0.0	0.9
Contractors/Visitors	28	0.0	0.0	0.0

Table 4 and Figure 4 show the annual average, minimum, and maximum individual external whole body exposure for all NEWs from 2018 – 2022. The average dose in 2022 was lower than previous years other than 2020 which was the same. The maximum

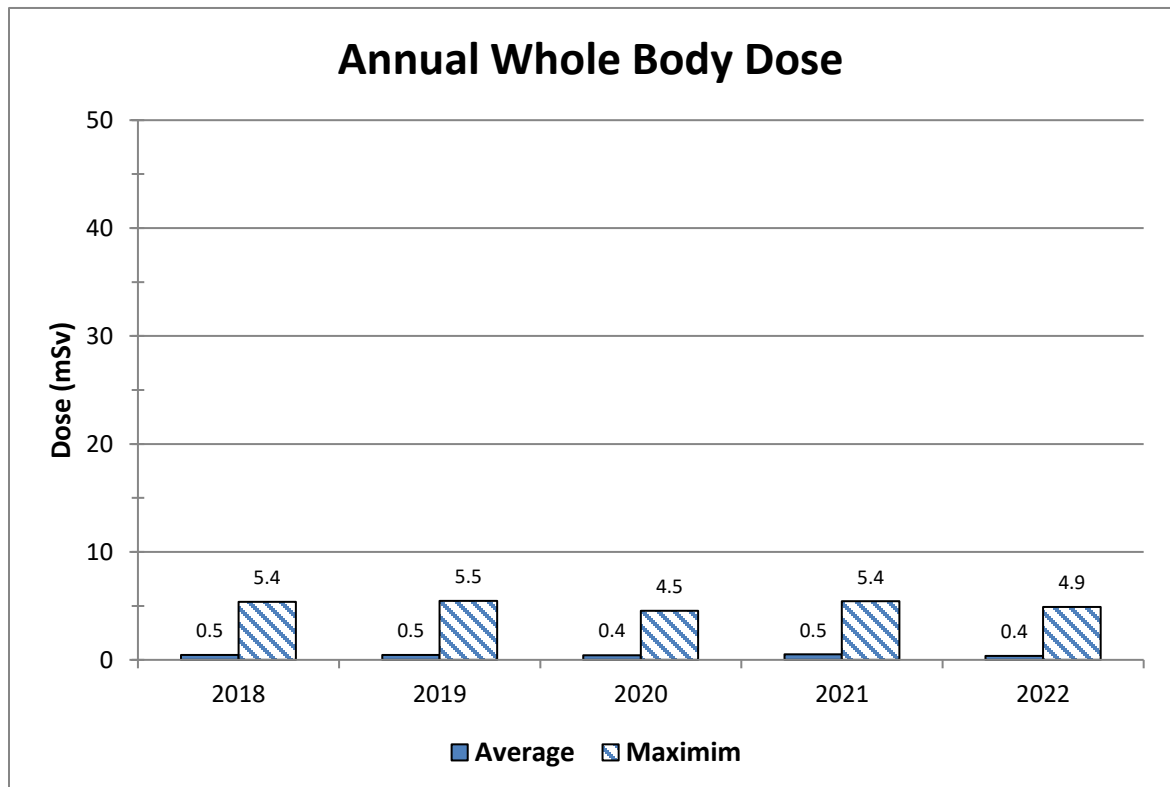
dose was also lower than previous years except 2020 which was lower. Average and maximum dose can be impacted by numerous conditions such as the number of people, overtime, work tasks, etc. In 2022 many of CFM's support staff returned to the site on a full time basis which would have lowered the average dose.

The individual with the maximum whole body dose is an operator in the Pelletizing Area; and is the same individual with the maximum dose in 2021.

Table 4

2018 – 2022 Whole Body Dose				
Year	Number of Individuals	Average Dose (mSv)	Minimum Dose (mSv)	Maximum Dose (mSv)
2018	267	0.5	0.0	5.4
2019	256	0.5	0.0	5.5
2020	247	0.4	0.0	4.5
2021	217	0.5	0.0	5.4
2022	241	0.4	0.0	4.9

Figure 4



Skin Dose

The CNSC regulatory limit for skin dose to NEWs is 500 mSv per year. CFM's action levels are 20 mSv per month and 5 mSv per quarter. The action level for skin dose was not exceeded in 2022.

Table 5 shows the annual NEW skin dose results for three work groups: employees in operations; employees in administration and/or support roles; and outside contractors/visitors. The highest exposures are from the operations work group, consisting of production, maintenance, and quality personnel. The maximum skin dose in 2022 for a production employee was 47.4 mSv (9% of annual limit). The average dose for all NEWs in 2022 was 2.8 mSv. In 2022, all individuals that were assigned dosimeters and classified as non-NEW received no measurable skin dose.

Table 5

2022 Annual Skin Dose				
Work Group	Number of Individuals	Average (mSv)	Minimum (mSv)	Maximum (mSv)
Operations	118	5.7	0.0	47.4
Administration / Support	95	0.0	0.0	1.3
Contractors/Visitors	28	0.0	0.0	0.0

Table 6 and Figure 5 display the distribution of skin dose received by NEWs in 10 mSv increments at CFM in 2022. The majority of NEWs received a skin dose below 10 mSv (89%) with no employee exposures above 50 mSv. The distribution in 2022 is improved when compared to the 2021 distribution with more NEWs in the 0-10 and 10-20 mSv bins; however, there were more NEWs in the 20-30 mSv range in 2022.

Table 6

2022 Skin Dose Distribution	
Dose Range (mSv)	Percentage of Individuals (%)
0 – 10	89.2
10 – 20	6.2
20 – 30	2.9
30 – 40	1.2
40 – 50	0.4
> 50	0.0

Figure 5

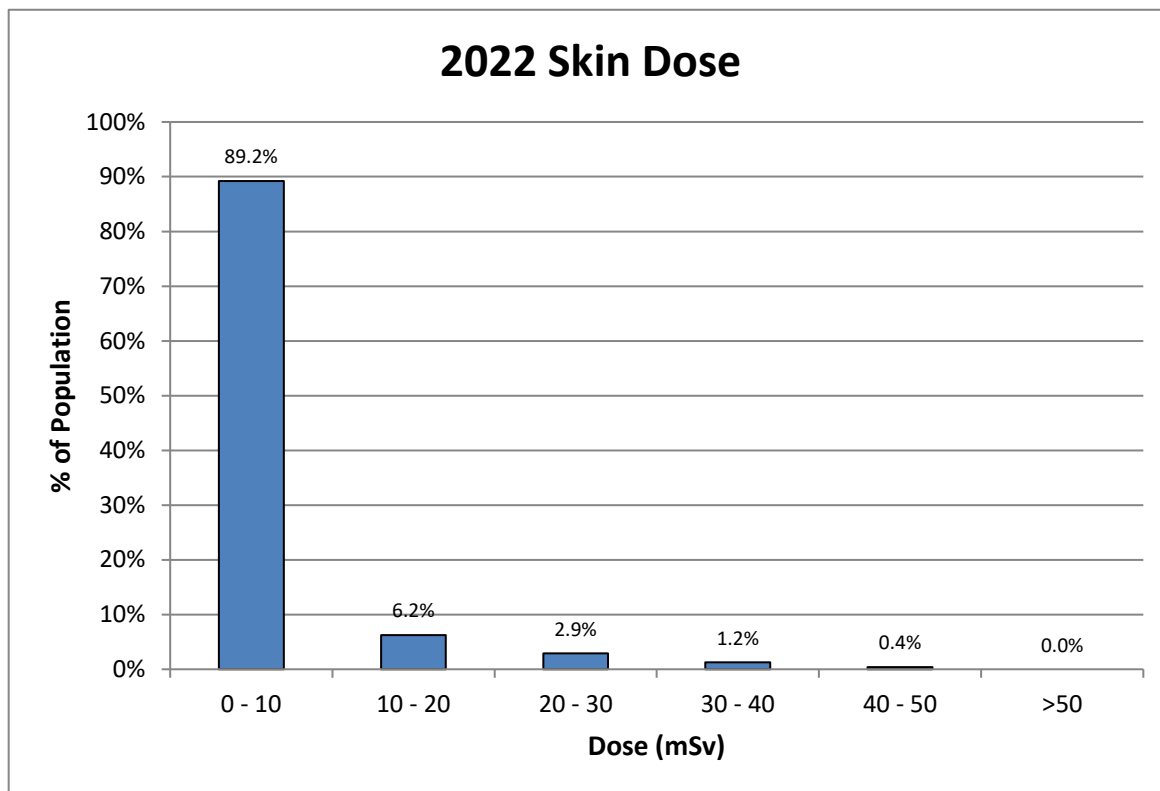
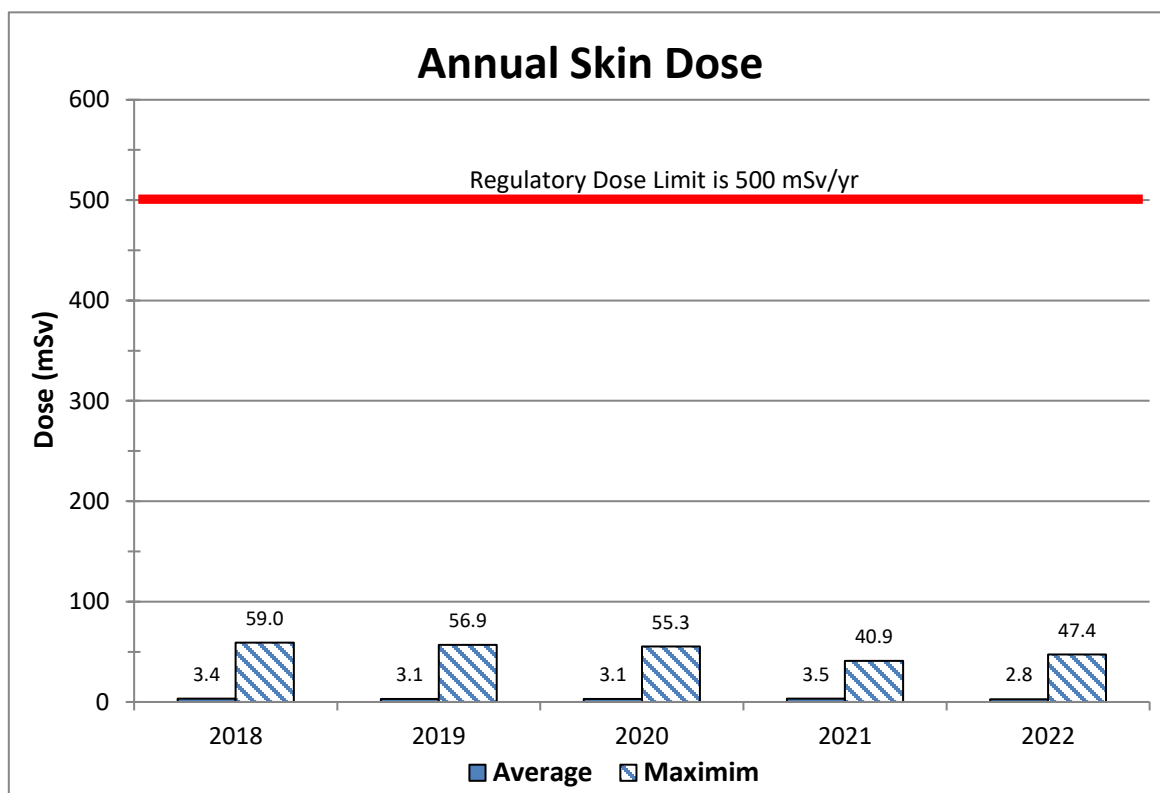


Table 7 and Figure 6 present the employee annual average, minimum, and maximum individual skin exposure for the five-year period from 2018 – 2022. The chart illustrates that the maximum annual dose received by an individual is below the regulatory limit. The average skin dose in 2022 was lower than the previous 4 years. This is due to number of employees in the 0 – 10 mSv range which has increased over the years with no employees over 50 mSv and less employees in the 40-50 mSv range. The maximum skin dose was lower in 2022 than previous years except for 2021. Average and maximum dose can be impacted by numerous conditions such as the number of NEWs onsite, overtime, etc. The employee with the maximum skin dose is a Pelleting Area employee and is not the same employee with the maximum whole body dose in 2022.

Table 7

2018 – 2022 Skin Dose				
Year	Number of Individuals	Average Dose (mSv)	Minimum Dose (mSv)	Maximum Dose (mSv)
2018	267	3.4	0.0	59.0
2019	256	3.1	0.0	56.9
2020	247	3.1	0.0	55.3
2021	217	3.5	0.0	40.9
2022	241	2.8	0.0	47.4

Figure 6


Eye Dose

Starting on January 1, 2021 the CNSC regulatory dose limit to the lens of the eye for NEW's is 50 mSv per year. Prior to this the regulatory dose limit to the lens of eye was 150 mSv. In 2022, CFM set a monthly interim action level of 6.0 mSv and a quarterly interim action level of 12.0 mSv. The interim action levels were approved by the CNSC in July 2022. There were no exceedances of the action level during the year. In 2022, all individuals that were assigned visitor dosimeters and classified as non-NEWs received no measurable eye dose.

Table 8 and Figure 7 display the distribution, in 5 mSv increments, of the calculated dose to the eye for all NEWs in 2022. The calculated eye dose for the majority of NEWs was below 5 mSv (89%) with very few employees above 20 mSv (less than 1%). The distribution in 2022 is improved when compared to the 2021 distribution with more NEWs in the 0-5 and the 10-15 mSv range and less individuals in the 15-20 mSv bin; however, there were more NEWs in the 10-15 mSv range in 2022.

Table 8

2022 Eye Dose Distribution	
Dose Range (mSv)	Percentage of Individuals (%)
0 – 5	88.8
5 – 10	6.6
10 – 15	3.3
15 – 20	0.8
> 20	0.4

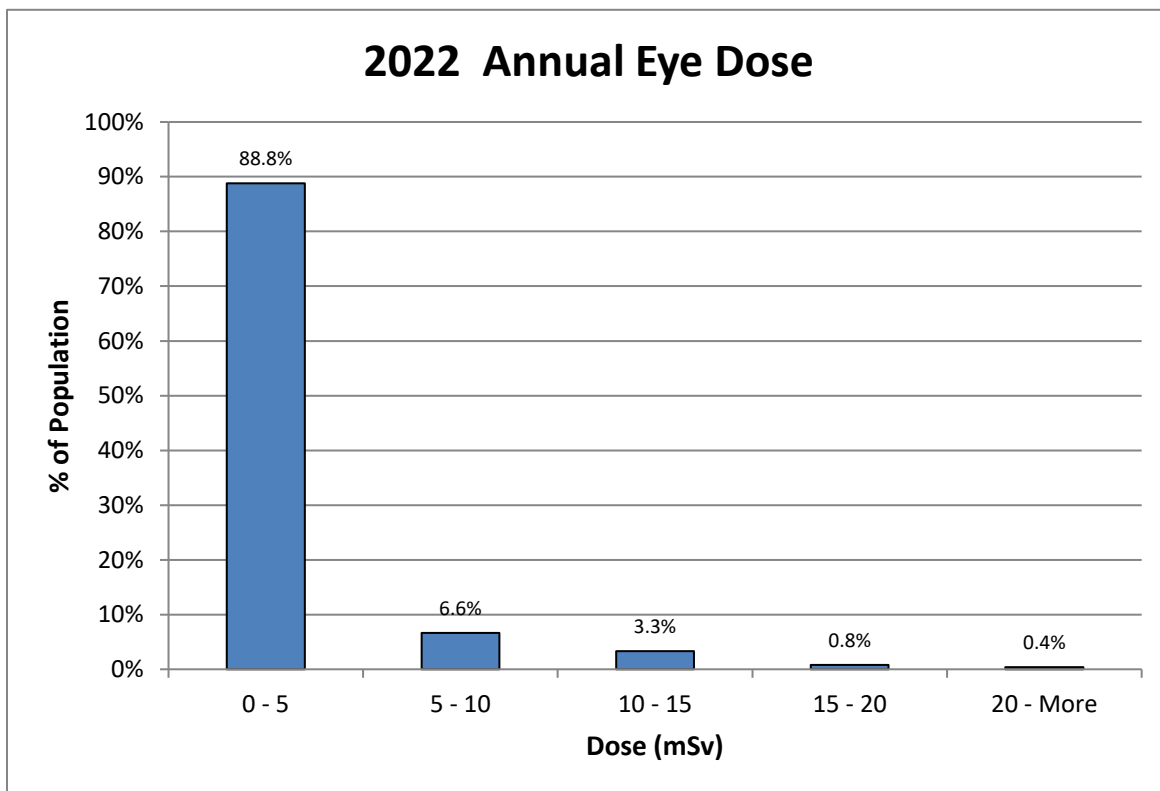
Figure 7


Table 9 shows the annual NEW eye dose results for three work groups: employees in operations; employees in administration, and/or support roles; and outside contractors/visitors. The highest doses are from the operations work group, consisting of production and maintenance personnel. In 2022, the average eye dose for all NEWs was 1.4 mSv and the maximum annual eye dose for production employees was 22.1 mSv.

Table 9

2022 Annual Eye Dose				
Work Group	Number of Individuals	Average (mSv)	Minimum (mSv)	Maximum (mSv)
Operations	118	2.9	0.0	22.1
Administration / Support	95	0.0	0.0	0.9
Contractors/Visitors	28	0.0	0.0	0.0

Table 10 and Figure 8 presents the employee average, minimum and maximum eye dose for the five year period from 2018 – 2022. The chart illustrates that the maximum annual

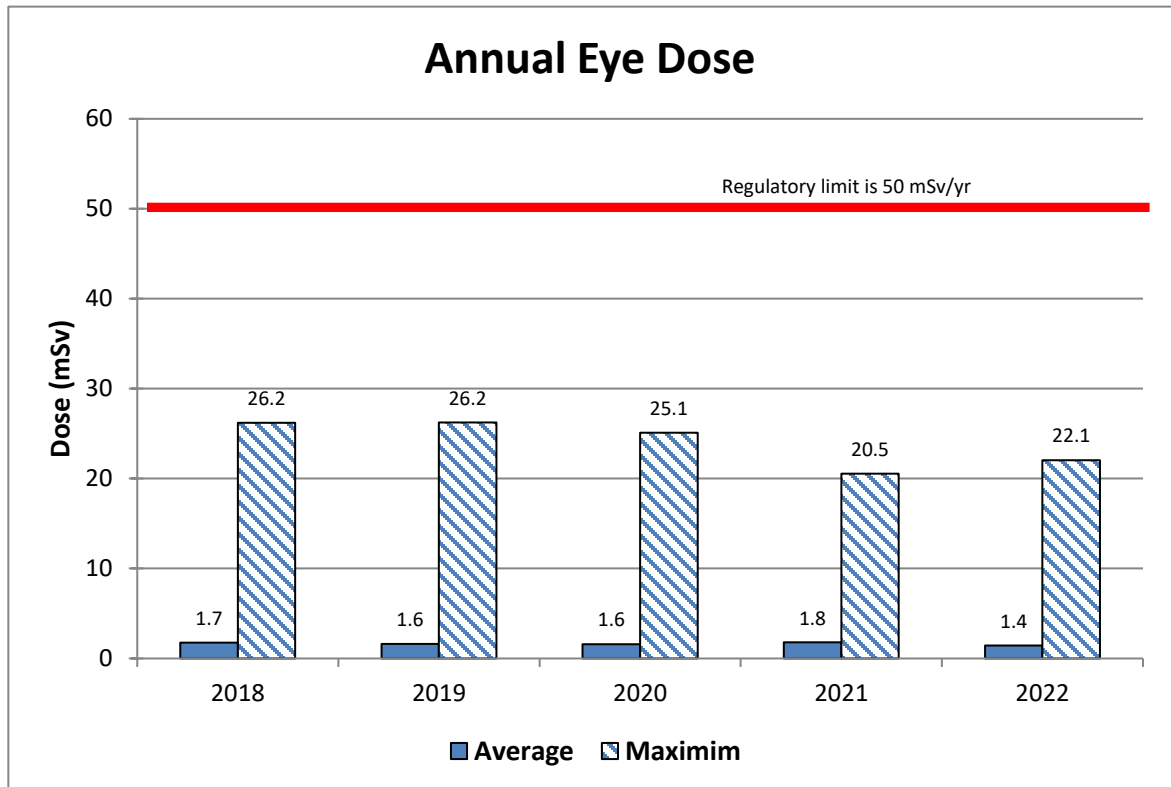
dose received by an individual is below the regulatory limit. Over the five year period the average eye dose is lower than previous years. The maximum eye dose was lower in 2022 than previous years except for 2021. In 2022, the individual with the highest dose was a Pelleting Area employee and was the same individual with the maximum skin dose.

Table 10

2018 – 2022 Eye Dose				
Year	Number of Individuals	Average Dose (mSv)	Minimum Dose (mSv)	Maximum Dose (mSv)
2018	267	1.7	0.0	26.2
2019	256	1.6	0.0	26.2
2020	247	1.6	0.0	25.1
2021	217	1.8	0.0	20.5
2022	241	1.4	0.0	22.1

*regulatory dose limit from 2018-2020 was 150 mSv/yr and from 2021-2022 the limit is 50 mSv.

Figure 8



Extremity Dose

The CNSC regulatory limit for extremity dose to NEWs is 500 mSv per year. The action level for CFM is 55 mSv per quarter. The quarterly action level applies to production NEWs who regularly handle product as part of their daily tasks.

In 2021, CFM began an assessment for the extremity dose to align with the *Radiation Protection Regulations (RPR)* issued in 2020. Specifically, section 8 of the RPR adds the requirement to use a licensed dosimetry service for equivalent doses to the skin, hands, and feet if the annual dose would be over 50 mSv. In order to determine if doses were above this level employees were asked to wear extremity rings continuously. A review of the doses was completed in November of 2021 identified the majority of employees did not require dose to be assigned from a licensed dosimetry service provider as employee dose was less than 50 mSv. Therefore, this group of employees stopped having dose assigned from extremity ring dosimeters at the beginning of November. There was one group of employees that required further data and continued to wear extremity rings until the end of 2021. The review of dose to that group was completed early in 2022 and it was determined that this group was also not required to be assigned dose from a licensed dosimetry service provider.

Extremity dose in 2021 was calculated using the previous method (i.e., wearing dosimeters for one week per quarter) for January to March and summed with the monthly dose results for April to October which was the last full month the ring dosimeters would be worn by all employees. Dose for November and December was estimated using the average of the monthly dose from April to October (excluding July due to shutdown). Since the pelleting area quality inspectors, who wore dosimeters from April to December of 2021, have a full year of extremity dose, these individuals were assigned dose using the previous method for the first quarter and the monthly dose the remainder of the year.

Beginning in 2022 the quarterly extremity dose was estimated using historic data. The first, second and fourth quarter of 2022 was similar to the second quarter of 2021 and was the quarter most representative as NEWs wore their rings for the entire quarter. The third quarter of 2022 was estimated using the data from the third quarter of 2021 since employees wore the dosimeters for the entire quarter as well as the plant was shutdown for 3 weeks in July for both years. The extremity dose for 2022 was estimated by summing the quarterly averages and the maximum results.

If there is a change in processing techniques or work configurations that would impact extremity dose, then an assessment is required to determine if the 50 mSv/yr criteria would be exceeded. Changes to equipment or processes are captured through CFM's

Management of Change (MoC) process. In 2022, there were no changes implemented that would have required an assessment of the impact to extremity dose.

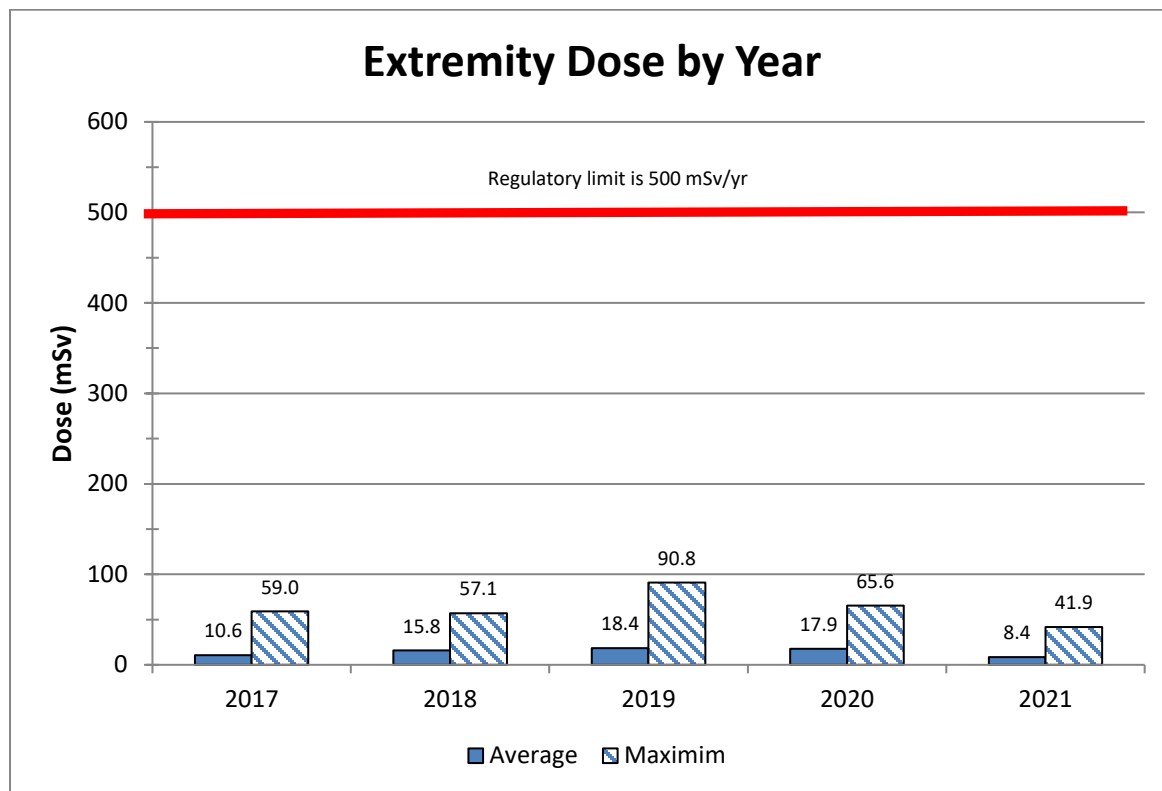
As the data is estimated there is no distribution available for 2022. Table 11 and Figure 9 show the annual average, minimum, and maximum extremity dose for all NEWs enrolled in the extremity program from 2018 – 2022. The average extremity dose in 2022 was 7.0 mSv and the estimated maximum dose in 2022 was 39.4 mSv. Historically, the Pelleting Area Inspectors were the work group with the highest extremity dose.

The average and maximum dose in 2022 was lower than the dose in previous years. The extremity dose assessment in 2021 demonstrated that the method of wearing rings for one week and extrapolating dose for the quarter was overestimating the actual dose. In 2021 dose was calculated using this method for the first quarter. In 2022, the dose was estimated using data obtained when employees wore the dosimeters continuously; therefore, is more representative of the actual dose. The chart illustrates that the maximum annual dose received by an individual is well below the regulatory limit and below the requirement to use a licensed dosimetry service for equivalent doses to the skin, hands, and feet (i.e., 50 mSv/yr).

Table 11

2018 – 2022 Extremity Dose				
Year	Number of Individuals	Average Dose (mSv)	Minimum Dose (mSv)	Maximum Dose (mSv)
2018	93	15.8	2.5	57.1
2019	85	18.4	2.8	90.8
2020	85	17.9	3.4	65.6
2021	83	8.4	0.0	41.9
2022	-	7.0	0.0	39.4

Figure 9



Urine Analysis

CFM collects routine bi-weekly urine samples from NEW's who work in the Pelleting Area and send them to Cameco's PHCF, which is part of a licensed dosimetry service that analyzes urine samples for uranium content. The action level for NEWs that participate in the internal dosimetry program is 10 µg/L uranium concentration for a routine sample. In 2022, there were no exceedances of the urine analysis action level.

Table 12 provides the distribution, in 2 µg/L increments, for the urine analysis results in 2022. Of the 1564 routine urine samples analyzed during the year, one routine sample result was above 2.0 µg/L. The maximum routine sample result collected in 2022 was 2.2 µg/L and the annual average was 0.23 µg/L. The maximum and average results were lower than previous years except for 2021.

Table 12

2022 Urine Analysis Uranium Concentration Distribution	
Single Sample Range (µg/L)	Percentage of Individuals (%)
0 – 2	99.9
2 – 4	0.1
4 – 6	0.0
6 – 8	0.0
8 – 10	0.0
>10	0.0

Internal Dose

CFM employees are incorporated into the approved and licensed internal dosimetry program for Cameco's FSD.

In 2022, there were no routine urine sample results above the internal administrative level of 4.0 µgU/L for routine samples and no internal dose was assigned to any employees from urine data.

Lung Counting

As part of the licensed FSD internal dosimetry program, Cameco employs the use of a lung counter to measure uranium in the lungs and calculate the associated committed effective dose. Employees who work in the Pelleting Area for more than 500 hours in a year undergo direct in-vivo (lung counting) measurements. The action level for CFM is 5 mSv per year for an annual lung dose.

In 2022, there was no exceedance of the annual lung count action level. A total of 57 employees in the production work group met the criteria and required lung counting. These lung counts were performed in the second and fourth quarter of 2022. The remaining NEWs that were onsite in 2022 were prorated to obtain an internal dose. This was calculated according to the number of hours the person was physically in the Pelleting Area during the year and the average dose received by the measured group. Only NEWs who worked for more than 80 hours in the Pelleting Area in 2022 were included in the internal dose program and were assigned a prorated lung dose.

There was a total number of 75 NEWs who were either measured for internal dose by lung counting or were assigned an internal dose by prorating the hours worked in the Pelleting area. The maximum internal dose assigned from lung counting was received by a Pelleting area employee. This individual was not the same person with the maximum whole body dose or the maximum total effective dose.

Table 13 and Figure 10 show the distribution of lung counting doses in 1.0 mSv increments. All NEWs were assigned an internal dose below 3.0 mSv. The majority (59%) were assigned a dose between 2 - 3 mSv.

Table 13

2022 Internal Dose Distribution (Lung)	
Dose Range (mSv)	Percentage of Individuals (%)
0 – 1	29.3
1 – 2	12.0
2 – 3	58.7
3 – 4	0.0
4 – 5	0.0
>5	0.0

Figure 10

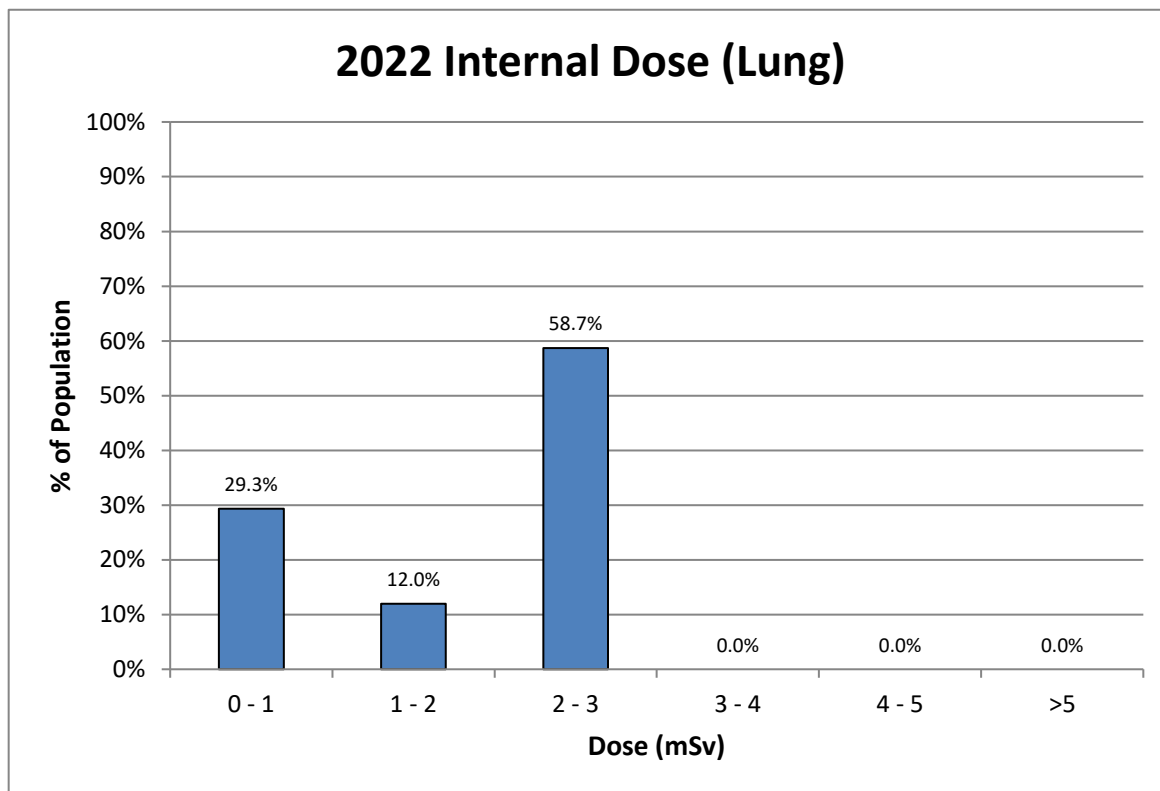


Table 14 shows the annual NEW lung dose results for two work groups: employees in operations; and employees in administration, and/or support roles. There were no outside contractors/visitors enrolled in the lung counting program. The number of individuals in the support group reflect employees and contractors that were onsite during the year, worked for more than 80 hours in the Pelleting Area, and are prorated based on the measured group. The majority of the employees in the operations work group have a measured lung dose (57) because they meet the criteria of greater than 500 hours working in the Pelleting Area. The remainder of the operations group include employees who worked in the Pelleting area more than 80 hours and less than 500 hours; therefore, their lung doses were prorated. The NEWs in the support group (5) were also all prorated based on the number of hours they worked in the Pelleting area. In 2022, there were 57 NEWs with a measured dose and 18 NEWs with prorated doses. The highest doses are from the operations work group, consisting of production and maintenance personnel.

Table 14

Internal Lung Count Doses 2022				
Dosimetry Group	Number of Individuals	Average (mSv)	Minimum (mSv)	Maximum (mSv)
Operations	70	1.7	0.1	2.4
Administration/Support	5	0.3	0.2	0.4

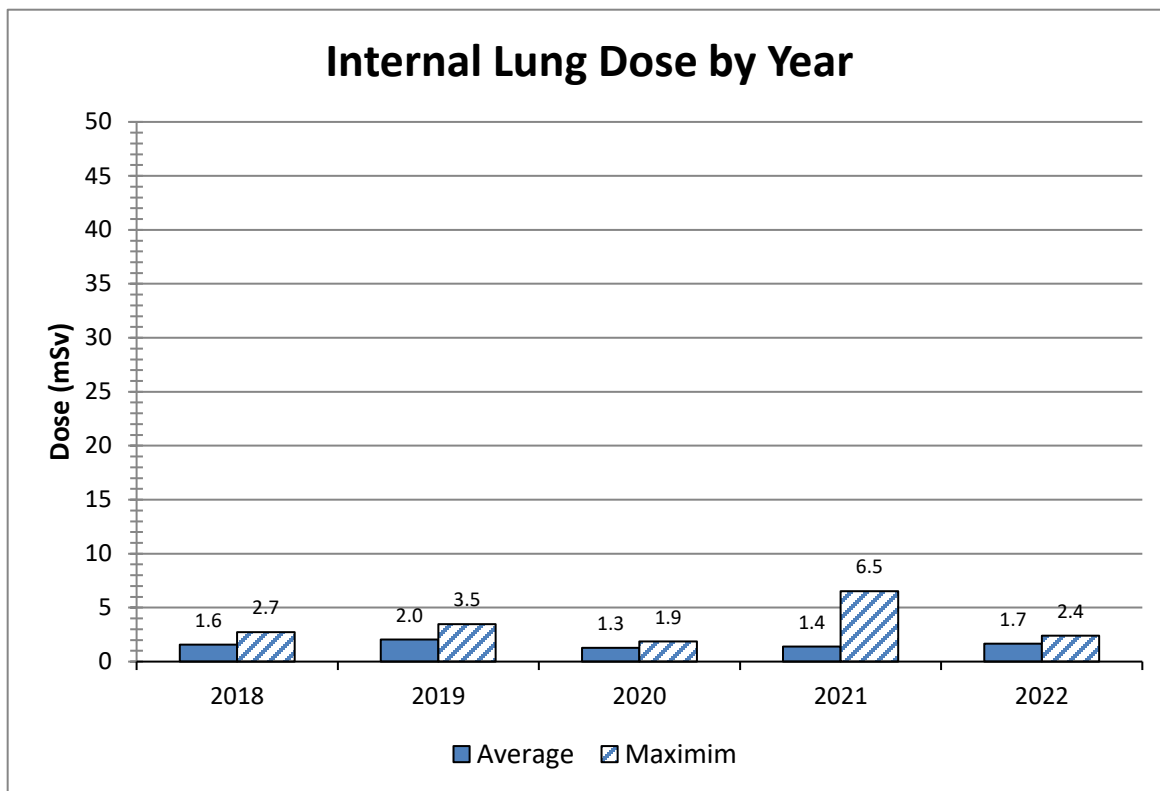
Table 15 and Figure 11 show the annual average, minimum, and maximum lung dose for the NEWs assigned a lung dose from 2018 – 2022. The chart illustrates that the maximum annual internal dose received by an individual is well below the regulatory limit. In 2022, the average lung dose for all NEWs in the internal dosimetry program was 1.7 mSv and the maximum lung dose was 2.4 mSv.

The average internal dose for 2022 is lower than 2019, higher than the other previous years. The maximum dose is lower than previous years except for 2020.

Table 15

2018 – 2022 Lung Dose				
Year	Number of Individuals	Average Dose (mSv)	Minimum Dose (mSv)	Maximum Dose (mSv)
2018	96	1.6	0.0	2.7
2019	81	2.0	0.0	3.5
2020	79	1.3	0.0	1.9
2021	80	1.4	0.0	6.5
2022	75	1.7	0.1	2.4

Figure 11



As per the dosimetry program, lung count measurements above the DL result in individual dose assessments, rather than assessment based on the group average. In 2022, all lung counts were below the DL with doses based and assigned on the group average.

Total Effective Dose

Total effective dose is calculated by adding the whole body external dose measured from OSLDs and the internal dose derived from the lung count program as well as any internal dose assigned from the urine analysis program. The CNSC annual regulatory limits for total effective dose are 50 mSv per year and no more than 100 mSv for specific 5 year periods.

Table 16 and Figure 12 display the distribution of total effective dose for NEWs in 2022 in 2 mSv increments. The majority of NEWs (79%) had a total effective dose of 2 mSv or less, with all NEWs less than 8 mSv.

Table 16

2022 Total Effective Dose Distribution	
Dose Range (mSv)	Percentage of Individuals (%)
0 – 2	79.3
2 – 4	13.3
4 – 6	6.6
6 – 8	0.8
8 – 10	0.0
> 10	0.0

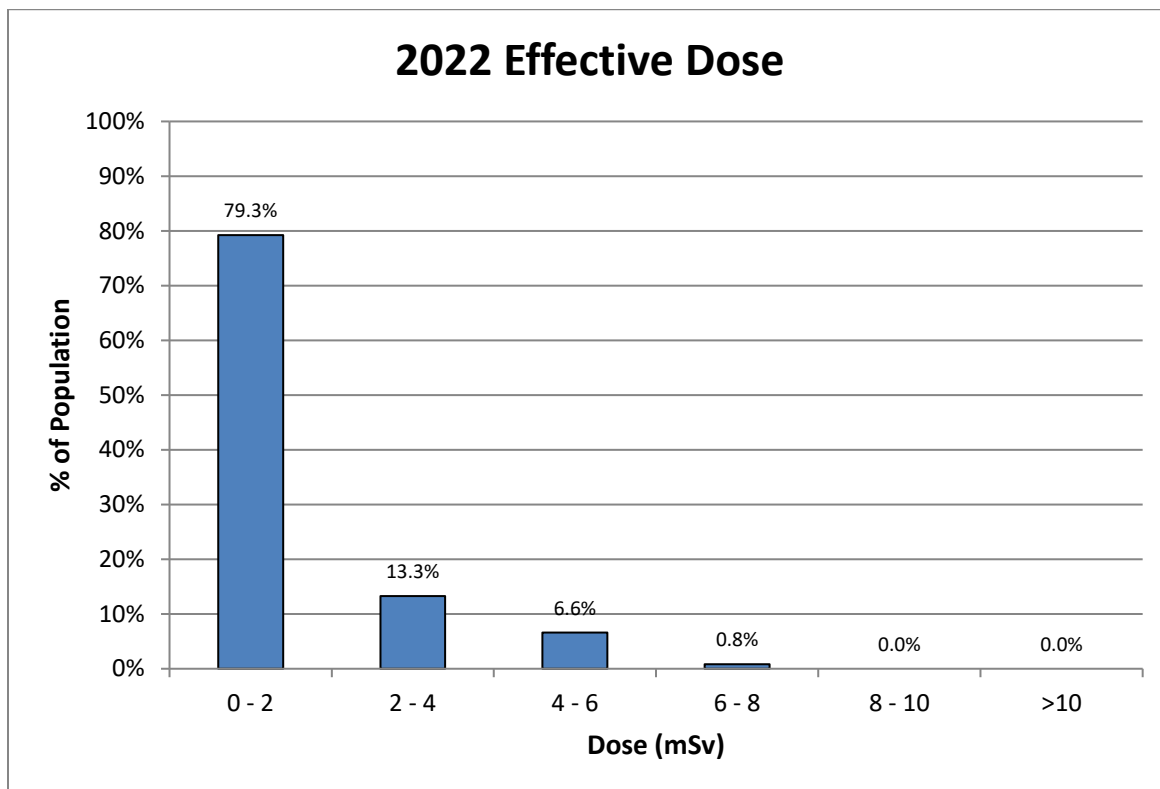
Figure 12


Table 17 shows the annual NEW total effective dose results for three work groups: employees in operations; employees in administration and/or support roles; and outside contractors/visitors. The highest exposures are from the operations work group, consisting of production, maintenance, and quality personnel. The maximum total effective dose for a NEW in 2022 was 7.2 mSv (14% of the annual dose limit), while the average total effective dose was 0.9 mSv.

Table 17

2022 Annual Total Effective Dose (all doses)				
Work Group	Number of Individuals	Average (mSv)	Minimum (mSv)	Maximum (mSv)
Operations	118	1.8	0.0	7.2
Administration / Support	95	0.0	0.0	0.9
Contractors/Visitors	28	0.0	0.0	0.0

Cameco measures and assigns dose to all workers with a potential to receive dose and designates workers as NEWs on this potential. Average results are reported using an assignment of a zero dose when the dose was too small to be measured. A measured dose

of zero is a legitimate dose and reflects the radiation exposure controls in place at the facility. Table 18 shows the annual NEW total effective dose results for measurable doses with zero doses removed for the three work groups: employees in operations; employees in administration and/or support roles; and outside contractors/visitors. The average effective dose for measurable doses with zero doses removed, for all NEW in 2022 was 1.6 mSv.

Table 18

2022 Annual Total Effective Dose (all measurable doses, zero doses removed)				
Work Group	Number of Individuals	Average (mSv)	Minimum (mSv)	Maximum (mSv)
Operations	103	2.1	0.0*	7.2
Administration / Support	24	0.2	0.0*	0.9
Contractors/Visitors	5	0.0	0.0*	0.0

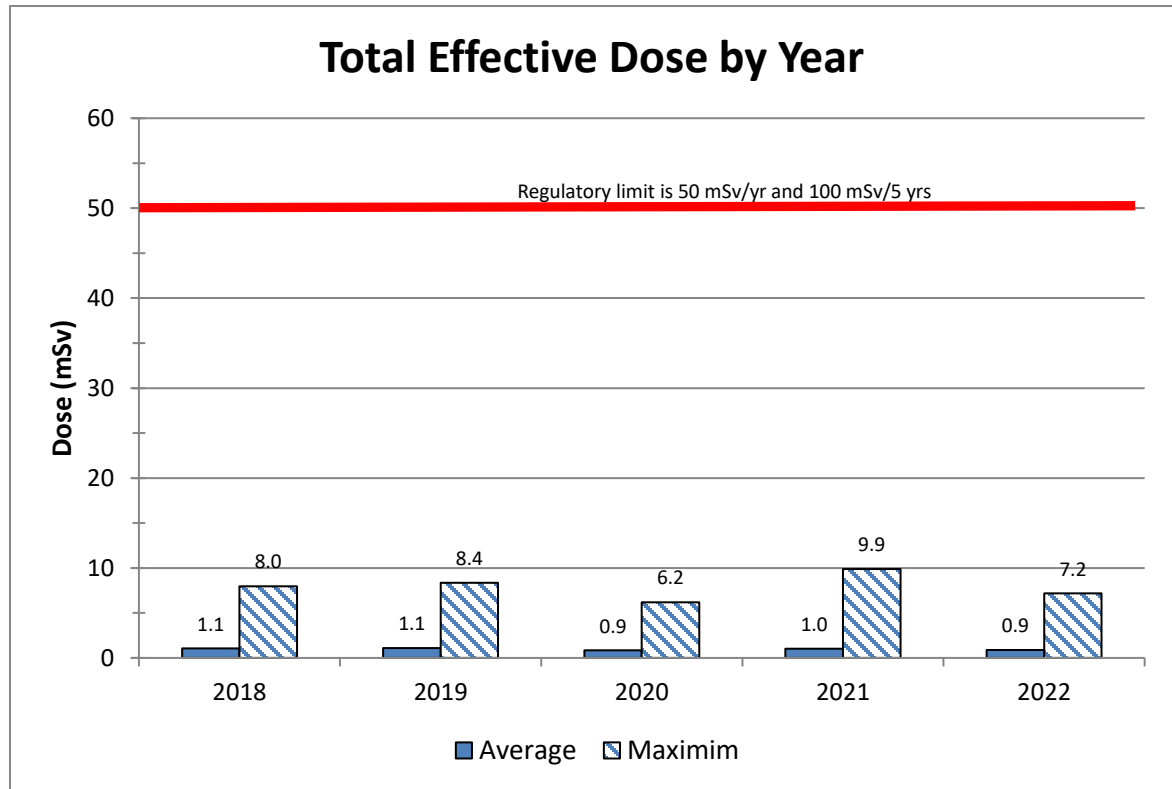
*minimum doses are rounded down to zero (i.e., all were less than 0.05 mSv)

Table 19 and Figure 13 show the employee annual total effective dose results for the period of 2018 – 2022. The average Effective Dose is equal to or lower than previous years. The maximum Effective Dose in 2022 was lower than the effective dose in previous years except for 2020. The external whole body dose contributed 68% of the maximum total effective dose with the remaining 32% coming from the internal lung dose. The person with the highest total effective dose was the same individual with the maximum whole body dose; however, it is not the same individual with the highest internal dose.

Table 19

2018 – 2022 Total Effective Dose				
Year	Number of Individuals	Average Dose (mSv)	Minimum Dose (mSv)	Maximum Dose (mSv)
2018	267	1.1	0.0	8.0
2019	256	1.1	0.0	8.4
2020	247	0.9	0.0	6.2
2021	217	1.0	0.0	9.9
2022	241	0.9	0.0	7.2

Figure 13



With respect to the regulatory limit of 100 mSv total effective dose over five years, the highest individual dose for the current five year dosimetry period (January 1, 2021 to December 31, 2026) is 16.5 mSv to a Pelleting Area operator.

The five NEWs with the highest total effective dose in 2022 are provided in Table 20. As indicated in table, these individuals all work in the Pelleting Area. Four of the five individuals with the highest total effective doses are furnace operators. Individuals working as furnace operators have historically received the highest external whole body dose. The individual with the highest effective dose is the employee with the lung dose that exceeded the action level. This employee is a general operator in the Pelleting Area. This information is provided to the JHSC committee for review and to discuss opportunities to lower dose.

Table 20

2022 Five Highest Total Effective Dose Individuals			
Occupation	Whole Body Dose (mSv)	Internal Dose (mSv)	Total Effective Dose (mSv)
Furnace Operator	4.9	2.3	7.2
General Pelletizing Area Operator	4.6	2.0	6.6
Furnace Operator	3.6	2.3	5.8*
Furnace Operator	3.9	2.0	5.9
Furnace Operator	3.6	2.1	5.7

*Results are 3.56 mSv for Whole Body and 2.28 mSv for Internal Dose with effective dose of 5.84 mSv (rounding issue).

Collective Dose

The collective dose in mSv for each dose component with all assigned doses from 2020 – 2022 is provided in Table 21. The number of employees included in each component is included in brackets next to the dose. The collective dose for Whole Body, Skin and Eye are decreasing. The internal collective dose is increasing and the effective dose in 2022 is in between 2020 and 2021.

Table 21

2020 – 2022 Collective Doses (mSv)*							
	Whole Body	Skin	Eye	Extremity Left	Extremity Right	Internal Dose	Effective Dose
2020	108.0 (247)	761.9 (247)	394.2 (247)	1488.8 (83)	1520.2 (83)	102.1 (80)	210.1 (247)
2021	109.9 (217)	752.3 (217)	392.1 (217)	656.4 (83)	697.9 (83)	111.0 (80)	220.9 (217)
2022	91.3 (241)	678.8 (241)	347.1 (241)	-	-	124.0 (75)	215.3 (241)

() includes the number of employees

*CFM began reporting collective doses in 2020

Contamination Control

CFM has an extensive contamination control program. The facility is divided into four zones for contamination control purposes. Zone 1 areas are designated as clean areas with no contamination permitted. Food and drink can be consumed in these areas and include the Lunchroom and office areas. Zone 2 areas contain no open sources of radioactivity but have the potential for contamination. These areas include the assembly area, change rooms and the machine shop. Zone 3 areas are the access points to Zone 4. Zone 4 areas contain open sources of radioactivity and include the pelletizing area. Consumption of food and drink are restricted in Zones 2, 3, and 4.

Routine contamination monitoring is done in all areas with results provided in Table 22. Of the 2779 readings taken, none exceeded the Administrative Control Limits (ACL) for each zone.

Table 22

2022 Contamination Monitoring Results			
Area	Total Number of Measurements	Administrative Limits (Bq/cm ²)	Number of Readings Above Internal Limits
Zone 1	500	0.4	0
Zone 2	768	4.0	0
Zone 3	168	4.0	0
Zone 4	1343	40	0

In-Plant Air

Routine air sampling is conducted at workstations throughout the plant continuously during operations to monitor airborne UO₂ in the work environment. To ensure exposures to airborne uranium are well below the regulatory dose limits, CFM uses an internal Administrative Control Limit (ACL) for any daily air sampling result of 595 µg/m³ (15 Bq/m³) which is less than half the recommended concentration for an 80 hour monitoring period (urine bioassay schedule). The 2000 hour ACL represents an annual monitoring period and has been set at 52 µg/m³ (1.3 Bq/m³).

At CFM, air contamination monitoring is performed via a continuous air sampling system and/or a fixed air sampling system at calibrated sampling locations throughout the facility where uranium dust levels may be present.

A summary of in-plant air sampling results including the area monitors for 2022 is provided in Table 23. Of the 12,123 monitoring results, one result (less than 0.1%) exceeded the 2000 hour ACL with no results exceeding the 80 hour ACL. This is a reduction in the number of exceedances over previous years. The average in-plant air result for the facility in 2022 was 2 µg U/m³ and the maximum was 87 µg U/m³.

Table 23

2022 Uranium In-plant Air Sampling Results					
Plant Area	# of Samples	Average ($\mu\text{g U/m}^3$)	Maximum ($\mu\text{g U/m}^3$)	# Samples > ACL ^{2000 hr}	# Samples > ACL ^{80 hr}
Ceramics Room	892	2	19	0	0
Compaction Room	455	2	10	0	0
Load Room	911	1	7	0	0
Pangborn Room	455	3	19	0	0
Pelleting Area	1366	2	18	0	0
UO ₂ Grinders	910	4	87	1	0
Waste Treatment	228	4	28	0	0
PP2 Area	2900	2	30	0	0
Dry Waste Treatment	1823	1	19	0	0
Furnace Hall	2183	1	12	0	0
TOTAL	12123	2	87	1	0

During normal operation, some processes in the Pangborn Room require the use of respiratory protection. Therefore, procedures are in place requiring workers to wear respirators when performing specific job tasks to minimize internal exposure (in addition to local extraction). Local extraction is sufficient in other areas where UO₂ powder is used.

The exceedance in the grinding area occurred after the grinding wheel was changed, the operator noticed the water angle to the outfeed was not at the correct angle causing misting/splashing. The nozzle position was adjusted, and the results returned to normal levels. The elevated result was entered into CIRS, an investigation was completed, and if required corrective actions were implemented.

Gamma Surveys

An ongoing ALARA initiative involves posting OSLDs around the pelleting area, the waste treatment area, the PP2 area, as well as the assembly area to determine areas of elevated gamma radiation. The annual average, quarterly minimum, and quarterly maximum result in each location is summarized in Table 24. The results illustrate that the Fuel Storage Area had the highest gamma fields (average of 7.2 $\mu\text{Sv/hr}$). The area is typically not occupied and has signage to notify employees and visitors to limit time spent in the area. The next highest reading (average 5.9 $\mu\text{Sv/hr}$) was in the powder receiving area. This is expected due to the amount of raw material stored in this area. Employees limit their time in this area as well. All areas of the facility are consistent with the levels seen in previous years.

Table 24

2022 Summary of Quarterly Plant Gamma Readings by Area (µSv/hr)				
Location #	Area	Average Result	Minimum Result	Maximum Result
13	Kitting	0.2	0.1	0.3
14	S Stacking	1.1	0.9	1.4
15	Stacking	0.2	0.2	0.3
16	Pelleting Entry	0.6	0.5	0.6
17	Pelleting Lab	0.1	0.1	0.1
18	S Grinding	1.1	1.0	1.2
19	Grinding	0.9	0.8	1.0
20	N Grinding	0.8	0.7	0.9
21	S Wall Pelleting	0.0	0.0	0.0
22	S Furnace	0.5	0.3	0.7
23	Furnace	0.8	0.7	0.9
24	N Furnace	0.0	0.0	0.1
25	SE Wall Furnace	0.5	0.3	0.6
26	E Wall Furnace	0.6	0.4	0.7
27	NE Wall Furnace	0.4	0.3	0.3
28	N Corridor	0.4	0.3	0.4
29	Ceramics Lab	0.8	0.2	2.4
30	R7#1 East Wall	1.4	1.2	1.6
31	PP2 West Wall	0.1	0.1	0.2
32	S Pressing	0.8	0.5	1.1
33	N Pressing	0.8	0.6	1.0
34	Pangborn Room	0.8	0.8	0.9
35	S Waste Treat.	1.7	1.3	2.3
36	N. Waste Treat	0.5	0.5	0.5
37	PP2 Powder Rec. N	1.2	1.0	1.4
38	Powder Receipt	0.5	0.1	1.2
39	U3O8 Add-back	1.5	1.4	1.6
40	S End Cap	0.1	0.1	0.2
41	End Cap	0.3	0.1	0.4
42	N End Cap	0.1	0.0	0.1
43	E Offices	0.0	0.0	0.0
44	S End Plate	0.0	0.0	0.0
45	End Plate	0.0	0.0	0.1
46	N End Plate	0.0	0.0	0.1
47	W Offices	0.0	0.0	0.0
48	S Inspection	0.1	0.0	0.1
49	Inspection	0.1	0.1	0.2
50	N Inspection	0.6	0.2	1.1
51	W Inspection	0.0	0.0	0.1
52	Strapping Bay	0.3	0.1	0.4
53	Packing	0.3	0.1	0.5
54	Fuel Storage Area	6.7	6.1	7.2
55	Graphite East	0.1	0.1	0.2
56	BMS Loading	0.8	0.6	1.3
57	PP2 Receiving	5.1	4.6	5.9
58	PP2 Press R53-1	1.4	1.2	1.6
59	PP2 E. Wall	0.6	0.5	0.6

2.3.2 Conventional Health and Safety

This safety and control area covers the implementation of a program to manage non-radiological workplace safety hazards and to protect personnel and equipment.

A key element of a safe, clean, and reliable operation is a comprehensive and well-established worker protection program. The foundation of the program is based on the *NSCA* and its regulations as well as Part II of the *Canada Labour Code*.

Cameco has five key principles in the area of safety that form the framework for 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 Corporation; and
- we are a learning organization.

CFM manages non-radiological health and safety through a comprehensive E/OH&S program as prescribed by the Cameco Health and Safety Management Program. CFM maintains a series of detailed health and safety procedures and instructions, and the safety program is further supported by monthly safety meetings on a wide variety of safety topics, regular safety audits and monthly inspections conducted by employees from all levels of the organization as well as regular safety training. Management is involved throughout the year to ensure the conventional health and safety program remains valid and effective. Regular meetings with the senior management team review progress on safety related objectives and KPI's. When targets are overdue or off track, the senior management team will take actions to address the concern. In addition, during the annual Management Review, the Conventional Health and Safety program is reviewed by management with various aspects to determine the effectiveness of the program.

CFM's safety program sets out the requirements for management of health and safety aspects of the operation consistent with Cameco's corporate SHEQ policy. Key components of the program include:

- compliance with all safety and health-related legal and regulatory requirements.
- setting of site safety and health objectives.
- implementation of corporate safety standards.
- development and maintenance of a formal hazard recognition, risk assessment and change control processes; and
- documentation of health and safety significant incidents from the start through to the verification of completion of corrective actions via the CIRS database.

All regulations are audited at least once every three years. As part of the site internal audit program, audits of the various elements of the health and safety program are done on a routine basis. Any issues identified during these audits are documented in the CIRS database in order for corrective actions to be tracked and implementation verified. Further information on Health and Safety audit findings is provided in the Management Systems section of this report.

In 2022, CFM maintained its course of inspections and audits to not only identify potential safety risks, but to take corrective actions to mitigate those risks to prevent employee injuries. JHSC workplace inspections continued throughout the year. JTO's were reviewed at JHSC meetings to ensure completeness and to verify the adequateness of corrective actions based on any findings of concern.

Some of the safety initiatives in 2022 included the following:

- Monthly safety meetings covering topics such as: Return to Work, Radiation Protection, Hearing Protection, Heat Stress, Workplace Violence Prevention, Summer Safety Ergonomics, WHMIS, Fall Arrest/Hoist/Incident Reporting, Fire Safety, Mental Health, and Winter Safety.
- Tracked Standard Threshold Shifts (STS) in hearing. This was documented through routine audiometric testing which identified STS were classified as level II incidents and entered into CIRS for tracking purposes along with a basic cause investigation being completed for each.
- Implementation of new ergonomic procedure focusing on ergonomic considerations at the design stage through the MOC process as well as directing ergonomic risk assessments and physical demands analysis to high ergonomic risk tasks based on risk assessments. Communication to employees regarding ergonomics takes place after each extended plant shutdown event (typically summer and Christmas) in the form of safety presentations and toolbox meetings.
- Continued safety awareness promotions and events including a mindfulness photography challenge with a focus on mental health. The challenge encouraged employees to get outside, and to focus on mindfulness. JHSC provided a Healthy Breakfast of fresh fruit, healthy cereals, gourmet bagels and yogurt parfaits event in May. JHSC promoted the Continuous Improvement Teams and conducted a "Green Card" draw for safety improvement ideas. Employees were encouraged to submit ideas to improve safety and their names were entered into a draw for prizes.

- Welding fume sampling and silica in air sampling were also completed by a qualified third-party contractor
- Completed a lockdown drill activity in accordance with HSI 053 Workplace Violence Prevention. The JHSC has compiled the results of this drill and are analyzing them to determine opportunities for improvement.
- CFM's new ergonomic procedure and contractor management program are in the process of being updated. Noise dosimetry is to be conducted in the 4th quarter for employees who work in hearing protection mandatory areas based on sound level assessments. Welding fume sampling and silica in air sampling are scheduled to be done in Q4
- Continued to support mental health improvement initiatives.

Initiatives that are planned for 2023 include the following:

- Complete ergonomics assessment on specified job areas.
- Continue transferring health and safety procedures to align with the Safety and health program.
- Revamp monthly layered inspection process and
- Continue the Continuous Improvement teams.

The Joint Health Safety Committee (JHSC) continued at CFM in 2022. With pandemic restriction easing, meetings were able to be held in person along with a virtual option and focused on a set of 4 goals:

1. Comply with the legislative standards defined for the JHSC
2. Create a culture of safety
3. Help create an injury free workplace
4. Support health and safety initiatives set by management

To achieve these goals, the JHSC targeted specific objectives including:

- Injury Trending – The JHSC regularly reviewed injury trends to guide focus for preventative measures. This information covered injury type, injured body part, contact type, and location. This information was posted for all employees to see as an awareness tool.
- Corrective action and activity follow up to ensure completeness and effectiveness of deficiency correcting for injuries.
- Quarterly activities to promote safety
- Participating in document reviews and corporate standard assessments
- Reviewing and updating risk assessments

- Auditing flammable cabinets

The committee met 22 times, reviewed 12 documents/program and completed 21 inspections, thereby meeting Canada Labour Code requirements.

The Job Task Observation completion rate improved from 94% in 2021 to 98% in 2022.

Occupational Health and Safety Meetings returned to in person meetings in 2022 as COVID restrictions lifted. The monthly safety presentations were also delivered through email/U-Share in 2022 where in person meetings were not practical or for those who did not feel comfortable with in person gatherings. The total completion of safety meetings was 98% of all required employees.

The tracking and trending of incidents, including near miss incidents, continues to direct the focus for safety improvements along with the JHSC objectives for 2023. In previous years, sprains and strains were the most prevalent employee injury at CFM and 2022 followed suit along with cuts and lacerations being a top injury type. While several of the ergonomic injuries were due to reaching and stretching, another key contributor was over-exertion. These issues will be driving the need for ergonomic assessments along with ergonomic considerations at the design stage through the management of change process in 2023.

All health or safety-related events are entered into the CIRS database system to ensure proper tracking and management. The CIRS classification system defines five categories of incidents based on actual and potential outcome, with Category I incidents being minor in scope and Category V incidents having the highest actual and potential consequences.

CFM's COVID hazard prevention response procedure continued to be revised throughout 2022. As provincial guidelines changed, CFM was able to keep up with changes for in-person meetings and types of face coverings.

CFM's Safety and Health Manual matches the requirements needed to qualify as the Hazard Prevention Program (HPP) – the identification of hazards, including health, safety, radiation, and fire safety hazards as they associate with both routine and non-routine activities and consists of 6 elements:

- an implementation plan
- a hazard identification and assessment methodology
- hazard identification and assessment
- prevention measures
- employee education
- program evaluation

Following the Canada Labour Code requirement of a Hazard Prevention Program, CFM evaluates the effectiveness of its health and safety program based upon a review of the following:

- a) Conditions related to the workplace and the activities of the employees;
 - Workplace violence survey/assessment
 - Management of Change process
- b) Workplace inspection reports;
 - JHSC monthly inspection reports
 - Industrial hygiene reports – noise, lighting, mould, asbestos
- c) Hazardous occurrence investigation reports;
 - All incidents are investigated back to root cause
- d) Safety inspection;
 - JTO's
 - Layered inspections
 - Sweep inspections
 - Process inspections
- e) First aid records and injury statistics, including records and statistics related to ergonomic related first aid injuries;
 - JHSC CIRS review
 - CFM Injury Classification reviews
 - Injury trending
- f) Observations of the Joint Health and Safety Committees; and
- g) Any other relevant information.

Utilizing the program reviews above as they align with a Hazard Prevention Program, statistics indicate that CFM continues to demonstrate a robust health and safety program. Through education, pro-active initiatives, and recognition of performance, the number of injuries and the severity of those injuries are continuing to trend down over the last 5 years. Based upon this review, CFM has an effective safety program in place.

The final TRIR for 2022 was 2.51, with two recordable events for a medical treatment. This is an increase over 2021 (0.44). Table 25 shows the average and top quartile TRIR rates over the last five years in similar industries from the US Bureau of Labor Statistics for Fabricated Metal Product Manufacturing (NAICS 332000). While results for 2022 are not yet available from the Bureau using the data from previous years CFM is expected to be in the top quartile for the year.

Table 25

2018 – 2022 TRIR Rates					
Year / Parameter	2018	2019	2020	2021	2022
Average TRIR*	4.5	3.4	3.6	4.3	Not Available
Top Quartile*	1.5	1.5	1.1	1.4	Not Available
CFM TRIR	3.1	1.3	1.7	1.7+	2.90

*Data obtained from US Bureau of Labor Statistics for Fabricated Metal Product Manufacturing (NAICS 332000).

+Value adjusted due to reclassification of injury in 2022

Table 26 shows the safety statistics for the last five years, from 2018 to 2022. First Aid Injuries decreased in 2022 while medical diagnostic and treatment injuries increased from 2021. A critical component of injury prevention at CFM is the reporting of Near Misses. Twenty-one near miss incidents were reported in 2022, a sizable decrease from 41 in 2021. While 14 near misses were classified as level I, 4 were classified as level II, and 3 were classified as level III. Two of the level III near misses involved outside contractors while the third involved a CFM Cobourg employee that was brought over to the Port Hope site for shutdown activities.

Table 26

2018 – 2022 Safety Statistics					
Year / Parameter	2018	2019	2020	2021	2022
First Aid Injuries	14	11	17	15	5
Medical Diagnostic Injuries	1	3	1	2	9
Medical Treatment Injuries	2	0	2	0	2
Lost Time Injuries	0	0	0	0	0
Lost Time Injury Frequency	0.0	0.0	0.0	0.0	0.0
Lost Time Injury Severity	0.0	0.0	0.0	0.0	0.0

2.3.3 Environmental Protection

This safety and control area covers programs that monitor and control all releases of nuclear and hazardous substances into the environment, as well as their effects on the environment, as the result of licensed activities.

There are both federal and provincial regulatory authorities that have legislative jurisdiction over environmental protection at the facility. CFM monitors facility discharges to ensure that they meet applicable provincial and federal requirements. CFM's environmental monitoring program is comprised of monitoring the following components:

- water and air emissions.
- gamma levels.
- ambient air; and
- soil and groundwater.

For key emission parameters, CFM has established internal action levels accepted by the CNSC, which may be indicative of a potential loss of control for that specific parameter. These action levels serve as an early warning of a condition that warrants further investigation. An exceedance of an action level does not indicate any adverse environmental effects; however, it is an indication there may be an issue that needs to be corrected within the environmental protection program. A result above an action level is investigated and remedial actions taken if necessary. Action levels are detailed in the Environmental Protection section of CFM's LCH.

The key characteristics of the operation and activities that can have a significant environmental impact are monitored and measured and are described in the Environmental Protection Program manual (CFM-EP) and associated procedures. This document identifies all of the 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.

Environmental protection objectives and targets are established jointly by the site management team and site specialists as well as corporate and divisional leaders to ensure there is agreement, commitment and awareness of these objectives and targets across all areas of the operation. These objectives and targets can address, among other things, waste reduction initiatives and other projects which examine ways to reduce environmental emissions. Resources are allocated as required to achieve the targets and the status of these objectives are reviewed by the site management team.

Some of the objectives and targets from 2022 included:

- strive for zero reportable environmental events.
- maintain environmental performance without increasing environmental impact.
- removal of outdoor storage drums and obsolete equipment.
- implement compliance plan to Cameco's Containment Standard
- continued with plan to remove legacy uranium contaminated waste from the site

In March of 2022, the Ministry of Environment Conservation and Parks conducted a facility inspection on air and subject waste at Port Hope. The inspection was an assessment of compliance and conformance based on observations and information available during the inspection review. No instances of non-compliance or non-conformance were identified during the inspection and no further action was required.

Late in 2022, CFM contracted a third party to confirm through direct gamma monitoring that the estimated/calculated public dose to this receptor was indeed correct. CFM has will continue to investigate option in 2023 to make improvements to the site to lower the public dose closer to the original calculated levels. Early designs suggest adding shielding to the Fuel Storage Building or to increase the soil on the current shielding berm to the north and west of the Fuel Storage Building.

Other environmental initiatives planned for 2023 include the following:

- maintain environmental performance without increasing environmental impact.
- continue with upgrades to the groundwater treatment facility.
- participate in a Cameco initiative to move environmental data to a new software system with full implementation expected in 2023.
- continue to implement recommendations from 2020 waste audit.
- continue with plan to remove legacy uranium contaminated waste from the site.

As part of the audit program, audits of the various elements of the environmental program are done on a routine basis. Any issues identified during these audits are documented in the CIRS database so that corrective actions can be tracked, and implementation verified. Further information regarding audits is provided in the Management Systems section of this report.

In 2022, all environmental releases were below the limits detailed in CFM's licence (FFOL-3641.0/2023). There were no spills to the environment in 2022.

To meet the annual assessment requirements of *CSA N288.4 Environmental Monitoring Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills* and *CSA N288.5 Effluent Monitoring Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills*, an assessment against performance criteria, objectives and targets, as well as the effectiveness of the effluent monitoring programs in accomplishing their respective objectives was performed. The following summarizes this assessment:

1. All required planned sampling with both internal and external analysis was completed as required to meet the Environmental Protection Program Table 12 “Planned Samples with Internal Analysis (Stacks In-Plant Air - uranium, and sanitary sewer - pH)” and Table 13 “Planned Samples with External Analysis” (Hi-Vol - uranium, Sanitary Sewer – uranium, Sanitary Sewer – by-law suite, Ground/surface water – general chemistry). Only planned periods (e.g., Maintenance shutdown) or severe weather conditions interrupted planned sampling. Program performance met the 90% target.
2. Sampling for some environmental parameters such as sewer and Hi-Volume air samples continued during planned maintenance outages while stack sampling (directly tied to production) were suspended until production resumed.
3. All sampling equipment was maintained in working order including applicable calibration cycles. A complete complement of back-up sampling equipment is maintained ready for immediate change over to limit sampling down time. Very few equipment failure events occurred in 2022. Planned sampling was only reduced by one sampling cycle during these events.
4. All data is summarized and reported to the CNSC during CFM’s quarterly and annual compliance reporting.
5. CFM updated its Environmental Risk Assessment (ERA) in 2021 to assess any risks that may have emerged since the last ERA review. The ERA reviews:
 - a. Changes that have occurred in site ecology or surrounding land use;
 - b. Changes to the physical facility or processes that have the potential to change the nature of the facility effluents and the resulting risks to receptors;
 - c. New environmental monitoring data collected since the last ERA;
 - d. New or previously unrecognized environmental issue that have been revealed by the EMP;
 - e. Scientific advancements that require a change to ERA approaches or parameters; and
 - f. Changes in regulatory requirements pertinent to the ERA.

In 2022, there were no significant programmatic changes or challenges in the environmental protection program

CFM's environmental protection initiatives have been effective as evidenced by low airborne and liquid emissions from the facility. Additionally, there were no regulatory limit or action level exceedances in the environmental program in 2022. Although some of the objectives were not met as planned in 2022, their scope has been identified as larger than expected and work continues to move these projects to their completion. CFM has identified areas for improvement and made plans/commitments for the following years to make improvements in its environmental performance.

Dose to the Public

The *NSCA* requires that no member of the public shall receive from a neighboring nuclear facility an annual radiation dose in excess of 1 mSv. To ensure compliance with this regulation, explicit limits are placed on the quantities of radioactive materials that may be released from licensed facilities in gaseous and liquid effluents, and on the gamma radiation levels emitted from the facility. These "Derived Release Limits" (DRLs) take into account all significant physical pathways and are calculated based on the average member of the site specific critical group receiving an annual dose of 1 mSv from each of the pathways. Since the pathways are site specific, different release limits apply to different facilities.

In 2021, CFM updated the Derived Release Limit Report to incorporate assessments of:

- a worker at the Port Hope Sewage Treatment Plant (STP),
- a palliative care facility constructed in 2014 to the northwest of CFM,
- changes to fuel storage practices,
- a shield berm installed on the north side of the fuel storage building,
- the current version of N288.1 *Establishing and implementing action levels for releases to the environment from nuclear facilities*.

This update resulted in significant changes to how the dose to the public is calculated. Most significantly, the critical receptor changed from the residents to the west of the facility to the residents of the palliative care facility to the northwest of the facility. The gamma dose as measured on the north fence line was determined to be most appropriate for calculation of dose at this receptor location. Additionally, the assessment of the STP worker indicated that although small, dose from water discharges needed to be included in the calculation of the dose to the public.

Similar to the changes to the calculations for dose to the public at PHCF in 2016 following the update to the DRL, the updated dose calculations for CFM related to the releases to water and the fence line gamma location are more conservative than those previously used. The reported dose since 2021 appears higher than previous years, but there has not been an actual increase in the emission/dose from the facility. The results represent a much more conservative estimate of dose to the public because the gamma monitoring location at the facility fence line is now closer to the operating facility than the previous location, resulting in the increase shown in the table. For this reason, the results beginning in 2021 should not be compared with previous years' results.

The dose to the public from CFM operations is calculated based on three components: dose to the public from air emissions, dose from water discharges and dose from gamma radiation.

The updated DRLs used in the calculations are:

- air effluent (process stacks) – 299 kg/year.
- air effluent (building ventilation) – 41.5 kg/year
- liquid effluent – 331 kg/year; and
- gamma radiation levels (location #12) – 1.35 microsievert (µSv)/hr

The dose to the public from air and water emissions is a small fraction of the public dose limit. The gamma component represents virtually all the estimated public dose.

Under its ALARA activities, CFM has focused considerable effort on ensuring adequate shielding to the west side of fuel storage areas due to the historical identification of the critical receptor as west of the facility. Prior to changing the critical receptor to location 12, CFM had implemented dose saving measures by installing a soil berm north of the Fuel Storage Building. Following the updated DRL and the first year of calculating dose based on a different critical receptor, CFM has identified an ALARA opportunity to further improve the gamma shielding on the north side of the Fuel Storage Building and will be implementing capital projects to reduce the dose measured at the fence line beginning in 2023.

Air effluent calculations include the assessment of releases of particulate UO₂ to air from process stacks and building ventilation from the facility. Process stacks are continuously sampled and analyzed daily for uranium emissions. The total amount of UO₂ released to the environment during the year in gaseous effluent from stacks in 2022 was 0.01 kg (5 grams).

In addition, each process area also has its own separate ventilation system. Emissions in the building ventilation from the Pelleting area is determined using the average in-plant air sampling result from the Pelleting Area along with exhaust discharge rates. The

amount of uranium emitted from the PP2 area is calculated using the daily average of the continuous alpha monitors (alpha CAMs) set up in the area. As the building ventilation in this area uses HEPA filtration, a 90% efficiency factor is used in the calculation. The estimated release of UO_2 from all sources of building ventilation during 2022 was 1.06 kg. Therefore, the total amount of UO_2 released to air from stack emissions as well as building ventilation is estimated to be 1.07 kg in 2022.

At CFM, the gamma component represents the majority of the public dose. The closest residence to the CFM facility is located outside the fence line on the west side of the site. The location at the fence line that represents the critical receptor is location #12. To determine the total effective dose in this location, the natural background dose rate of $0.08 \mu\text{Sv/hr}$ for the Port Hope area is subtracted from the result.

The public dose calculation is demonstrated in the following formula:

$$\text{Public Dose} = \text{Dose Air (stacks)} + \text{Dose Air (building ventilation)} + \text{Dose Water} + \text{Dose Gamma (location \#12)}$$

The total dose to the member of the public, in 2022, from air emissions (process and building ventilation), liquid emissions and gamma levels is calculated to be 0.293 mSv.

The 2022 annual estimated dose, along with each component to the public, using revised DRLs, the revised formula (including liquid and breaking apart air sources), and the new location for the critical receptor is provided in Table 27 and Figure 14. Also provided for 2018 – 2021 is the estimated public dose using the previous method of calculation.

The table illustrates the total dose to the critical receptor as well as the individual contributions from air and gamma converted into mSv/yr units for comparison. The dose to the critical receptor remains low when compared to the dose limit; however, there is an increase to public dose since 2021 for the reasons noted above. The public dose calculated in 2022 is slightly lower than the public dose calculated in 2021. This is directly related to the lower gamma dose rate at location 12.

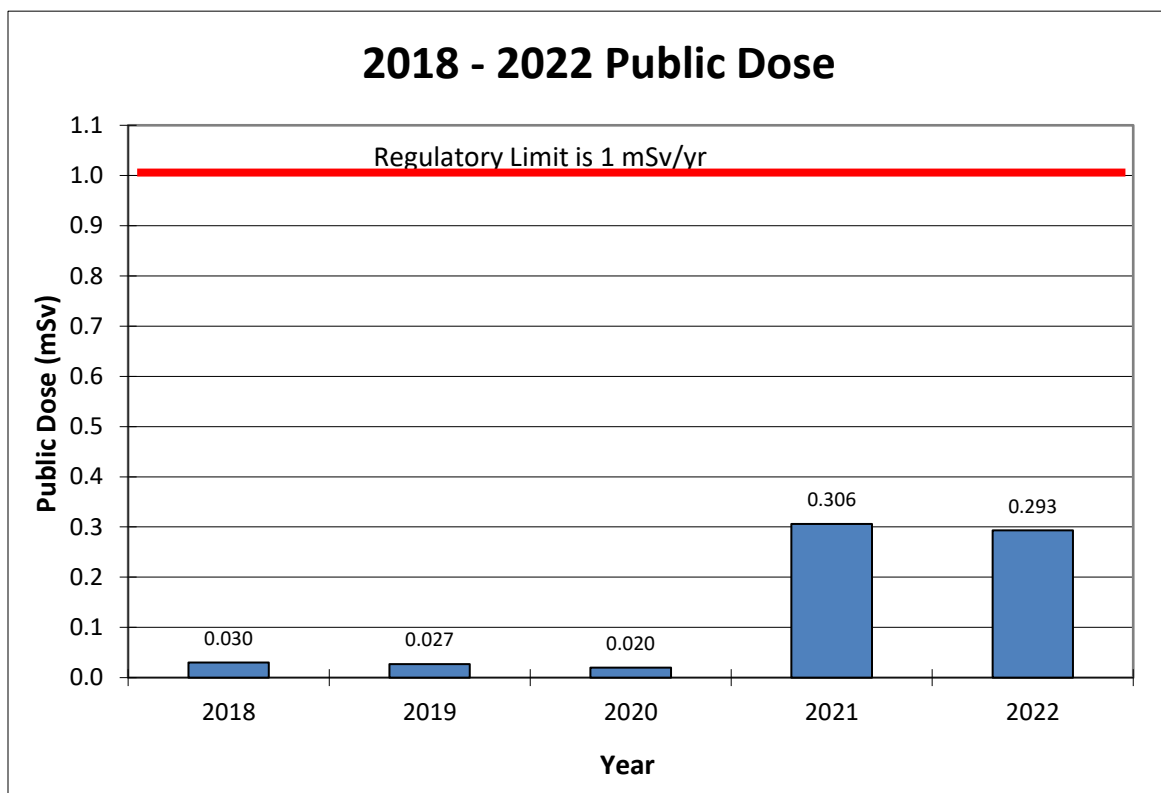
Table 27

2018 – 2022 Dose to the Public (mSv/yr)					
Parameter	2018	2019	2020	2021	2022
Air (combined)	0.004	0.004	0.003	0.021	-
Air (process stacks)	-	-	-	0.000	0.000
Air (building ventilation)	-	-	-	0.021	0.026
Liquid	-	-	-	0.004	0.001
Gamma (Location 12)	-	-	-	0.281	0.267
Gamma (Location 1)	0.026	0.023	0.017	0.002*	-
Total dose to Previous Critical Receptor (Location #1)	0.030	0.027	0.020	0.027*	-
Total Dose to Critical Receptor (Location #12)	-	-	-	0.306*	0.293

*Data calculated using location #1 gamma dose as well as revised DRL's and including liquid dose

+Data calculated using location #12 gamma dose as well as revised DRL's and including liquid dose

- not calculated in specified time period

Figure 14


Gamma Monitoring

In order to ensure that local residents are not exceeding the public dose limit, environmental dosimeters are strategically placed (at chest height) around the exterior perimeter of the licensed facility. The dosimeters are deployed on a quarterly basis and measure gamma levels in mSv and are converted into $\mu\text{Sv/hr}$ when the number of hours the dosimeters were deployed are taken into account. Twelve locations have been selected around the licensed facility's fenced perimeter.

The perimeter gamma DRL for the critical receptor at location #12 is $1.35 \mu\text{Sv/hr}$ and the action level remains at $1.0 \mu\text{Sv/hr}$ respectively. The other DRL's listed for gamma monitoring are for location #1 and location #2 at $4.96 \mu\text{Sv/hr}$ and $0.46 \mu\text{Sv/hr}$ respectively. There were no exceedances of the DRL's or the action levels in 2022.

Table 28 provides the average quarterly and maximum gamma levels in $\mu\text{Sv/hr}$ for all fence line monitoring locations (i.e., 1-12) in 2022. The location with the highest gamma level in 2022 was location 12. This is due to the proximity of the location to the Fuel Storage Building and is within the typical range.

Table 28

2022 Gamma Monitoring Results ($\mu\text{Sv/hr}$)				
Location	Regulatory Limit (DRL)	Action Level	Annual Average	Quarterly Maximum
1	4.96	0.2	0.02	0.02
2	0.46	0.2	0.04	0.07
3	-	1.0	0.00	0.00
4	-	1.0	0.00	0.00
5	-	1.0	0.00	0.00
6	-	1.0	0.00	0.00
7	-	1.0	0.00	0.00
8	-	1.0	0.00	0.00
9	-	1.0	0.04	0.07
10	-	1.0	0.00	0.00
11	-	1.0	0.27	0.30
12	1.35	1.0	0.36	0.38

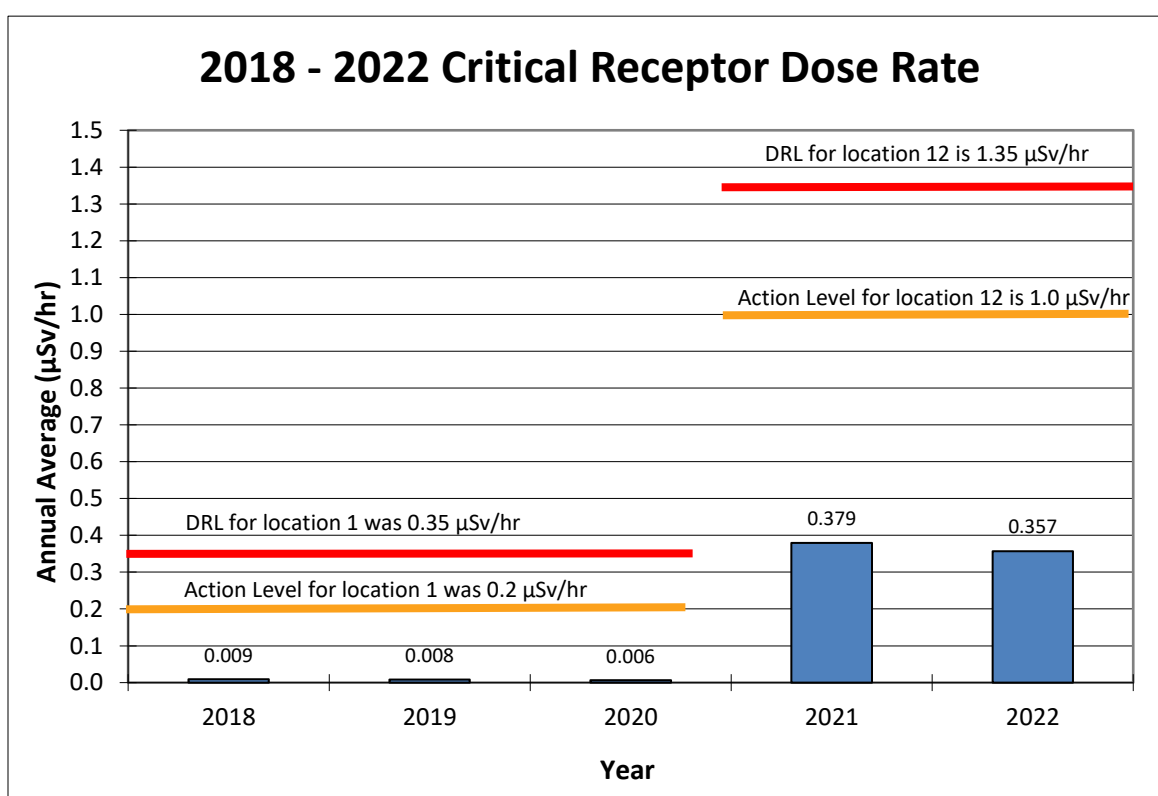
The annual average monitoring results for location 1 (previous critical receptor location) and location 12 (critical receptor from 2020 DRL report) are provided in Table 29 and Figure 15. Results have been corrected to take into account background gamma levels by subtracting $0.08 \mu\text{Sv/hr}$.

Table 29

2018 – 2022 Critical Receptor Gamma Monitoring Results (µSv/hr)			
Period	Regulatory Limit (DRL)	Action Level	Annual Average
2018	0.35	0.2	0.009*
2019	0.35	0.2	0.008*
2020	0.35	0.2	0.006*
2021	1.35	1.0	0.379*
2022	1.35	1.0	0.357*

*Uses location #1 as the critical receptor and 2002 DRLs

+ uses location #12 as the critical receptor and 2020 DRLs

Figure 15


Discharge to Air

Discharge to air is calculated from the releases of particulate UO₂ to air from process stacks and through building ventilation. Process stacks are sampled and analyzed daily for uranium emissions. In addition, each process area also has its own separate ventilation system. Emissions from this system are determined using in-plant air sampling data and exhaust discharge rates.

Stack Emissions

Samples of the gaseous effluent released from the plant are obtained by stack sampling which has been designed to meet the requirements of ANSI N13.1 *Guide to Sampling Airborne Radioactive Materials at Nuclear Facilities*. The samples are analyzed by alpha counting to obtain the uranium concentration. In 2022 CFM sampled 9 process stacks throughout the year for uranium emissions.

A variety of pollution control equipment including baghouses, and absolute filters are used at the facility to control and reduce emissions to air. On March 1, 2022, when CFM was issued a new licence, the release limit for air emissions changed from 14 kg/yr to 10.5 kg/yr. This includes emission from both the exhaust ventilation and process stacks. The stack effluent action level is 2.0 $\mu\text{g}/\text{m}^3$ uranium concentration for a single stack reading. There were no exceedances of the release limit or the action level with respect to air emissions.

Table 30 provides the 2022 average and maximum daily uranium concentration in $\mu\text{g}/\text{m}^3$ by stack. The maximum for all the stacks was 0.699 $\mu\text{g}/\text{m}^3$ and occurred in Waste Treatment Area Absolute Filter stack in the second quarter.

Table 31 and Figure 16 provide the estimated uranium emitted in kilograms from 2018 to 2022. The total amount of uranium dioxide released to the environment during the year in gaseous effluent from stacks was 0.01 kg (5 grams). As indicated in the tables, stack emissions remain low and are well below the annual release limit.

Table 30

2022 Stack Sampling Summary (µg/m³)			
Source	Action Level (µg/m³)	Average Annual Result (µg/m³)	Maximum Annual Result (µg/m³)
BMS Extraction	2.0	0.04	0.25
Furnace Burn-off	2.0	0.01	0.06
Hoffman Vacuum	2.0	0.01	0.07
Mist Collector	2.0	0.01	0.09
PP2 East	2.0	0.03	0.15
PP2 West	2.0	0.01	0.06
Pangborn North Dust Collector	2.0	0.04	0.19
Pangborn South Dust Collector	2.0	0.01	0.12
Waste Treatment Area Absolute Filter	2.0	0.21	0.70
Overall Average & Maximum		0.04	0.70

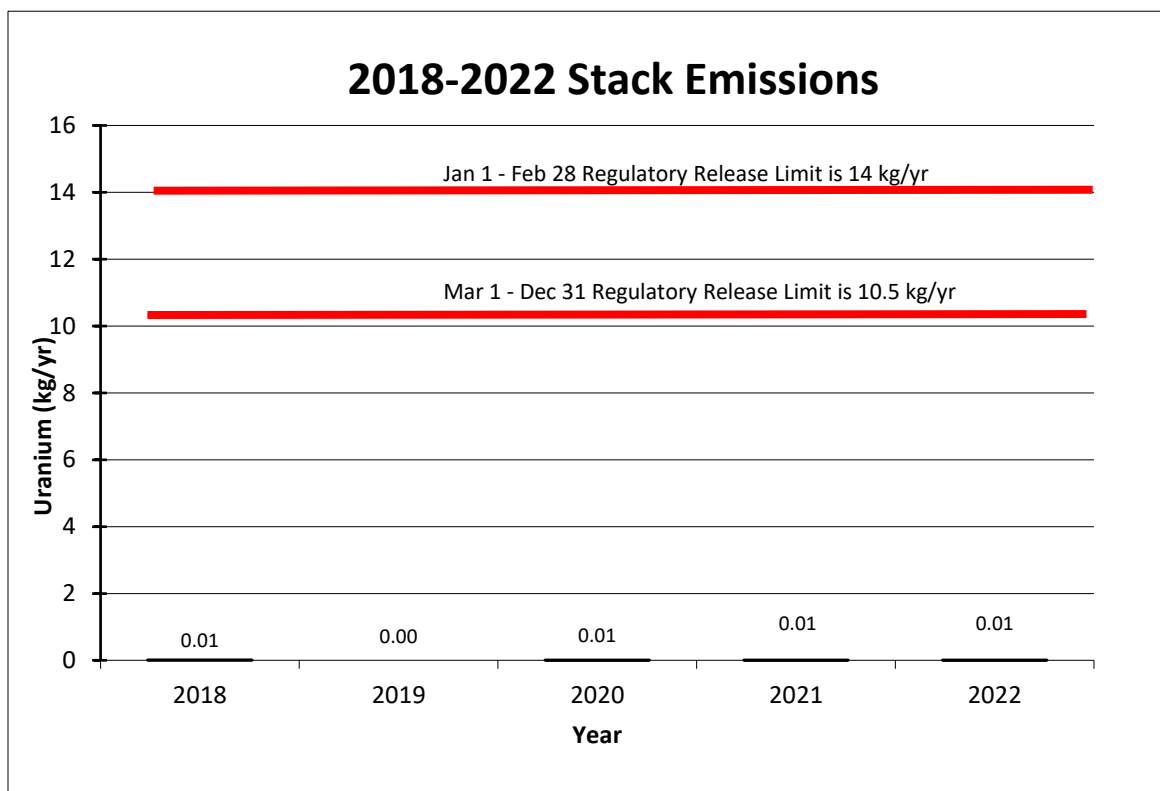
Table 31

2018-2022 Stack Emissions (kg/yr)						
	Release Limit	2018	2019	2020	2021	2022
Annual Stack Emissions	14* 10.5	0.01	0.00*	0.01	0.01	0.01

*Air emissions for 2019 was 4 grams and reported as 0.00 kg

+Jan. 1 to Feb 28, 2002 release limit was 14 kg/yr and Mar 1. to Dec. 21, 2022 was 10.5 kg/yr

Figure 16



Building Ventilation Emissions

Emissions from the main Pelletizing Area building ventilation system are determined using in-plant air sampling data and exhaust discharge rates. Emissions in the PP2 area are calculated using alpha continuous air monitors and the exhaust discharge rate for the area. As the exhaust in this area uses HEPA filtration, a 90% efficiency factor is also applied in the calculation.

The DRL for air effluent (building ventilation) is 41.5 kg/year. On March 1, 2022, when CFM was issued a new licence, the release limit for air emissions changed from 14 kg/yr to 10.5 kg/yr. This includes emission from both the exhaust ventilation and process stacks. The action level for building ventilation is 1.0 g/hr monitored on a daily basis for the Pelletizing Area and 0.4 g/hr for the PP2 area. There were no exceedances of the CNSC release limit or the building ventilation action levels in 2022.

Table 32 and Figure 17 provides the estimated release of uranium concentration through exhaust ventilation from 2018 to 2022. The estimated release of UO_2 from all exhaust

ventilation in 2022 was 1.06 kg, with the majority of the amount coming from the Pelleting Area (approximately 87%).

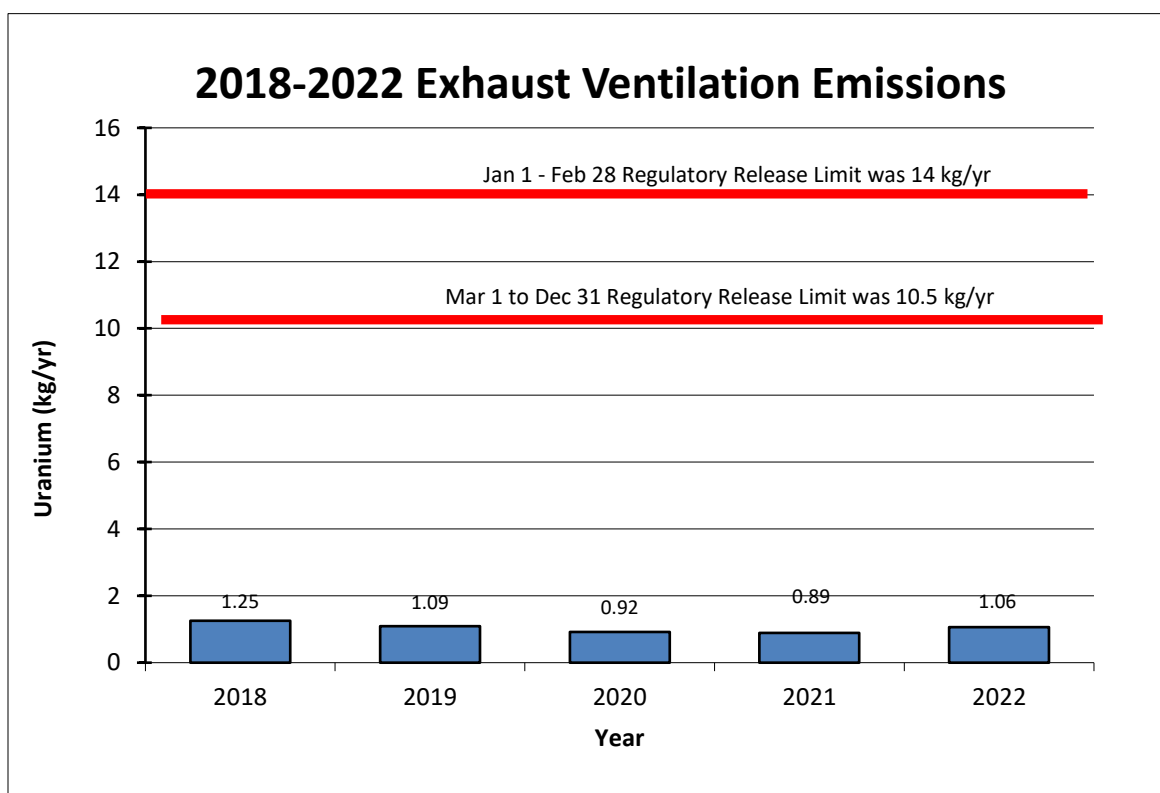
The annual value is calculated on a daily basis with a total sum provided for the year. The amount emitted in 2022 was higher than 2020 and 2021 but was lower than 2018 and 2019.

Table 32

Exhaust Ventilation Emissions (kg/yr)						
Parameter	Release Limit	2018	2019	2020	2021	2022
Annual Exhaust Emissions	14 ⁺	1.25	1.09	0.92	0.89	1.06

+Jan. 1 to Feb 28, 2002 release limit was 14 kg/yr and Mar 1. to Dec. 21, 2022 was 10.5 kg/yr

Figure 17



The daily average concentration of uranium emitted through exhaust ventilation in the Pelleting Area in 2022 was 0.2 g/hr and the maximum concentration of uranium was 0.4 g/hr which is comparable to the average from previous years with the maximum lower than the maximum from previous years except for 2021. The average and maximum in

the PP2 area in 2022 was 0.0 g/hr and 0.1 g/hr respectively which is the same as previous years. Table 33 provides the average and maximum uranium concentration emitted through the building ventilation system in g/hr from 2018 to 2022 for the Pelleting Area and the PP2 area. Figure 18 provides the average and maximum uranium concentration emitted through the Pelleting Area and Figure 19 provides the average and maximum uranium concentration emitted through the PP2 area.

The table and figures demonstrate that the PP2 area has much lower emissions through building ventilation than the Pelleting Area.

Table 33

Building Ventilation Rates by Year (g/hr)							
Parameter	Action Level	Measure	2018	2019	2020	2021	2022
Uranium Emissions from Pelleting Area	1.0	Average	0.2	0.2	0.1	0.1	0.2
		Maximum	0.9	0.5	0.5	0.3	0.4
Uranium Emissions from PP2 Area	0.4	Average	0.0	0.0	0.0	0.0	0.0
		Maximum	0.1	0.1	0.1	0.1	0.1

Figure 18

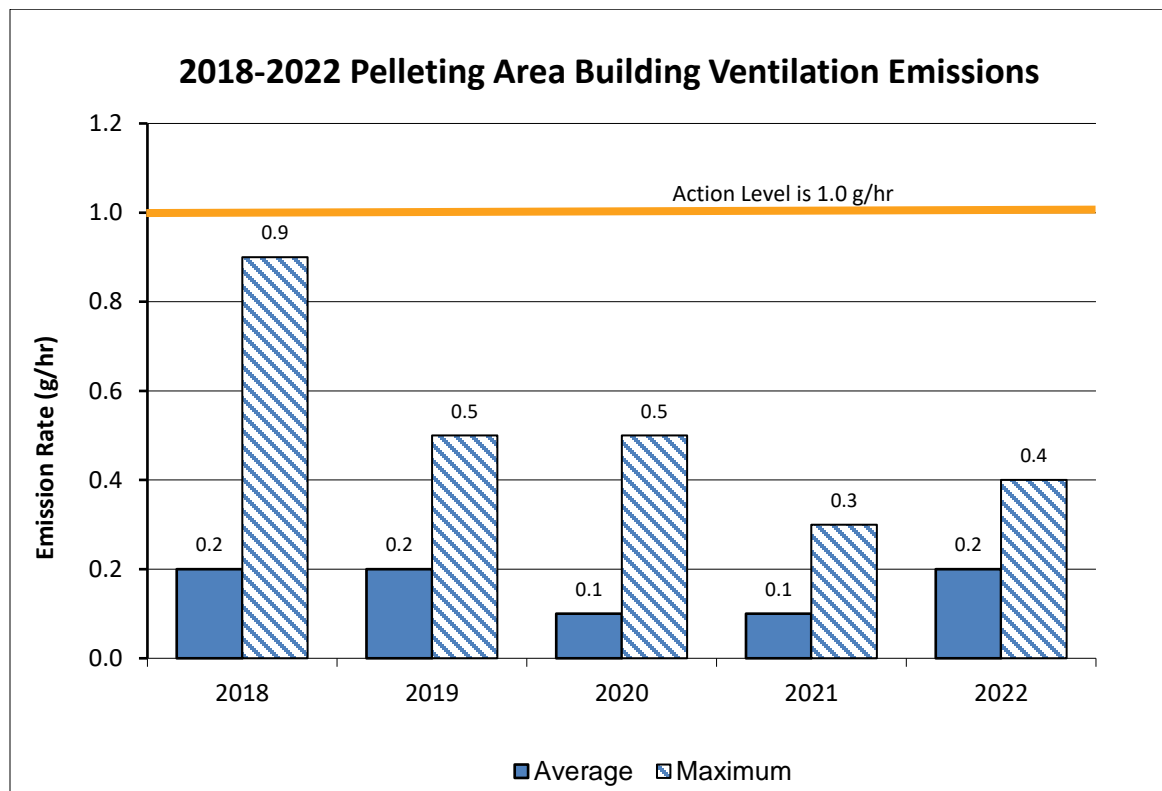
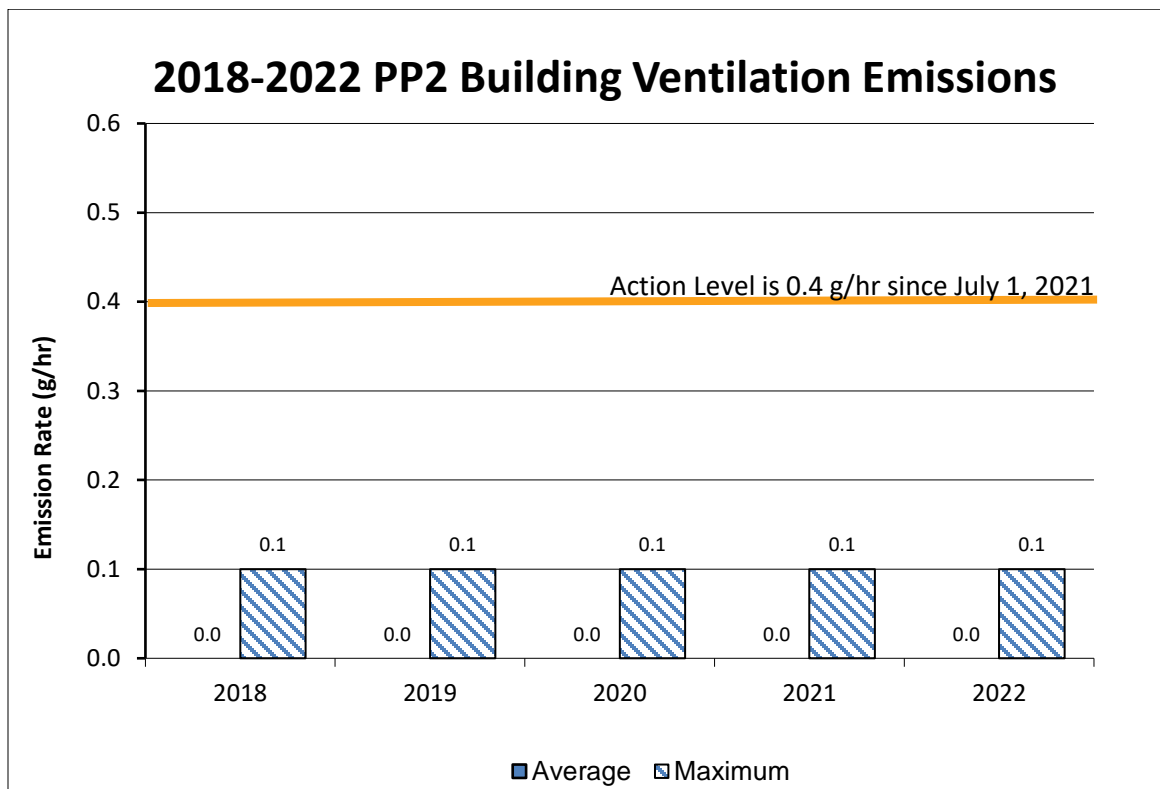


Figure 19


Discharge to Sewer

Liquid effluent generated from production processes is collected and treated to remove the majority of the UO_2 using an evaporator process. The condensed liquid is sampled and analyzed prior to a controlled release to the sanitary sewer. Liquid effluent generated from sanitary sewer systems (i.e., showers and bathroom facilities, laundry facilities, etc.) are released directly to sanitary sewer.

Liquid effluent is monitored for uranium content to ensure compliance with various federal, provincial, and municipal regulations. Automated sampling takes a sewer sample from the plant sewer line at regular intervals 24 hours per day at the point of discharge to create a composite. A composite sample is taken twice a week and is analyzed for uranium concentration. The composite sample is representative of liquid effluent discharged from the facility, including the condensate liquid effluent and the discharge from the groundwater treatment system.

On March 1, 2022 CFM was issued a new licence and the release limit for liquid emissions changed from 475 kg/yr to 1.7 mg U/L for a weekly composite sample. The action level for the uranium concentration in sewer emissions discharged to the municipal

sewer system is 0.1 mg/L for a weekly composite. The action level for pH is greater than or equal to 6.5 and less than or equal to 9.0.

The total amount of uranium released to the sanitary sewer in 2022 was estimated to be 0.21 kg. The average concentration of uranium in the sewer effluent for the year was 0.02 mg/L with a maximum result for a single composite sample of 0.09 mg/L.

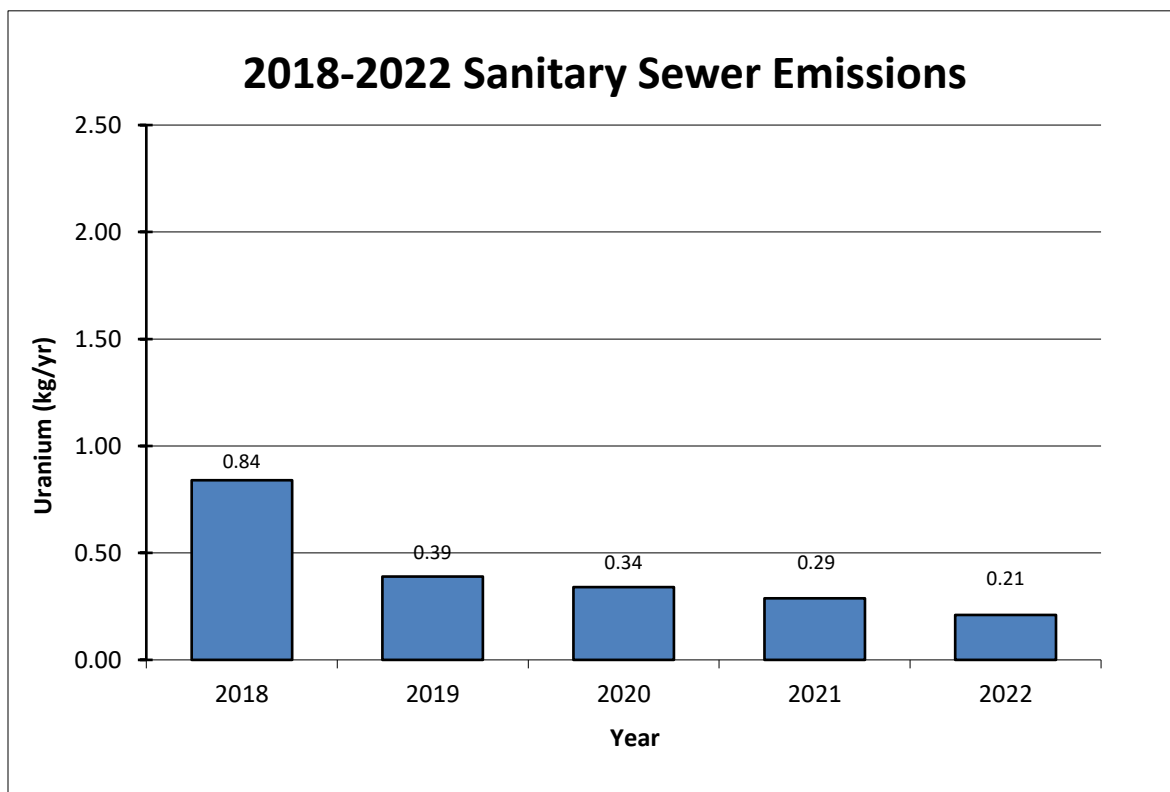
Since 2019 there continued to be a reduction in the amount of uranium emitted through the sanitary sewer. This is most likely attributed to the installation and commissioning of the automated pellet grinding equipment in 2017 and 2018. The pellet wash water on the automated lines is processed in the waste treatment circuit and not released to the sewer. This has reduced the amount of uranium emitted in liquid effluent. The volume of water discharged from the facility was markedly lower than previous years largely due to issues with the groundwater treatment system.

Table 34 provides the average and maximum uranium concentration for single composite samples from 2018 to 2022. Also provided are the 2022 minimum and maximum pH measurements along with the volume of water discharged and the emission results. Figure 20 provides the estimated amount of uranium discharged through the sanitary sewer. The estimated annual discharge in 2022 was lower than previous years.

Table 34

2018-2022 Sanitary Sewer Emissions							
Parameter	Measure	Action Level	2018	2019	2020	2020	2022
Uranium	Avg.		0.02	0.01	0.01	0.01	0.02
(mg/L)	Max.	0.1	0.11	0.03	0.05	0.03	0.09
pH	Min.	6.5	7.3	7.4	7.3	6.8	6.6
(pH units)	Max.	9.0	8.4	8.2	8.9	8.9	7.6
Volume of water (m3)	-	-	36 022	29 064	24 172	20 998	13 720
Estimated Discharge (kg)	-	-	0.84	0.39	0.34	0.29	0.21

Figure 20



Ambient Air Monitoring

In addition to onsite monitoring of emissions, CFM has a comprehensive ambient monitoring program including sampling of ambient air, soil, and groundwater.

CFM uses hi-volume air samplers to measure the concentration of UO_2 that has been emitted from gaseous emissions (i.e., stack as well as building ventilation emissions) along the plant boundary at ground level. The system provides information on the impact to the public as well as the environmental impact from facility operations. High volume air samples are collected in the four corners within the CFM fence line. The samplers are run for 24 hours per day on a continuous basis. The sample filter is changed once a week and analyzed for uranium concentration.

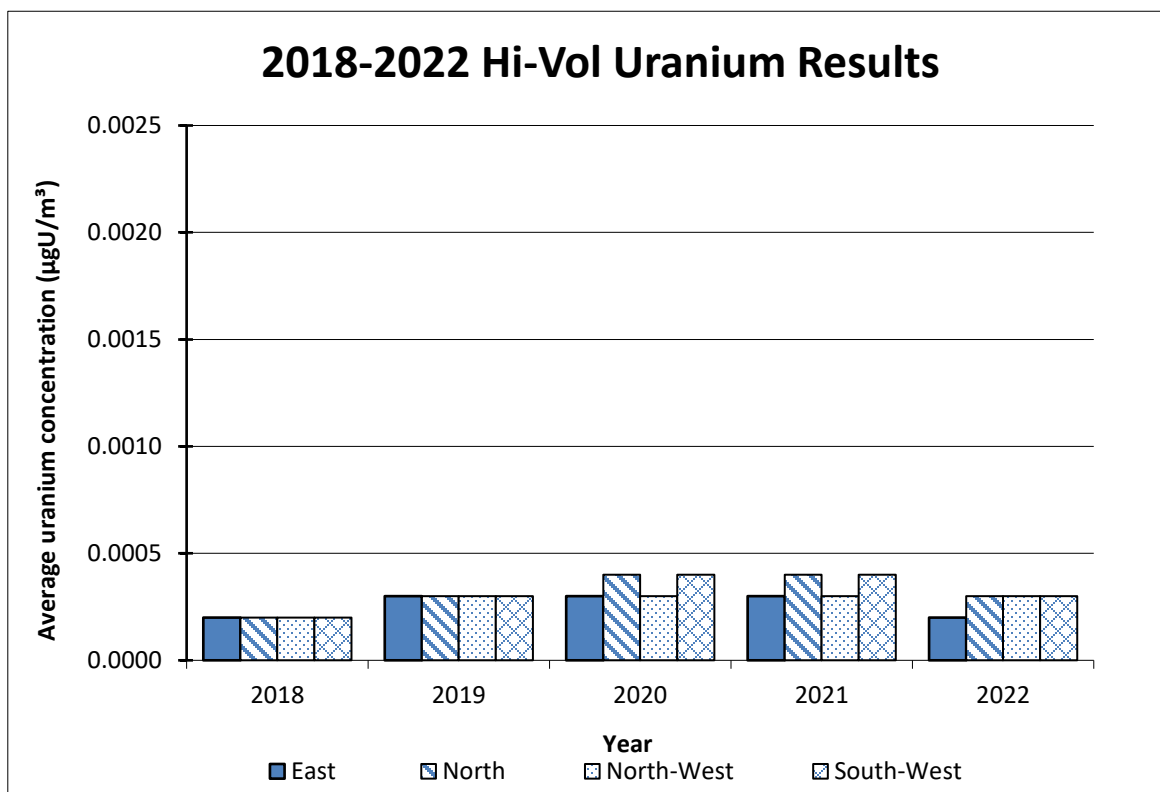
The maximum concentration of uranium in 2022 was $0.0023 \mu\text{g}/\text{m}^3$ and occurred during the second quarter in the North location. Annual results from all stations remain well below the MECP standard annual average limit of $0.03 \mu\text{gU}/\text{m}^3$ that came into effect in July 2016 as well as the provincial ambient air quality criteria (AAQC) of $0.06 \mu\text{gU}/\text{m}^3$ TSP.

Table 35 and Figure 21 present results of the annual average and maximum uranium in air concentrations for 2018 – 2022 at the four locations.

Table 35

Annual Uranium-in-Air Concentration at Hi-Vol Stations						
		2018	2019	2020	2021	2022
East	Average	0.0002	0.0002	0.0003	0.0003	0.0002
	Maximum	0.0005	0.0008	0.0014	0.0039	0.0009
North	Average	0.0002	0.0003	0.0004	0.0004	0.0003
	Maximum	0.0005	0.0014	0.0024	0.0050	0.0023
North West	Average	0.0002	0.0003	0.0003	0.0003	0.0003
	Maximum	0.0006	0.0016	0.0012	0.0042	0.0021
South West	Average	0.0002	0.0003	0.0004	0.0004	0.0003
	Maximum	0.0005	0.0015	0.0014	0.0056	0.0011

Figure 21



Soil Monitoring

As part of CFM's commitment to protecting the community and the environment, samples from the soil and vegetation are routinely collected from specific locations surrounding the facility for analysis. The purpose of the survey is to measure and document uranium concentrations in the soil and vegetation to verify that no significant build up from emissions of uranium have been released from the facility.

At least every three years, vegetation and core samples are each separately collected at 23 locations surrounding the Port Hope facility (locations are provided in Figure 23). From 2008 to 2010 CFM was performing soil monitoring on an annual basis until the decision was made to go back to the three year sampling schedule that was in place previously.

Core samples are taken in five areas within each location. Each core sample is divided into three sections (0-5 cm, 5-10 cm, and bottom 10-15 cm) and combined with the other cores taken from the same site to obtain a representative sample of that location. In addition, a representative sample of the surface vegetation growing within the sampling site is taken. Uranium samples are sent to an external laboratory and are reported in micrograms per gram ($\mu\text{g/g}$).

Soil sampling was conducted in 2022 on the three year schedule. The average and maximum results of the soil sampling conducted in 2022 are provided in Table 36 and Figure 22 along with the last five sampling campaigns. The maximum results in 2022 were higher than previous years with the maximum of 33.9 $\mu\text{g/g}$ measured in location 14 which is located in the north-east corner of the parking lot outside the fence line. This location has historically shown elevated results although not in recent years. The elevated maximum results are not attributed to air deposition due to the low levels of uranium released. The results are most likely attributed to natural variations in the soil.

Table 36

Soil Results (µg/g)						
Depth	Average/Maximum	2010	2013	2016	2019	2022
Vegetation	Average	1.5	1.3	0.7	0.3	0.3
	Maximum	6.0	2.9	3.4	1.3	2.8
Surface	Average	5.2	4.1	-	-	-
	Maximum	18.6	13.1	-	-	-
0-5cm	Average	5.6	4.7	3.0	2.9	3.6
	Maximum	21.1	17.4	10.2	7.6	25.8
5-10cm	Average	5.6	4.8	3.2	3.0	4.0
	Maximum	19.1	17.3	11.2	7.5	33.9
10-15cm	Average	-	-	3.2	2.8	3.4
	Maximum	-	-	11.1	7.5	20.6

- results are not available due to change in sampling approach.

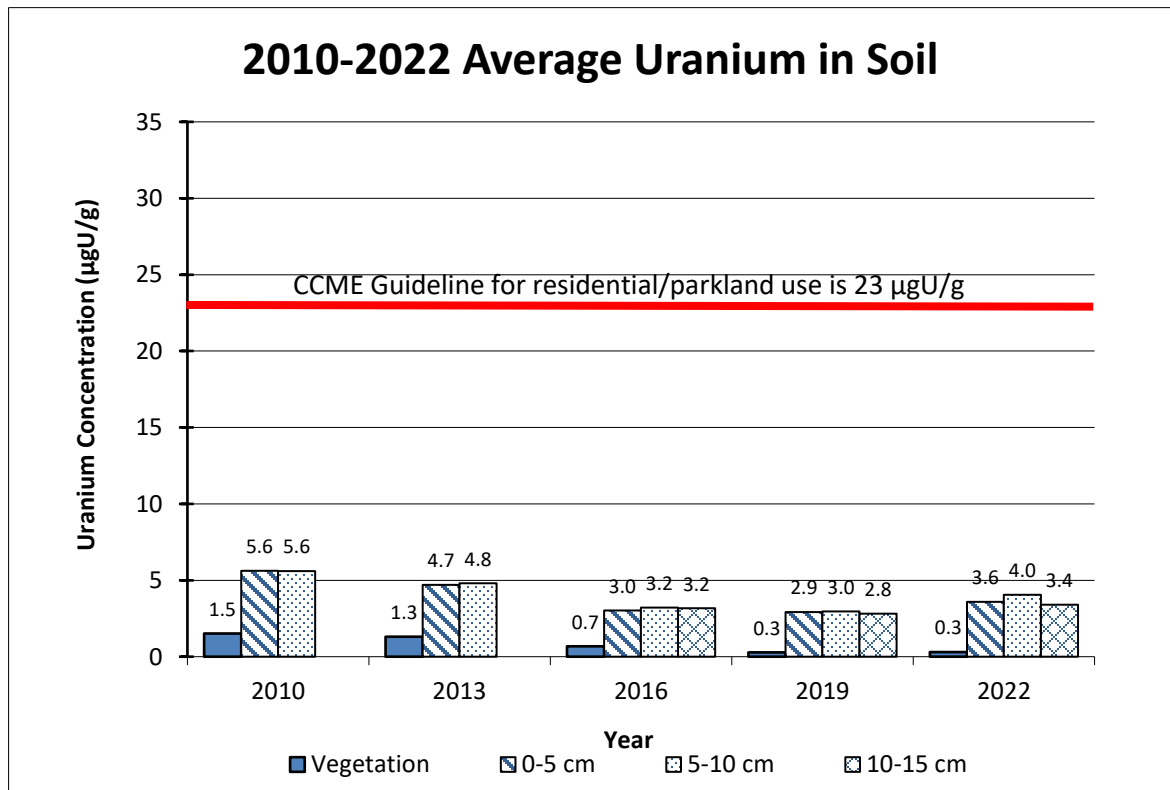
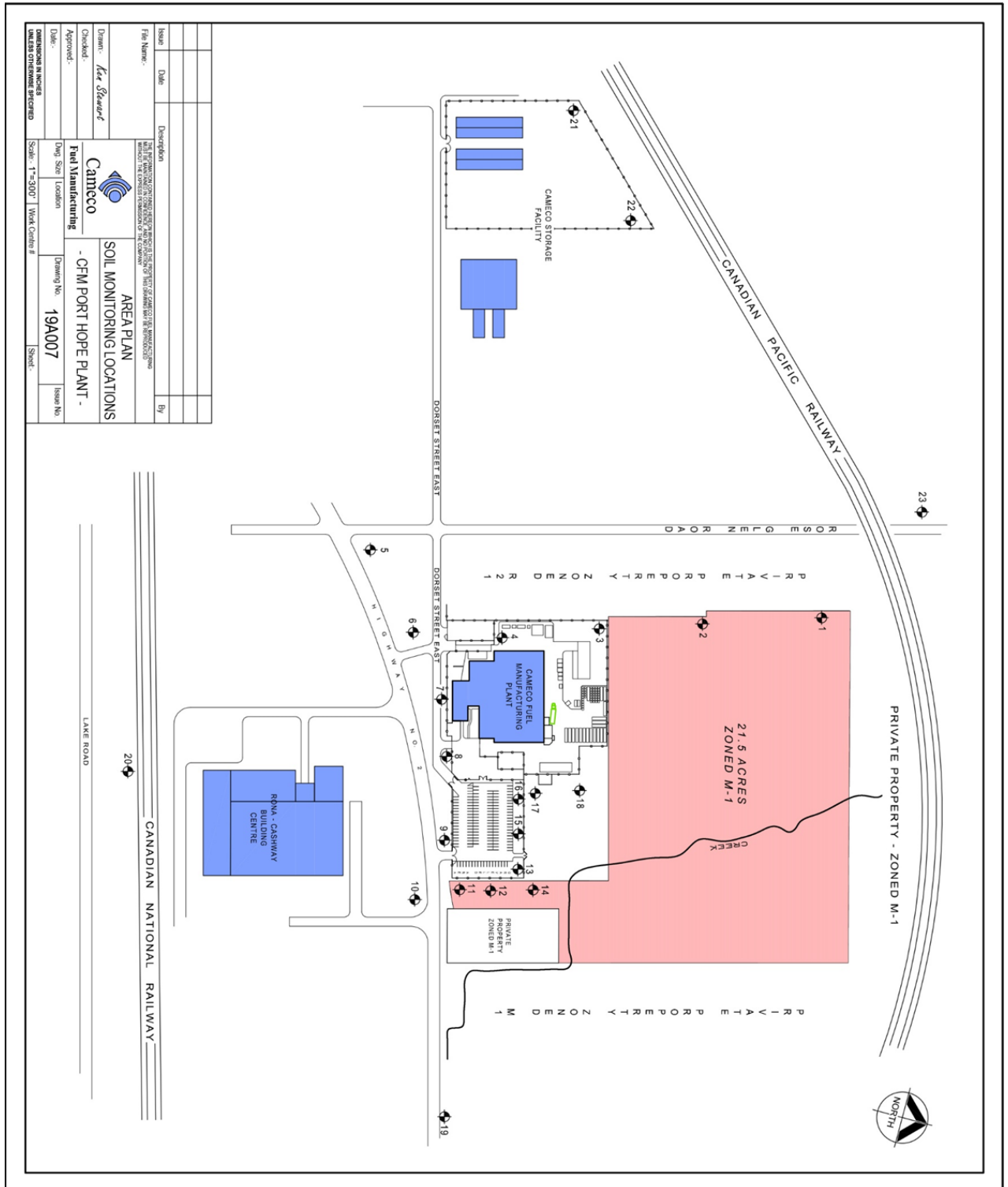
Figure 22


Figure 23: Soil Sampling Locations



Groundwater Monitoring

CFM has an extensive groundwater monitoring program in place. Groundwater monitoring locations are sampled semi-annually in the spring and fall of each year, while the surface water and storm sewer intermittent drainage feature (drainage ditch) locations are targeted for sampling three times per year in the spring, summer and fall in association with precipitation events. Samples are collected by a third-party consultant and are sent to an independent laboratory for analysis. Results of the groundwater monitoring program, among other items, are summarized and discussed in third party annual groundwater and surface water review reports. These reports are submitted to the CNSC and the MECP under separate covers.

Up to 10 of 12 pumping wells and up to two sumps (internal and external) were in operation during 2022. The 2022 mean recovery rate was approximately 7.9 m³/day, a significant decrease from the 2021 mean rate of 28.3 m³/day. Extended periods of treatment system downtime were experienced between January-February and August-December 2022. System downtime periods related to major equipment failures, replacement equipment lead times, and sanitary sewer discharge line throughput limitations.

Key groundwater pump-and-treat system maintenance tasks completed within the 2022 calendar year included typical pumping well equipment replacements (submersible pumps), air stripper unit breakdown/scale accumulation removal, a system flow meter verification, air stripper discharge pump replacements and a blower replacement.

Figure 24 and Figure 25 illustrate the monitoring well locations and groundwater elevation contours for the 2022 spring and fall sampling campaigns. Groundwater in overburden is interpreted as entering the site from the west to northwest and flowing to the east and southeast in the direction of Gages Creek. When operational, the groundwater pump-and-treat system has local influence on overburden groundwater flows.

Effluent and Environmental Monitoring Program Performance

The facility Environmental Protection Program sets out the effluent and environmental monitoring requirements for the facility to ensure adequate environmental protection measures are in place. The performance criteria of these programs is that at least 90% of planned samples are collected and analyzed to meet the data acceptance criteria. Please find below the performance criteria for the data collected during the year:

- Water samples (i.e., sanitary discharge) – 100% of planned samples were collected

- Air samples (i.e., stacks, in-plant air, CAM heads) – 99% of planned samples were collected
- Environmental Samples (i.e., 100% surface water, 92% groundwater, 100% hivol, 100% fenceline gamma, 100% soil, 100% vegetation) – 99% of planned samples were collected

In 2022, all analysis under the environmental program was completed with the quality control set out in the analytical methods. There were approximately 50 samples not collected for various reasons either due to analytical issues or collection issues due to weather, etc). Therefore, the samples collected and analyzed throughout the year meet the data acceptance criteria.

Figure 24: Groundwater Elevation Contours – Spring

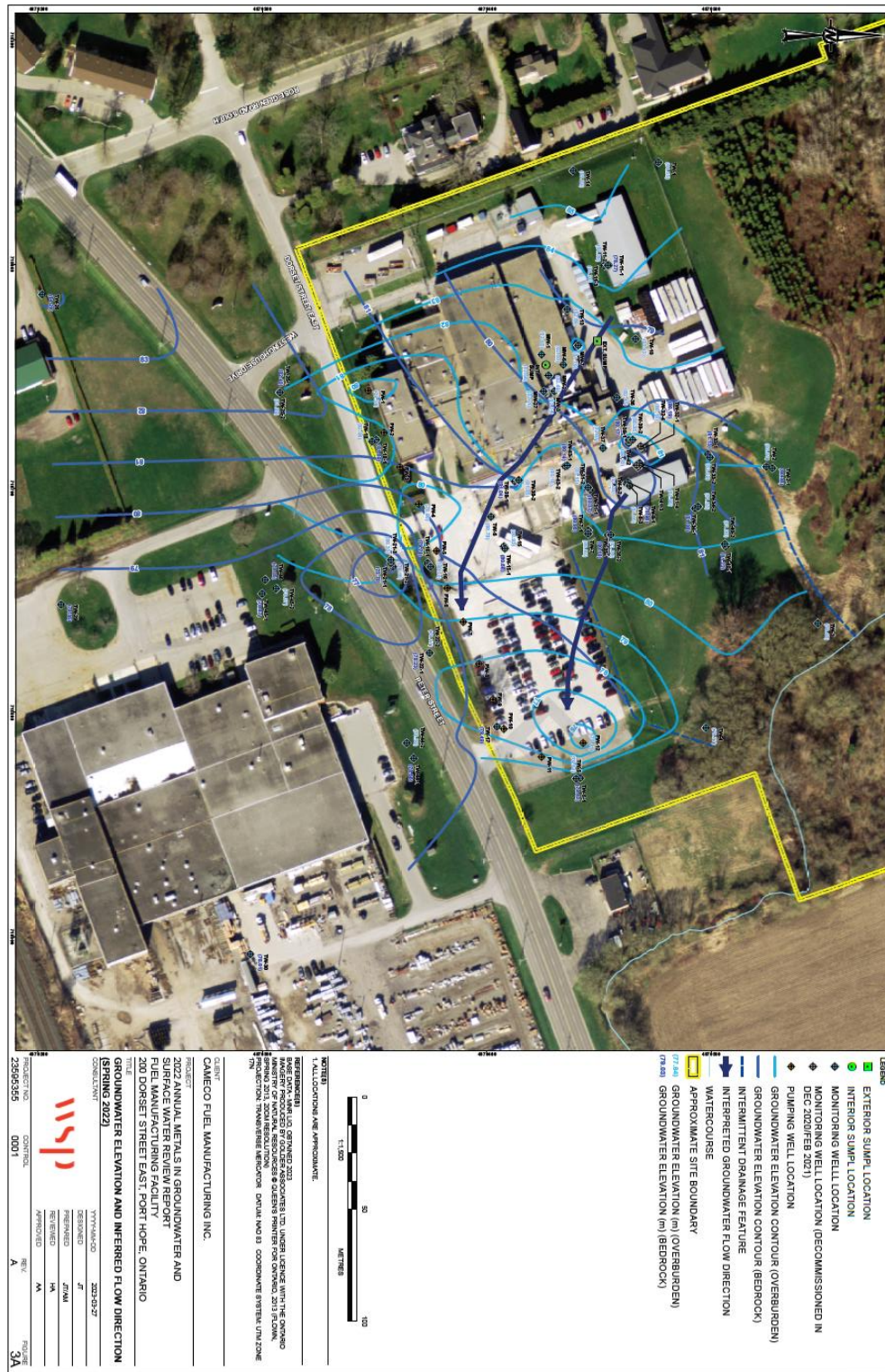
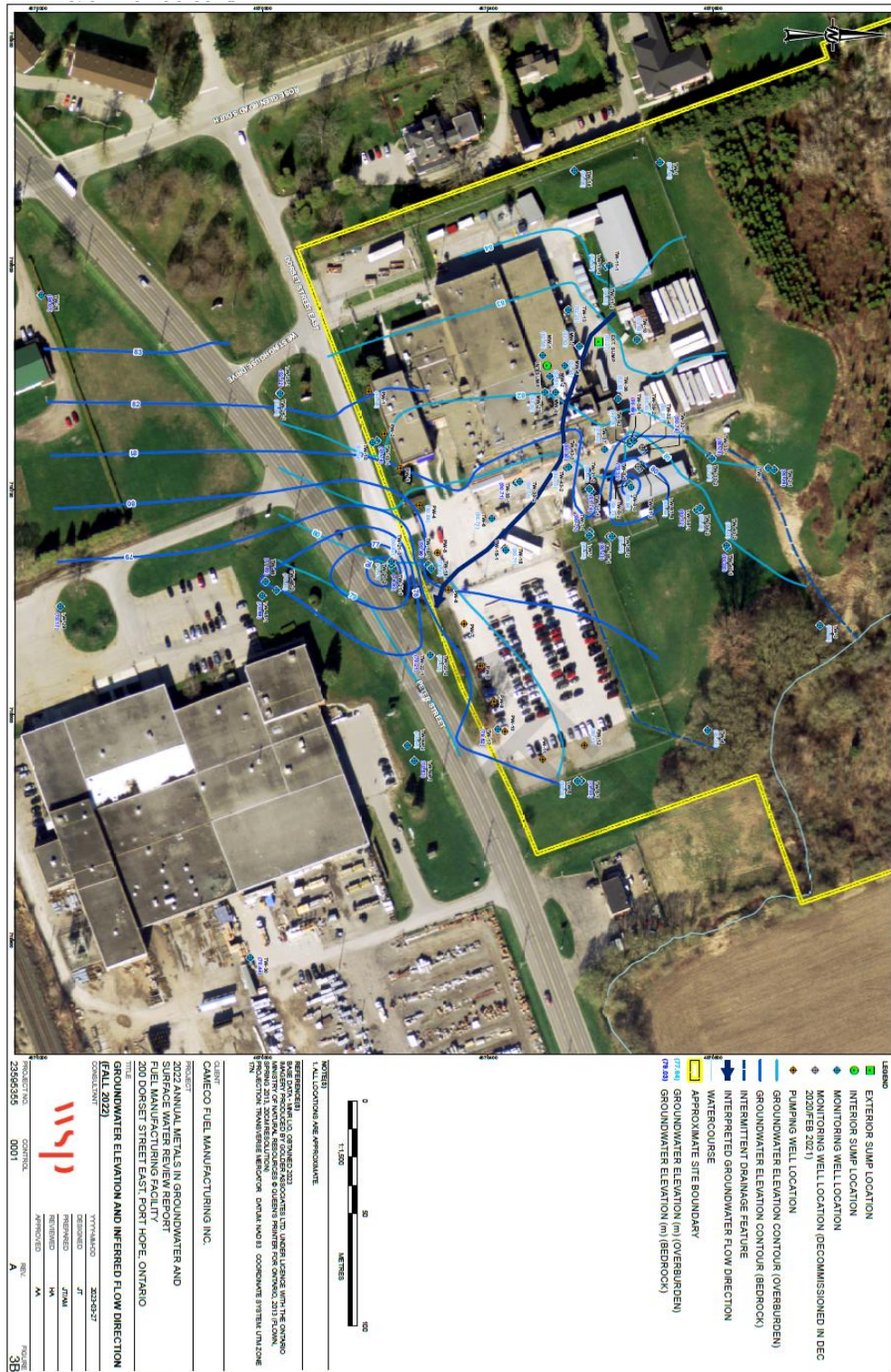


Figure 25: Groundwater Elevation Contours – Fall



2.3.4 Emergency Management and Response

This safety and control area covers emergency plans and emergency preparedness programs. These procedures must exist for emergencies and for non-routine conditions. This also includes the Fire Protection Program (FPP) and any results of emergency exercise participation.

Effective emergency response is carried out through CFM's Emergency Preparedness and Response Procedure. The plan assigns specific accountabilities and sets out processes and procedures to protect the health and safety of employees, contractors, the public and the environment in the case of an emergency.

As the primary response provider for the facility, the Port Hope Fire and Emergency Services (PHFES) have the resources in place to effectively respond to emergencies at the facility. CFM has a memorandum of understanding with the PHFES and the Municipality of Port Hope which provides the framework for successful emergency response to the facility. Also, as part of the agreement, CFM provides PHFES with the necessary equipment and training to effectively respond to emergencies at the facility.

Emergency response is a key component of an effective FPP. The FPP at the facility meets both internal Cameco requirements, and it also meets the requirements of the standards: *N393-13; Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*, *National Fire Code of Canada*, 2015, and the *National Building Code of Canada*, 2015. In developing the FPP, a defense-in-depth approach was used to ensure that the fire protection measures are adequate for the fire safety of the facility. The FPP is comprised of the FHA and other fire protection supporting documents which cover a number of areas including fire prevention and fire protection. The supporting documents define those elements which positively contribute to prevent fires, maintain fire safe conditions at the facility, maintain reliability of the fire protection systems and provide an effective emergency response to limit the effects of fire.

The annual third party review completed in 2022, will be submitted in 2023, and included all elements according to the three year cycle outlined in CSA N393. The annual SCI (Site Condition Inspection) report identified eight new findings under the categories of fire separations and compressed gas cylinders. As a result of the findings, six corrective actions and one activity were entered into CIRS. All corrective actions and the activity remain on schedule.

The three-year FPP audit was completed as required by CSA and identified two findings and five opportunities for improvement under the categories of fire protection program and sprinkler systems. As a result of the findings and opportunities for improvement, two corrective actions and five activities were entered into CIRS. The corrective actions and activities remain on schedule.

The three-year Emergency Drill Audit was completed as required by CSA N393 which identified six opportunities for improvement. As a result of the opportunities for improvement, four activities were entered into CIRS and remain on schedule.

CFM completed the annual emergency response training virtually to the internal emergency response team, consisting of senior managers, supervisors as well as immediate responders. The training department continued to deliver the emergency response training in a virtual format in 2022. Immediate Responder qualifications are continues to be reviewed on a monthly basis. If any qualifications are not current, the Immediate Responder is deemed “inactive” and is informed they are not to take on an active role during an emergency situation.

In 2022 as part of the three year cycle, CFM completed a full scale, real-time exercise titled Operation “Gloria”. The exercise was conducted to practice emergency response to an incident involving site personnel, the PHFES, and Cameco’s Local Crisis Management Team (LCMT). The exercise was designed to practice an integrated response from agencies to a realistic emergency event that could have impacts on the facility, site employees and the surrounding community. The full-scale exercise is not meant to be a venue to coach but to allow all personnel to respond as if it was a real emergency.

The objectives of the exercise were:

1. Demonstrate the ability to design an emergency exercise with a defined set of objectives developed from findings of previous emergency exercises. The scenario should incorporate two credible emergencies (fire and missing/contaminated/injured person).
2. Practice the activation, response, and support from the CFM emergency response groups (establish response teams with appropriate staffing levels including Team A, Team B, IC/Safety Officer, etc.).
3. Practice evacuation and headcount procedures.
4. Demonstrate PHFES can effectively manage a fire emergency at CFM (establish IC post, practice accountability, establish entry control procedures etc.).
5. Practice response and coordination of an emergency with support from the Cameco LCMT, including a coordinated approach for communications.
6. Practice unified command with PHFES to effectively establish an Incident Command Post.
7. Practice the notification of Regulatory Agencies including the conduct of live notification and follow up with the CNSC Duty Officer.
8. Demonstrate that PHFES has taken control of the site and released the site back to CFM.
9. Practice effective CFM IC personnel accountability (effective use of the accountability board).

10. Demonstrate the ability to collect feedback, identify lessons learned and corrective measures needed.

The exercise was determined to be successful and demonstrated good coordination between CFM Immediate Responders and external responders. From the exercise some lessons were learned that will be incorporated into CFM's Emergency Response Procedure as part of continuous improvement.

CFM provided Port Hope Fire and Emergency Services with its annual familiarization training to the fire fighters on June 14th. CFM Port Hope is investigating the installation of a two-stage fire alarm system to address the false alarms in response from the Port Hope Fire Emergency Services.

CFM continues to have a strong positive relationship with the Port Hope Fire Emergency Services (PHFES). During the exercise it was reinforced that there is a clear relationship, the response plan and incident command was understood by both parties.

With the positive outcomes from the emergency exercise with PHFES and the findings from the Site Condition Inspection and Fire Protection Program audit, the Emergency Management and Fire Protection has been effective.

2.3.5 Waste and By-product Management

This safety and control area covers internal waste and by-product-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 and by-product management facility. This also covers the ongoing decontamination and planning for decommissioning activities.

Solid waste materials contaminated with uranium are reprocessed, recycled, and re-used to the extent possible. Waste materials that cannot be reprocessed, recycled or re-used are safely stored on site until disposal.

Wastes generated at CFM are segregated as non-hazardous, contaminated hazardous or non-contaminated hazardous waste at the point of generation. Non-hazardous waste is either recycled or transferred to an appropriate waste management facility. Contaminated hazardous waste and non-contaminated hazardous waste is stored in appropriate containers pending assessment of recycling or disposal options in accordance with site procedures.

During 2022, CFM continued to improve the existing waste management program in accordance with Canadian Safety Association (CSA) standards N292.3-14 Management of low and intermediate-low radioactive waste and N292.0-14 General principles for the management of radioactive waste and irradiated fuel. Removal activities were undertaken in 2022 to address some of the accumulated legacy radioactive waste that has been stored at CFM for many years. This included sorting, removal of nuclear material and repackaging of legacy drums. Disposal of this material at an appropriately permitted facility continued in 2022 with two shipments removing approximately 11,400 kg of non-combustible waste from the facility.

There was no significant generation of by-products at the facility in 2022.

All contaminated waste material was packaged and shipped in accordance with applicable Transportation of Dangerous Goods regulations. All waste was shipped to facilities that are licensed to accept the waste material.

CFM has waste processing and disposal streams in place for Contaminated Combustible materials that are generated through current production as well as a stream for marginally contaminated material. CFM also performs decontamination of other materials for recycling (metal) or disposal through domestic waste streams. As a result of the waste minimization effort and the removal of legacy waste along with inspection and audit results completed in 2022, management determined the waste management program to be considered effective.

Table 37 provides the amount of waste generated and recycled for hazardous and non-hazardous materials in 2022. The hazardous waste disposed in 2022 was lower than in

2021, the hazardous waste recycled was higher; and the contaminated combustible waste that was shipped off site was lower in 2022.

Table 37

2022 Waste Management Results (kg)	
Hazardous Waste Disposed via Certified Waste Disposal Co.	523
Hazardous Waste Recycled	3964
Hazardous (Contaminated) Combustible Waste Shipped BRR or other facility	3572

2.3.6 Nuclear Security

This safety and control area covers the programs required to implement and support the security requirements stipulated in the regulations, in *Nuclear Safety and Control Regulations*, the *Nuclear Security Regulations* and other CNSC requirements.

CFM's security plan provides the basis for security operations at the facility and identifies the systems and processes in place to meet security program objectives. Accordingly, the plan and related procedures are considered prescribed information, subject to the requirements of the *Nuclear Safety and Control Regulations*.

Though CFM's security program is well managed and remains in compliance with CNSC regulatory requirements, the facility continues to look for enhancement opportunities. Management determined the security program at CFM is suitable and was reviewed to be effective by reviewing audit and inspection findings along with reviewing security concerns or incidents.

2.3.7 Safeguards and Non-proliferation

This safety and control area covers the programs required for the successful implementation of the obligations arising from the Canada/ International Atomic Energy Agency (IAEA) Safeguards and Non-proliferation Agreement. CFM maintains compliance with the CNSC regulatory document, *Safeguards and Nuclear Material Accountancy, REGDOC – 2.13.1*.

All required reporting obligations to the regulators for 2022 were submitted either prior to the deadline or on time.

CFM participated in five safeguard inspections/activities in 2022:

- Design Information Verification (DIV), February 2022
 - Findings: No major findings
 - Performed by IAEA inspectors and CNSC personnel (participated remotely).
- Short Notice Random Inspection, June 2022
 - Findings: No major findings
 - Performed by IAEA inspectors and CNSC personnel (participated remotely).
- Short Notice Random Inspection, June 2022
 - Findings: No major findings
 - Performed by IAEA inspectors and CNSC personnel (participated remotely).
- Physical Inventory Verification/Design Information Verification, July 2022
 - Findings: No major findings
 - Performed by: IAEA inspectors and CNSC personnel.
- Short Notice Random Inspection, November 2022
 - Findings: No major findings
 - Performed by: IAEA inspectors and CNSC personnel (participated remotely).

All of the above activities were successfully completed without event or any notable non-conformance.

CFM is maintaining an effective safeguards program and is ensuring all measures required to ensure safeguards are implemented at the facility.

2.3.8 Packaging and Transport of Nuclear Substances

This safety and control area covers the packaging and transport of nuclear substances and other nuclear materials to and from the licensed facility.

UO₂ powder is transported by road from the PHCF to CFM. As well, UO₂ in the form of finished fuel bundles is transported in shipping containers that meet the package requirements as specified in the CNSC *Packaging and Transport of Nuclear Substances Regulations, 2015*.

There were no reportable events which occurred at CFM in 2022 that were in violation of the CNSC *Packaging and Transport of Nuclear Substances Regulations, 2015* or the *Transport of Dangerous Goods Act*. CFM determined the program is effective and suitable after reviewing the frequency and severity or lack of incidents.

Cameco has in place an Emergency Response Assistance Plan (ERAP) describing the system used by Cameco to respond to off-site transport incidents for Class 7 products. The plan which has been accepted by Transport Canada is pursuant to federal transportation of dangerous goods requirements and applies to transportation emergencies. Transportation activities related to the shipping and receiving of goods to or from CFM are included in the plan.

3. OTHER MATTERS OF REGULATORY INTEREST

3.1.1 Public Information Program

In 2022, Cameco Fuel Manufacturing continued to fully meet the requirements of the Canadian Nuclear Safety Commission's (CNSC) REGDOC 3.2.1, Public Information and Disclosure.

For 2022, the communications team for Cameco's Fuel Services Division was comprised of a manager of public and government affairs and one communications specialist. The divisional communications team is part of Cameco's corporate Sustainability and Stakeholder Relations department.

Many of the pandemic restrictions were lifted over the course of 2022 allowing many of the in-person engagement activities to return such as the Port Hope Fall Fair and Cameco's community barbeque.

Education and Awareness

Cameco leverages a range of communications tools to help inform and educate interested persons and/or groups of CFM's operations and activities.

Cameco issues its Energize newsletter to help keep the Port Hope community up to date. Three issues were published in 2022 and mailed to all addresses in the Municipality of Port Hope. Each issue was posted to camecofuel.com promoted on social media.



News & Information from Cameco



winter 2022

Cameco announces \$100,000 donation to Fare Share Food Bank and Green Wood Coalition

At the end of 2021, Cameco announced a \$100,000 combined donation to the Northumberland Fare Share Food Bank and Green Wood Coalition. Each organization will receive \$50,000 to help them build and sustain the vital services they provide which help to address and support people experiencing difficult circumstances.

Cameco president and CEO Tim Gitzel was in Port Hope on December 17 to tour the Northumberland Fare Share Food Bank and attend a cheque presentation ceremony.



PHOTO FROM LEFT: HON. DENISE DUNN, chair, Fare Share Food Bank; TIM GITZEL, president & CEO, Cameco; GARY CHURCH, vice president, Cameco Fuel Services Division; and GUY STANFIELD, executive director, Green Wood Coalition.

In this edition:

- Cameco announces \$100,000 donation to Fare Share Food Bank and Green Wood Coalition
- Vision in Motion project update at Port Hope Conversion Facility
- Cameco facilities in Port Hope and Blind River granted licence renewals from the CNSC
- Mental health grants awarded to nine groups

[Read this edition online >](#)

energize

News & Information from Cameco



spring 2022

Cameco Fuel Manufacturing licence renewal process

A message from
Doug Jensen, general
manager of Cameco Fuel
Manufacturing

Have you ever thought about where the electricity comes from when you turn on your light switch or charge your cell phone? In Ontario, about 60% of all electricity comes from CANDU nuclear reactors, and half of these reactors are powered by the fuel bundles manufactured right here in Port Hope.

Cameco Fuel Manufacturing



In this edition:

- Cameco Fuel Manufacturing licence renewal process
- Quick facts about CFM Port Hope
- The benefits of nuclear
- Cameco in the community

[Read this edition online >](#)

energize

News & Information from Cameco



summer 2022

Cameco Charity Golf Tournament returns in September

All funds raised support
the Cameco Fund for
Mental Health

After a two-year hiatus due to the COVID-19 pandemic, the Cameco Charity Golf Tournament is returning as an in-person golf tournament at Oakwood Golf Club on September 9, 2022.

All funds raised from the event will support the Cameco Fund for Mental Health, which provides funding for mental health initiatives in Northumberland County and area.

"We are very excited to be back with a full golf tournament experience this year," said Dele Clark, vice-president of



In this edition:

- Cameco Charity Golf Tournament returns in September
- How to participate in the licence renewal process for Cameco Fuel Manufacturing
- The benefits of nuclear: Medical Isotopes
- New Isotope Production System at Bruce Power successfully produces first medical isotope

[Read this edition online >](#)

Summer 2022: [Energize - Summer 2022 - Making a Difference - Community - Cameco Fuel Services](#)

Spring 2022: [Energize - Spring 2022 - Making a Difference - Community - Cameco Fuel Services](#)

Winter 2022: [Energize - Winter 2022 - Making a Difference - Community - Cameco Fuel Services](#)

Each issue provided readers with a variety of updates about Cameco's activities such as CFM licence renewal, community initiatives and survey results.

Cameco Ontario
October 25, 2022

This evening, Oct. 25, 2022, Cameco is conducting a planned emergency preparedness exercise at its Fuel Manufacturing facility located at 200 Dorset, Port Hope. The exercise will involve Port Hope Fire and Emergency Services who will be on site as part of a coordinated effort. If you have any questions, please email us at cameco_ontario@cameco.com or call us at 905.800.2023.

October 25, 2022 Emergency Response Exercise



This evening (October 25, 2022), Cameco is conducting a planned emergency preparedness exercise at its Fuel Manufacturing facility located at 200 Dorset, Port Hope. The exercise will involve Port Hope Fire and Emergency Services who will be on site as part of a coordinated effort.

If you have any questions, please email us at cameco_ontario@cameco.com or call us at 905.800.2023.



CFM held an emergency response exercise on October 25 which involved Port Hope Fire and Emergency Services. A post was made to social media channels to inform the community and post cards were mailed out to approximately 1,200 addresses near the facility.

Vision in Motion



Through the Vision in Motion project, Cameco will clean up and improve the Port Hope Conversion Facility site, address legacy waste inherited from previous operations, and give the public access to more of the waterfront.



Upcoming Building 27 Demolition

Demolition of building 27 at the Port Hope Conversion Facility is set to begin this year.

Residents can expect to see scaffolding going up around the building in preparation for the safe removal of the building.

Port Hope Conversion Facility Site Changes from Vision in Motion

The Vision in Motion project will reduce the footprint of the Port Hope Conversion Facility by approximately

20%

The lands freed up by the project will be returned to the community.



Port Hope Centre Pier Before and After



Before



After

For more information on the Vision in Motion project, please scan the QR code or visit www.camecofuel.com/vim



Cameco sponsored an information booth at the Port Hope Fall Fair from September 16-18. The booth was staffed by Cameco leaders and subject matter experts throughout the weekend. The information boards featured Cameco's operations and activities including PHCF, Vision in Motion, CFM and more.

On February 3, Cameco participated in the Durham College and Ontario Tech University Virtual Job Fair.

2022 saw the return of the Cameco barbeque which was first launched in 2019. The barbeque was held on September 28 from 4-7 p.m. in Memorial Park, Port Hope. Postcards advertising the event were mailed out to approximately 2,700 addresses in

Port Hope and advertised via social media. Cameco leadership and subject matter experts were available to talk with guests and answer questions. Information boards and displays provided information about PHCF, Vision in Motion, CFM operations and activities and the licence renewal. Approximately 300 people attended the BBQ.

[Port Hope Community BBQ - Making a Difference - Community - Cameco Fuel Services](#)

Port Hope Community BBQ

Share   



Join us for a **FREE** community BBQ on September 28 from 4 p.m. to 7 p.m. at Memorial Park in Port Hope.

[Click here to RSVP!](#)

Join us for a **FREE** community BBQ on September 28 from 4 p.m. to 7 p.m. at Memorial Park in Port Hope.
Meet our subject matter experts & learn more about Cameco's operations!

RSVPs are encouraged via email to: cameco_ontario@cameco.com

[Click here to RSVP!](#)

Public Inquiries: Ensuring stakeholders and residents have access to information about Cameco is an important component of the Public Information Program. Interested persons can contact Cameco via email (cameco_ontario@cameco.com) or phone (905.800.2020).

In 2022 the [cameco_ontario](mailto:cameco_ontario@cameco.com) email received 19 emails from the public who RSVP'd to the annual BBQ. CFM received one inquiry from a member of the public through security regarding an activity to remove debris from the roof of the facility. This question was answered in a timely manner with no further follow-up required. An additional question was raised regarding noise levels through the CNSC project officer in advance of the relicensing webinar. Information was provided to the CNSC as requested.

Public Polling

Port Hope Community Survey Results 2022

Share   



"Cameco appreciates and is proud of the continued support we receive from the Port Hope community for our local operations," said Dale Clark, vice-president of Cameco's Fuel Services Division. "We are particularly happy to see the strong community support for the long-term licence application for Cameco Fuel Manufacturing."

In July and August 2022, Fast Consulting conducted the annual public opinion survey of Port Hope and found that 93% of residents support Cameco's continued operations in Port Hope. For the past decade, Cameco has maintained an approval rating above 80% and remains a trusted corporate citizen in the local community.

"Cameco appreciates and is proud of the continued support we receive from the Port Hope community for our local operations," said Dale Clark, vice-president of Cameco's Fuel Services Division. "We are particularly happy to see the strong community support for the long-term licence application for Cameco Fuel Manufacturing."

A large majority of residents (82%) expressed support for Cameco Fuel Manufacturing's long-term 20-year licence application to the Canadian Nuclear Safety Commission. Cameco plays a large role in the Ontario nuclear industry, and it is evident residents are aware that all uranium in Ontario reactors is processed by Cameco in Port Hope and that nuclear energy provides more than half of the electricity to Ontario.

The public opinion survey of 402 Port Hope residents (Wards 1 and 2) was conducted by Fast Consulting, a third-party consultant. Cameco conducts public opinion surveys to measure levels of awareness, support and trust in the community and to gauge the effectiveness of its communication and public engagement efforts. See the summary report for more details.

On October 5, 2022, Cameco announced the results of its Public Polling. Cameco has been polling the local community since 2004. The survey found that 93% of residents support the continuation of Cameco's operations in Port Hope. Specific to CFM's licence renewal application, the poll asked if residents were supportive of CFM's request for a 20-year licence, of which 82% indicated their support. For the past decade, Cameco has maintained an approval rating above 80% and remains a trusted corporate citizen in the local community.

Other key findings from the 2022 survey include:

- 85% of respondents agree that Cameco does everything possible to protect people and the environment.
- 77% respondents recall receiving a newsletter from Cameco; 84% of them read the newsletters.
- 79% of respondents think that Cameco makes information about its operations in Port Hope readily available to residents.
- 94% of respondents describe themselves as knowledgeable about Cameco

The summary of findings was posted to the website [Port Hope Community Survey Results 2022 - Making a Difference - Community - Cameco Fuel Services](#) and promoted on social media.

Polling results have remained consistent over the years and as such, the next public opinion poll will be in 2024 as Cameco has decided to conduct polling every two years.

Social Media



Social media remains a key tool in sharing information with the public and provides an opportunity for some engagement through sharing, comments, and private messages.

In 2022, the Cameco Ontario Facebook page grew by 238 followers ending the year with 1,259 followers. The 110 posts over the course of the year shared information about Cameco's operations, CFM's licence renewal, community initiatives and sponsorships.

The Cameco Ontario Twitter page grew by 16 followers with 388 followers by the end of the year.

The Cameco Instagram page continued to grow in 2022, reaching 739 followers, an increase of 84 followers. The content was primarily the same as what was posted to Facebook.

Top posts



Today, the Canadian Nuclear Safety Commission (CNSC) announced that the Blind River Refinery has been granted a 10-year licence renewal. The renewed licence allows the

8142 impressions



Cameco Fuel Manufacturing in Port Hope currently has a job opening for a 6B Fuel Assembly Operator. Apply online today! <http://ow.ly/Rb2L50M8IRt>

4572 impressions



Cameco Fuel Manufacturing in Port Hope currently has a job opening for a 6B Fuel Assembly Operator. Apply online today! <http://ow.ly/onMw50KRvK8>

4217 impressions

Public Disclosure

In 2022, CFM made three public disclosures. There was no health or safety risk posed to the public or environment.

[Environment & Safety - Fuel Manufacturing: Port Hope & Cobourg - Fuel Services - Businesses - Cameco](#)

Public Disclosures were shared with and discussed with Curve Lake and Scugog Island First Nations during regular meetings. No questions were received from members of the public.

Posting Date	July 7, 2022
Incident Date	July 6, 2022
Incident	Emergency Response Team Activation
Details	<p>The Cameco Fuel Manufacturing (CFM) Emergency Response Team (ERT) was activated in response to fumes from roofing tar work being detected by an office area smoke detector which triggers an automatic fire alarm and notifies Port Hope Fire and Emergency Services. The fire department responded to the site and confirmed the conditions that activated the alarm.</p> <p>There was no health or safety risk posed to the public or environment.</p>
Corrective Action	<p>Port Hope Fire and Emergency Services confirmed the source of fumes was normal given the roofing work that is taking place during the CFM maintenance shutdown.</p> <p>The Canadian Nuclear Safety Commission has been notified.</p>
Cameco Environmental Effect Rating	1

Posting Date	July 25, 2022
Incident Date	July 21, 2022
Incident	Emergency Response Team Activation
Details	<p>Port Hope Fire & Emergency Services responded to a fire alarm at Cameco Fuel Manufacturing (CFM) at approximately 4:10 a.m. on July 21, 2022. Port Hope Fire & Emergency Services determined that there was no fire, and it was a false alarm.</p> <p>There was no health or safety risk posed to the public or environment.</p>
Corrective Action	<p>Port Hope Fire & Emergency Services determined that there was no fire, and it was a false alarm. It was confirmed that the CO2 fire suppression system was the source of the false alarm and it had been removed several years ago. The alarm point has been removed from the monitoring system.</p> <p>The Canadian Nuclear Safety Commission has been notified.</p>
Cameco Environmental Effect Rating	1
Posting Date	March 16, 2023
Incident Date	Dec. 24, 2022
Incident	Emergency Response Team Activation
Details	<p>Port Hope Fire & Emergency Services responded to an alarm at Cameco Fuel Manufacturing (CFM) on December 24, 2022. It was determined by Port Hope Fire & Emergency Services that the alarm was false and there was no fire.</p> <p>The facility was in a safe shutdown state for the holiday shutdown.</p> <p>There was no health or safety risk posed to the public or environment.</p>
Corrective Action	<p>The Port Hope Fire and Emergency Services identified a potential defect in a sprinkler head as the likely cause.</p> <p>The Canadian Nuclear Safety Commission has been notified.</p>
Cameco Environmental Effect Rating	1

Community Investment

Many events and initiatives returned to the local area in 2022. Over the course of 2022, Cameco provided support and sponsorship to 42 community organizations including Northumberland Hills Hospital, Northumberland Hispanic Cultural Club, Northumberland Fare Share Food Bank, Green Wood Coalition, Northumberland United Way, Northumberland Hispanic Cultural Club's Hispanic Heritage Month in October, Rebound Child and Youth Services, Community Care Northumberland, Curve Lake First Nation, and more. This does not include the organizations that were supported through the Cameco Fund for Mental Health.

The Cameco Annual Charity Golf Tournament returned as full golf tournament at Dalewood Golf Club on September 9. Information about the tournament was advertised via social media and local radio. The sold-out tournament raised over \$35,000 for the Cameco Fund for Mental Health.

[Step Up 2022 - Past Events - Ontario - Events - Step Up for Mental Health](#)

Adjudication for the Cameco Fund for Mental Health involved Cameco representatives and local mental health experts. Recipients were notified and a news release was issued.

[Ontario - The Fund - Step Up for Mental Health](#)

Indigenous Engagement

On October 29, 2021, Cameco submitted its Indigenous Engagement Report (IER) to the CNSC which was developed in support of CFM's 20-year licence renewal request to fulfill the requirements of the CNSC's REGDOC 3.2.2 Indigenous Engagement.

The information provided in this section describes CFM's activities under the PIP and the IER.

Cameco continued regular meetings with Curve Lake and Scugog Island First Nations throughout the year. Most of these meetings focused on various aspects of CFM's licence renewal.

Curve Lake and Scugog Island were emailed public disclosures through the year, and these were discussed at the next scheduled meeting. Quarterly compliance reports and copies of the Energize newsletters were sent to Curve Lake, Hiawatha, Alderville, Scugog Island, Rama and the Mohawks of the Bay of Quinte.

On May 13, Cameco emailed a letter about the intervention process for the CFM licence renewal. The letter provided key dates, how to intervene and a link to the CFM licence

renewal briefing guide. The letter was emailed to Curve Lake, Scugog Island, Alderville, Hiawatha and Rama First Nations and the Mohawks of the Bay of Quinte. The same letter was sent to the Métis Nation of Ontario, Region 6 on May 16.

An invitation to attend the community barbeque was sent to Curve Lake, Scugog Island, Alderville and Hiawatha First Nations. Representatives from Curve Lake First Nation attended the community barbeque.

Below is a summary of the meetings and topics covered in 2022:

Indigenous Community	Date of Meeting	Topics
Curve Lake First Nation	January 26	Review of 2021/open items Key focus areas for 2022
	February 23	Next steps for CFM licence renewal Briefing guide development
	April 1	CFM licence renewal – 20 years, production increase
	April 27	CFM licence renewal – review of environmental data
	July 27	CFM soil and groundwater monitoring programs; upcoming community activities
	September 28	Community activities; public opinion polling results
	November 28	General update and discussion following the CFM licence hearing
Mississaugas of Scugog Island First Nation	January 10	General reconnect – plan for 2022
	February 28	About Cameco Updates on licence renewal
	March 24	CFM licence renewal – 20 years, production increase
	May 13	CFM licence renewal – review of environmental data
	July 26	CFM soil and groundwater monitoring programs; upcoming community activities
	October 25	Community activities; public opinion polling results

	December 6	General update and discussion following the CFM licence hearing
Métis Nation of Ontario – Region 6	November 3	General overview of Cameco (PHCF and CFM specifically) and overview of CFM licence renewal

On March 23, Cameco hosted the Indigenous Advisory Council for the Small Modular Reactor Action Plan. The Council brings together Indigenous leaders from Ontario, Alberta, Nunavut, Saskatchewan, and New Brunswick. Tours of PHCF and CFM Port Hope were provided by Cameco leadership and included overview presentations and opportunities for questions and dialogue.

Members of Anishinabek Nation toured the PHCF and CFM on May 24. The guests included the Anishinabek Nation Grand Council Chief, Northern Superior Regional Deputy Grand Council Chief (Biinjitiwaabik Zaaging Anishinaabek), Southeast Regional Deputy Grand Council Chief (Alderville First Nation), Southwest Regional Deputy Grand Council Chief (Chippewas of the Thames First Nation) and Curve Lake First Nation. The tours were provided by local Cameco leadership and included overview presentations of each operation, and opportunities for questions and dialogue.

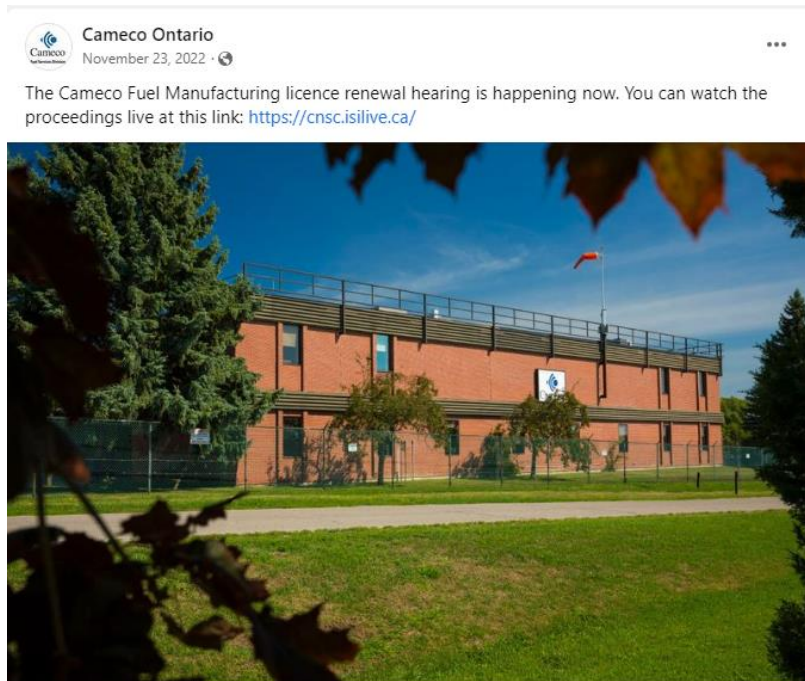
Licence Renewals

On February 17, 2022, the CNSC announced it had granted CFM a 1-year licence renewal. Cameco posted a statement on its website, within the winter 2022 edition of Energize and on social media. [1 Year Licence Renewal - Cameco Fuel Manufacturing - Business - Cameco Fuel Services](#)

Information about CFM's 20-year licence renewal was provided through various communication channels including Energize, the Port Hope Fall Fair, the Cameco Community BBQ, website and social media.

The VP of Fuel Services Division and CFM's general manager delivered a delegation to MPH Council on May 17. The delegation focused on CFM's application to renew its operating licence and included information on the request for a 20-year licence and production increase.

On July 6, letters were sent out to potential intervenors. The letters provided information about the CNSC's licence renewal process and how interested persons/groups can intervene.



Industry

Cameco was a sponsor of the Canadian Nuclear Association conference which took place in Ottawa from April 12 to 14. Cameco was a bronze sponsor and staffed a booth.

Cameco hosted the Canadian Nuclear Society 15th International Conference on CANDU Fuel in Ajax from August 21 to August 24

Earned Media

Cameco received media coverage throughout the year covering a range of activities. Media coverage was overall positive:

- **Cameco Fund for Mental Health 2021 Awards Benefit Nine Northumberland Organizations** – Today's Northumberland – January 31, 2022
 - <https://todaysnorthumberland.ca/2022/01/31/cameco-fund-for-mental-health-2021-awards-benefit-nine-northumberland-organizations/>
- **Northumberland organizations benefit from Cameco Fund for Mental Health Fund** Northumberland 89.7 – Feb 1, 2022
 - [Northumberland organizations benefit from Cameco Fund for Mental Health Fund — Northumberland 89.7 FM \(northumberland897.ca\)](https://www.northumberland897.ca/northumberland-organizations-benefit-from-cameco-fund-for-mental-health-fund/)
- **‘It’s like being held by a caring person’: New art program in Port Hope to support mental health** – Northumberland News – March 16, 2022

- <https://www.northumberlandnews.com/community-story/10588795--it-s-like-being-held-by-a-caring-person-new-art-program-in-port-hope-to-support-mental-health/>
- **The Cameco Charity Golf Tournament Returns for 2022 – Today’s Northumberland – June 30, 2022**
 - [The Cameco Charity Golf Tournament Returns for 2022 - Today's Northumberland - Your Source For What's Happening Locally and Beyond \(todaysnorthumberland.ca\)](https://www.todaysnorthumberland.ca/The-Cameco-Charity-Golf-Tournament>Returns-for-2022-Today's-Northumberland-Your-Source-For-What's-Happening-Locally-and-Beyond)
- **Cameco recognized for its ongoing support of student nutrition programs in Northumberland County – Today’s Northumberland – April 26, 2022**
 - [Cameco Recognized for Its Ongoing Support of Student Nutrition Programs in Northumberland County - Today's Northumberland - Your Source For What's Happening Locally and Beyond \(todaysnorthumberland.ca\)](https://www.todaysnorthumberland.ca/Cameco-Recognized-for-Its-Ongoing-Support-of-Student-Nutrition-Programs-in-Northumberland-County)
- **Hit the links with Cameco is support of mental health in Northumberland – Northumberland News – Sept. 9, 2022**
 - [Hit the links with Cameco in support of mental health in Northumberland \(northumberlandnews.com\)](https://www.northumberlandnews.com/Hit-the-links-with-Cameco-in-support-of-mental-health-in-Northumberland)
- **COMMUNITY SPOTLIGHT: CCN Volunteer Fair brings over 30 Local agencies together with prospective volunteers – Oct 26, 2022 – Go Northumberland**
 - [COMMUNITY SPOTLIGHT: CCN Volunteer Fair brings over 30 Local agencies together with prospective volunteers | 93.3 myFM \(gonorthumberland.ca\)](https://www.gonorthumberland.ca/COMMUNITY-SPOTLIGHT-CCN-Volunteer-Fair-brings-over-30-Local-agencies-together-with-prospective-volunteers)
- **Port Hope's Cameco golf tournament fundraiser means more money for mental health initiatives – Nov 6, 2022 – Northumberland News**
 - [Port Hope's Cameco golf tournament fundraiser means more money for mental health initiatives \(northumberlandnews.com\)](https://www.northumberlandnews.com/Port-Hope's-Cameco-golf-tournament-fundraiser-means-more-money-for-mental-health-initiatives)
- **Cameco Fund for Mental Health 2022 Awards Grants to Nine Northumberland County Organizations – Today’s Northumberland – Dec. 17, 2022**
 - [Cameco Fund for Mental Health 2022 Awards Grants to Nine Northumberland County Organizations - Today's Northumberland - Your Source For What's Happening Locally and Beyond \(todaysnorthumberland.ca\)https://www.northumberlandnews.com/whatso](https://www.todaysnorthumberland.ca/Cameco-Fund-for-Mental-Health-2022-Awards-Grants-to-Nine-Northumberland-County-Organizations)

[n-story/10668366-hit-the-links-with-cameco-in-support-of-mental-health-in-northumberland/](https://www.northumberlandnews.com/story/10668366-hit-the-links-with-cameco-in-support-of-mental-health-in-northumberland/)

- **Cameco contributing \$50K to support Northumberland mental health initiatives** –Northumberland News – Dec. 24, 2022
 - [Cameco contributing \\$50K to support Northumberland mental health initiatives \(northumberlandnews.com\)](https://www.northumberlandnews.com/story/10668366-hit-the-links-with-cameco-in-support-of-mental-health-in-northumberland/)
- **Cameco contributing \$50K to support Northumberland mental health initiatives** – The Peterborough Examiner – Dec. 24, 2022
 - [Cameco contributing \\$50K to support Northumberland mental health initiatives | ThePeterboroughExaminer.com\)](https://www.thepeterboroughexaminer.com/news/local/cameco-contributing-50k-to-support-northumberland-mental-health-initiatives/)

Advertising

In 2022, advertising was conducted through social media platforms, local news websites and local radio.

Three local social and radio media campaigns ran at various times through the year:

- Port Hope Cameco Charity Golf Tournament: Ads ran from July 11, 2022 to September 9, 2022.
- Port Hope Community BBQ: Ads ran from September 26, 2022 to September 28, 2022.
- Cameco Fund for Mental Health Applications – Port Hope: Ads ran from October 20, 2022 to November 17, 2022, promoting the application process for the Cameco Fund for Mental Health in Northumberland County.



Online ads were placed with Today's Northumberland, Port Hope Now, Cobourg Now and Go Northumberland.

Cameco also continued the monthly community partner advertising program with the local radio station. With this program, a one-month radio advertising package is donated to a local charity or community organization each month.

Cameco placed print ads in booklets for events it sponsored, including the Northumberland Hills Hospital Gala booklet, Film Access Northumberland, Eye2Eye Film Festival book, Handbags for

Hospice, as well as advertising on the Port Hope Police reusable shopping bag which was given out at community events by the Port Hope police.

Government Stakeholders

Government relations (GR) involves building strong relationships and positive interactions with local elected officials. Cameco engages in GR activities at the municipal, provincial, and federal levels. Locally, the focus is on municipal and provincial officials.

The VP of Fuel Services Division and CFM's general manager delivered a delegation to MPH Council on May 17. The delegation focused on CFM's application to renew its operating licence.

Cameco welcomed Members of Parliament Benjamin T Lobb, MP Huron-Bruce, Corey Tochor, MP Saskatoon-University and Larry Maguire, MP Brandon-Souris to tour the Port Hope Conversion Facility and CFM on May 27.

Local elected officials at all levels of government were sent letters on July 6, 2022, to follow-up on licensing and provide information on the CNSC's intervention process.

Tours

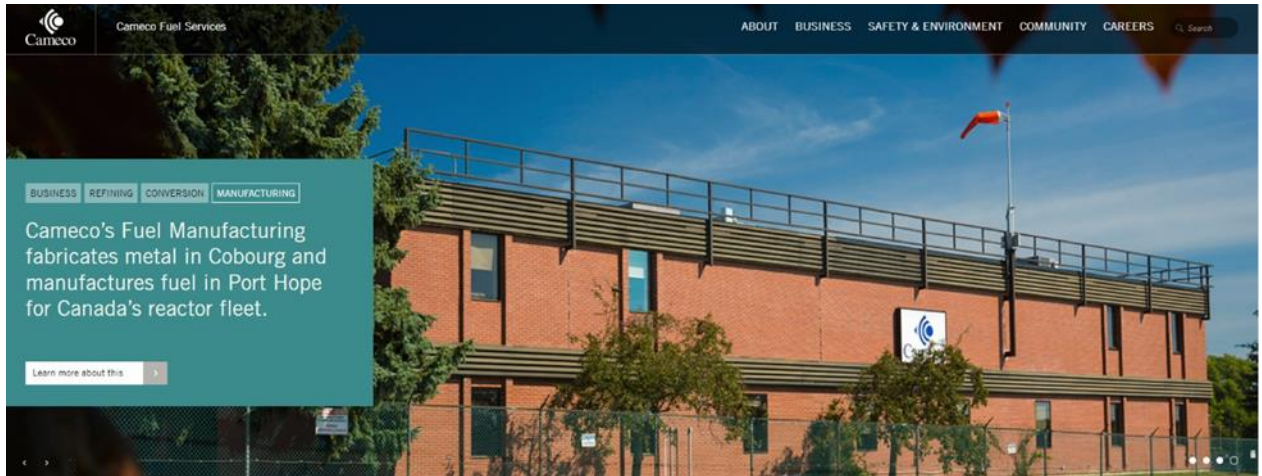
Providing facility tours is a valuable component of PHCF's engagement and outreach activities.

As noted above in the Indigenous engagement section, Cameco provided tours to the Indigenous Advisory Council for the Small Modular Reactor Action Plan in March, and members of Anishinabek Nation toured the PHCF and CFM on May 24.

Cameco welcomed Members of Parliament Benjamin T Lobb, MP Huron-Bruce, Corey Tochor, MP Saskatoon-University and Larry Maguire, MP Brandon-Souris to tour the Port Hope Conversion Facility and CFM on May 27.

Members of the Durham chapter of North American Young Generation in Nuclear (NAYGN) toured CFM Port Hope on September 16. Members of the Canadian Forces from Canadian Forces Base Trenton toured CFM Port Hope on October 12.

Website



Cameco has a dedicated website for its Ontario operations: [Home - Cameco Fuel Services](#)

A dedicated page for CFM's 20-year licence renewal was also updated throughout the year: [20 Year Licence Renewal - Cameco Fuel Manufacturing - Business - Cameco Fuel Services](#)

Cameco updated its website with information throughout 2022 including:

- Three Public Disclosure related to CFM
- Three Energize newsletters
- Public polling results
- Cameco Step Up for Mental Health activities including news releases
- Quarterly and annual CNSC reports
- Invitation to the community barbeque
- An updated public summary of CFM's Preliminary Decommissioning Plan: [Media Library - Media - Cameco Fuel Services](#)
- An updated Safety Analysis Report – Public Summary [Media Library - Media - Cameco Fuel Services](#)
- A briefing guide for CFM's 20-year licence renewal was uploaded to the licensing page
 - [20 Year Licence Renewal - Cameco Fuel Manufacturing - Business - Cameco Fuel Services](#)
- CFM upload its CMD to the licensing page:
 - [20 Year Licence Renewal - Cameco Fuel Manufacturing - Business - Cameco Fuel Services](#)

Communications Products

Cameco strives to provide accurate and timely information to stakeholders and other interested parties. Information products are developed to support various communications and engagement vehicles and activities.

- Three issues of Energize – mailed to Port Hope addresses and posted online
- Leveraging social media to link to Energize and other key updates for the public
- Public Polling summary of results – posted online and linked from social media
- Invitation to the community barbeque – posted online and mailed
- Printed information boards

3.1.2 Site-Specific

CFM's Ceramics lab has the capabilities and equipment to produce small quantities of special material fuel containing enriched uranium. These fuel types are manufactured in a similar manner but on a smaller scale than natural uranium manufacturing. As CFM has the ability to handle enriched UO_2 in batch processes and in solid form, nuclear criticality safety is achieved by employing engineered and administrative controls over batch size (Smallest Critical Mass) in processing and storage areas. CFM has a *Nuclear Criticality Safety Program Manual* (CFM-NC) to address the handling and processing of enriched uranium. The CFM-NC has been developed to guide generation and implementation of CFM's criticality prevention practices as they pertain to licensing and criticality prevention issues. This safety program meets the CNSC regulatory document *REGDOC - 2.4.3 CNSC Regulatory Document Safety Analysis Nuclear Criticality Safety v1.1*.

Processing of any amount of enriched material at CFM is governed by a criticality control committee (CCC) as described in the CFM-NC.

There were no processing activities of enriched material conducted on site in 2022.

Cameco maintains the required nuclear liability insurance for CFM as required under the Canadian *Nuclear Liability Act*.

CFM has a CNSC approved Preliminary Decommissioning Plan (PDP), which was updated in 2021 in accordance with the CNSC guidance documents *G-219, Decommissioning Planning for Licensed Activities*, and *G-206, Financial Guarantees for the Decommissioning of Licensed Activities*. With the update of CFM's Preliminary Decommissioning Plan in 2021, this reduced liability allowed for a reduction of financial guarantee required by the G-206.

CFM met all site-specific reporting requirements in 2022.

3.1.3 Improvement Plan and Future Outlook

Some of the improvement plans and the future outlook at CFM for 2023 include:

- continue to reduce workplace hazards.
- continue to improve ergonomics through ergonomics assessments.
- continue promotion and involvement of all personnel in continuous improvement through committees.
- continue to implement recommendations from Waste Reduction Plan and Waste Audit.
- continue to support plan to remove legacy waste from site.
- continue to investigate options to lower public dose at critical receptor location.
- continue groundwater treatment system upgrades
- maintain compliance to regulatory, industry and corporate standards.
- support nuclear safety through continual product quality improvement.

CFM is not planning any other major changes in 2023 that may require approval from the Commission.

3.1.4 Safety Performance Objectives for Following Year

CFM remains committed to continual improvement and will continue to look for opportunities to make the site operate more efficiently, while minimizing risk to employees, the public and the environment.

The following is a summary of the projected facility operations, changes to equipment, procedures, production capacity, organization, and licensing documents that are planned for 2023:

- Submit updated Radiation Protection Program manual.
- Submit updated Environmental Program manual.
- Submit updated Emergency Response plan
- Submit updated Change and Design Control procedure
- Submit updated Preventative Maintenance Execution Program
- Submit updated Waste Management Plan
- Submit updated Pressure Retaining Components procedure

4. CONCLUDING REMARKS

Cameco is committed to the safe, clean, and reliable operation of all of its facilities and continually strives to improve safety performance and processes to ensure the safety of both its employees and the local residents.

CFM management systems continue to be effective in providing an appropriate level of management direction to CFM. Opportunities for continual improvement continue to be identified and acted upon. As such, CFM is positioned to effectively manage operational risks and needs while continuing to improve.

Improvements will include continued work to clarify expectations through improved procedures and training material, continued responsiveness to employee identified and data driven SHEQ improvements, and continuing to stabilize equipment reliability, particularly of those processes that have been recently installed.

Overall, it was determined during the management review that the CFM Management Systems, adhering to the N286, N299.1 and N285.0 standards, and the CFM License Conditions (LCH) are suitable, adequate, and effective.

As a result of the effective programs, plans and procedures in place, CFM was able to maintain individual radiation exposures well below regulatory dose limits. In addition, environmental emissions and public radiation exposures continued to be controlled to levels that are a fraction of the regulatory limits.

In 2022, there were no action level exceedances in the radiological or environmental monitoring program.

CFM remains committed to continual improvement and will continue to engage all employees in the identification and implementation of activities that reduce injury risks, increase environmental protection, improve product quality and efficiency in 2023.