



**CAMECO FUEL
MANUFACTURING**

200 Dorset Street East
Port Hope, Ontario
Canada L1A 3V4

Tel 905.885.4537

Fax 905.885.1538

www.cameco.com

October 4, 2021

CFM-10837-LTR
VIA EMAIL

Mr. Marc Leblanc
Commission Secretary
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
280 Slater Street
Ottawa, ON K1P 5S9

Dear Mr. Leblanc:

Cameco Fuel Manufacturing Renewal of Licence FFL-3641.0/2023 for a 20-year term

Cameco Fuel Manufacturing (CFM) is located at 200 Peter Street, Port Hope, Ontario. The facility is currently licensed to process and store natural, depleted and enriched uranium compounds. Further to the above-captioned, the current licence for CFM, FFOL-3641.0/2022 is set to expire on February 28, 2022. Cameco applied for a licence renewal period of one year in December 2020. The documents in support of this licence renewal have been accepted by Canadian Nuclear Safety Commission (CNSC) staff and the Hearing in Writing is scheduled for December 2021. The applied-for one-year licence (FFL-3641.0/2023) will presumably expire in February 2023.

With the attached application, CFM is requesting that the CNSC renew the above-referenced one-year Class IB Nuclear Fuel Facility Operating Licence for CFM for a period of 20 years. In addition to the longer term, Cameco is requesting a change from the activities authorized under the current operating licence. Specifically:

- (a) an annual production limit of 1,650 tonnes of uranium (tU) as uranium dioxide (UO₂) pellets, which is the current production capacity of the licensed facility.

The attached application will provide the information required to support renewal of the licence for a period of twenty years. A detailed mapping of the licence application requirements is provided in Appendix 4 of the attached application.

CFM is committed to the safe operation of its facilities and strives to continually improve safety performance and processes to ensure the safety of our employees and the people in neighbouring communities. In support of continual improvement, CFM maintains strong programs, plans and procedures in the areas of health safety, radiation protection, environment, emergency response, fire safety, waste management and operations quality assurance.

As a result, CFM's operations have maintained radiation exposures well below dose limits, environmental emissions controlled to levels that are a fraction of release limits, and public radiation exposures well below established limits. The performance of this facility over the current licence period demonstrates that CFM is qualified to carry out the activities permitted under the licence.

As required by subsection 5(a) of the *General Nuclear Safety and Control Regulations* (GNSCR), the enclosed application describes the CFM operation and the supporting information to demonstrate that CFM is qualified to carry on the activities that the licence renewal would authorize and will, in carrying on its activities, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security measures required to implement international obligations to which Canada has agreed.

Pursuant to section 15 of the GNSCR, I have the authority to sign the application on behalf of CFM and certify that all statements and representations made in the application and any supplementary documentation are true and correct to the best of my knowledge and are binding on CFM.

If you have any questions or if we can provide you with additional information to facilitate your review of this application, then please do not hesitate to contact me or the CFM General Manager, Doug Jensen.

Sincerely,



Dale Clark,
Vice President, Cameco Fuel Manufacturing

- c. J. Thelen, G. Smith, A. McAllister (CNSC)
T. Smith, D. Jensen, R. Peters, M. Garrard, M. Longinov, L. Mooney (Cameco)



**CAMECO CORPORATION
FUEL SERVICES DIVISION**

**LICENCE RENEWAL APPLICATION
For Cameco Fuel Manufacturing Inc.
Proposed Licence FFL 3641.00/2023**

October 4, 2021

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	CAMECO CORPORATION AND THE FUEL SERVICES DIVISION	1
1.2	CAMECO FUEL MANUFACTURING	2
1.3	APPLICATION FOR LICENCE RENEWAL	2
1.4	LICENSING BASIS	3
1.5	APPLICATION FORMAT	4
2.0	DESCRIPTION OF OPERATIONS AND OTHER LICENSED ACTIVITIES	5
2.1	ORGANIZATION AND RESPONSIBILITIES	5
2.2	FACILITY LOCATION AND LAYOUT	5
2.3	PROCESSES AND MATERIALS	10
2.3.1	<i>UO₂ Pellet Operations</i>	10
2.3.2	<i>Bundle Assembly Operations</i>	11
2.3.3	<i>Pre-Press and Granulate Process</i>	11
2.3.4	<i>Enriched Uranium Operations</i>	11
2.3.5	<i>Nuclear Substances and Radiation Devices</i>	12
2.4	PUBLIC INFORMATION PROGRAM	12
2.4.1	<i>Public Engagement Strategies</i>	12
2.4.2	<i>Target Audiences</i>	13
2.4.3	<i>Engagement Mechanisms</i>	13
2.4.4	<i>Information Products</i>	14
2.4.5	<i>Indigenous Engagement</i>	15
2.5	FINANCIAL GUARANTEE	16
2.6	NUCLEAR LIABILITY INSURANCE	17
3.0	SITE PERFORMANCE OVERVIEW	17
3.1	PERFORMANCE IN THE CURRENT LICENCE PERIOD	17
3.2	FACILITY OPERATION AND PHYSICAL DESIGN	17
3.3	RADIATION PROTECTION	18
3.4	CONVENTIONAL HEALTH AND SAFETY	18
3.5	ENVIRONMENTAL PROTECTION	19
3.6	PUBLIC INFORMATION AND COMMUNITY ENGAGEMENT	19
4.0	SAFETY AND CONTROL AREAS	20
4.1	MANAGEMENT SYSTEM	20
4.1.1	<i>Organizational Structure</i>	21
4.1.2	<i>Safety, Health, Environment and Quality Policy (SHEQ) Policy</i>	24
4.1.3	<i>Safety Culture</i>	24
4.2	HUMAN PERFORMANCE MANAGEMENT	25
4.2.1	<i>Training Program</i>	25
4.3	OPERATING PERFORMANCE	26
4.3.1	<i>Operating Limits</i>	26
4.3.2	<i>Operating Plan</i>	27
4.3.3	<i>Reporting Requirements</i>	27
4.3.4	<i>Regulated Activities</i>	28
4.4	SAFETY ANALYSIS	28
4.4.1	<i>Safety Analysis Report</i>	29
4.5	PHYSICAL DESIGN	29
4.5.1	<i>Facility Design</i>	29
4.5.2	<i>Facility and Process Changes</i>	30
4.5.3	<i>Third Party Review for Fire Protection</i>	30

4.5.4	<i>Pressure Boundary Program</i>	30
4.6	FITNESS FOR SERVICE	30
4.6.1	<i>Maintenance Program</i>	30
4.6.2	<i>Periodic Inspection and Testing for Fire Protection Systems</i>	31
4.7	RADIATION PROTECTION	31
4.7.1	<i>Radiation Protection Program</i>	31
4.7.2	<i>Potential Radiological Hazards</i>	31
4.7.3	<i>In-Plant Monitoring</i>	32
4.7.4	<i>Nuclear Energy Workers</i>	32
4.7.5	<i>Personal Dosimetry</i>	32
4.7.6	<i>External Dosimetry</i>	32
4.7.7	<i>Internal Dosimetry</i>	33
4.7.8	<i>Urine Analysis</i>	33
4.7.9	<i>Lung Counting</i>	34
4.7.10	<i>Contamination Control</i>	34
4.7.11	<i>Monitoring at the Point of Final Exit</i>	34
4.7.12	<i>Radioisotope Control</i>	35
4.7.13	<i>Nuclear Criticality Control</i>	35
4.8	CONVENTIONAL HEALTH AND SAFETY	35
4.8.1	<i>Conventional Safety Program</i>	36
4.8.2	<i>Hazards</i>	36
4.8.3	<i>Work Controls</i>	36
4.8.4	<i>Health and Safety Committee</i>	37
4.9	ENVIRONMENTAL PROTECTION	37
4.9.1	<i>Environmental Protection Program</i>	37
4.9.2	<i>Environment Risk Assessment</i>	38
4.9.3	<i>Environmental Regulation</i>	38
4.9.4	<i>Airborne Emission Program</i>	39
4.9.5	<i>Liquid Emission Program</i>	39
4.9.6	<i>Terrestrial Monitoring Program</i>	40
4.9.7	<i>Estimated Dose to the Public</i>	41
4.9.8	<i>Setting of Authorized Release Limits for Effluent Discharges</i>	41
4.9.9	<i>Setting of Action Levels</i>	42
4.9.10	<i>Reporting of Environmental Information</i>	43
4.10	EMERGENCY MANAGEMENT AND FIRE PROTECTION	44
4.10.1	<i>Emergency Response Plan</i>	44
4.10.2	<i>Emergency Preparedness and Response Organizations</i>	44
4.10.3	<i>Emergency Response Assistance Plan</i>	44
4.10.4	<i>Fire Protection Program</i>	44
4.10.5	<i>Fire Hazards Analysis</i>	45
4.10.6	<i>Fire Safety Plan</i>	45
4.10.7	<i>Emergency or Fire Recovery Plan</i>	45
4.11	WASTE MANAGEMENT	46
4.11.1	<i>Waste Management Program</i>	46
4.11.2	<i>Current CFM Waste Streams</i>	46
4.11.3	<i>Preliminary Decommissioning Plan</i>	48
4.12	SECURITY	48
4.12.1	<i>Security Plan</i>	48
4.13	SAFEGUARDS AND NON-PROLIFERATION	48
4.13.1	<i>International Obligations</i>	48
4.13.2	<i>Inventory and Reporting</i>	49
4.14	HANDLING, STORING, PACKAGING AND TRANSPORT	49
4.14.1	<i>Packaging and Transport Program</i>	49

Table of Tables

Table 1 Total Effective Dose in Current Licence Period.....	18
Table 2 Agencies with Jurisdiction over CFM Operations.....	28
Table 3 Action Levels for External Dosimetry.....	33
Table 4 Action Level for Urinalysis.....	33
Table 5 Release Limit - Air Discharge.....	42
Table 6 Release Limit – Liquid Discharges.....	42
Table 7 Action Levels for Airborne Emissions.....	43
Table 8 Action Levels for Liquid Emissions.....	43
Table 9 Action Levels for Gamma Emissions.....	43

Table of Figures

Figure 1 – Location of Cameco Fuel Manufacturing.....	6
Figure 2 – Aerial View of Cameco Fuel Manufacturing.....	7
Figure 3 - Facility Licenced Area.....	8
Figure 4 – Cameco Fuel Manufacturing Property Layout.....	9
Figure 5 - CANDU Fuel Bundle Manufacturing Process.....	10
Figure 6 - Organizational Structure – Fuel Services Division and Corporate that Support CFM.....	22
Figure 7 - CFM Organizational Structure.....	23

Table of Appendices

Appendix A – Standards and Guidance Relevant to the Safety and Control Areas.....	50
Appendix B – Documents Supporting the Licence Application.....	55
Appendix C - List of Acronyms Used in the Application.....	57
Appendix D – Licence Renewal Application Requirements Matrix.....	59
Appendix E – Detailed Operational Performance Report for FFOL-3641.0/2022.....	72

1.0 INTRODUCTION

1.1 Cameco Corporation and the Fuel Services Division

Cameco Fuel Manufacturing Inc. (CFM), a wholly owned subsidiary of Cameco Corporation (Cameco), operates a Class IB nuclear fuel manufacturing facility in Port Hope, Ontario under Canadian Nuclear Safety Commission (CNSC) operating licence FFOL-3641.0/2022 (the Licence). The current Licence is valid until February 28, 2022, and an application for renewal of the Licence for a period of one year is to be considered by the Commission in December 2021. This application for a twenty-year licence is submitted on the basis that CFM receives the applied-for one-year licence, which that will then require renewal in February 2023.

Cameco's Fuel Services Division (FSD) supplies the world's reactor fleet with fuel to generate one of the cleanest sources of electricity available today. CFM operates a fuel fabrication facility located in Port Hope, Ontario that handles nuclear material primarily for the domestic CANDU market and is the subject of this licence application. CFM also operates a specialty metals fabrication facility in Cobourg, Ontario to facilitate the complete CANDU fuel supply cycle; however, this facility does not process nuclear material and is not subject to licensing by the CNSC.

Cameco's core values of safety and environment, people, integrity and excellence guide decisions and actions taken by the company. The safety of people and protection of the environment are the foundations of Cameco's operations. All workers share in the responsibility of continually improving the workplace safety of the workplace and lessening impacts on the surrounding environment. Cameco values the contribution of every worker and respects individual dignity, creativity and cultural diversity. Through personal and professional integrity, Cameco workers lead by example, earn trust, honour commitments, and conduct business ethically. Through leadership, collaboration and innovation, Cameco workers strive to achieve their full potential in the pursuit of excellence in all that they do.

Cameco's four measures of success are:

- a safe, healthy and rewarding workplace,
- a clean environment,
- supportive communities, and
- outstanding financial performance.

These success measures provide the framework on which business decisions are made to ensure that CFM remains qualified to carry out its licensed activities, in compliance with

the applicable regulatory and licence requirements in a manner protective of the environment, health and safety of people and ensuring that national security and international obligations are maintained.

1.2 Cameco Fuel Manufacturing

CFM fabricates nuclear fuel for power and research reactors at its Fuel Fabrication Facility located at 200 Dorset Street East, Port Hope, Ontario (Figure 1) in the Municipality of Port Hope (MPH). The CFM Port Hope site is comprised of the main manufacturing building and three steel pre-fabricated buildings: the Waste Storage Building; the Maintenance Storage Building; and the Fuel Storage Building. There are also miscellaneous smaller outbuildings and storage trailers located on the licensed site.

1.3 Application for Licence Renewal

The Vice-President, Fuel Services Division is the licence applicant on behalf of CFM. CFM is seeking a licence renewal of the proposed FFL-3632.0/2023 for Cameco Fuel Manufacturing for a term of 20 years.

This application requests the continued authorization to:

- (i) operate the nuclear fuel facility for the production of uranium dioxide pellets from depleted, natural and enriched uranium compounds
- (ii) possess, transfer, use, process, import, package, transport, manage store and dispose of the nuclear substances that are required for, associated with, or arise from the activities described in (i); and
- (iii) possess and use prescribed equipment and prescribed information that are required for, associated with, or arise from the activities described in (i).

Also, CFM is requesting a change in the production limit from the current monthly limit of 125 Megagrams (Mg) of Uranium Dioxide (UO₂) as pellets during any calendar month to an annual production limit of 1,650 tonnes of uranium (tU) as uranium dioxide (UO₂) pellets. The requested 1650 tU/yr divided equally by month would be equivalent to 155 Mg uranium/month, a 24% increase in the production limit. The annual production limit reflects the production capacity of the licensed facility as it is currently configured such that no physical changes to the facility are required.

This document supports the licence renewal application and is intended to demonstrate adherence of CFM's operations to the requirements of the current licence.

The business address of CFM in Port Hope is 200 Dorset Street East, Port Hope, Ontario, L1A 3V4.

The business address of Cameco Corporation is 2121-11th Street West, Saskatoon, Saskatchewan, S7M 1J3.

1.4 Licensing Basis

The licensing basis for CFM consists of applicable laws and regulations, the safety and control measures in the licence and the licence application and documents in support of the application. This includes the *Nuclear Safety and Control Act (NSCA)* and associated regulations, including, but not limited to the following:

- *General Nuclear Safety and Control Regulations*
- *Class I Nuclear Facilities Regulations*
- *Radiation Protection Regulations*
- *Packaging and Transport of Nuclear Substances Regulations, 2015*
- *Nuclear Substances and Radiation Devices Regulations*
- *Nuclear Non-proliferation Import and Export Control Regulations*
- *Nuclear Security Regulations*

Other laws, regulations and international agreements that are applicable to CFM operations:

- *Impact Assessment Act* and its regulations (formerly the *Canadian Environmental Assessment Act*);
- *Canadian Environment Protection Act, 1999* and its regulations;
- *Nuclear Liability and Compensation Act*;
- *Transportation of Dangerous Goods Act, 1992* and its regulations;
- *Access to Information Act*;
- *Canada/IAEA Safeguards Agreements*;
- *Canada Labour Code, Part II*;
- *Environmental Protection Act (Ontario)* and its regulations;
- *Ontario Water Resources Act* and its regulations; and
- *Technical Standards and Safety Act, 2000 (Ontario)* and its regulations;

The safety and control measures are described in the Licence Conditions Handbook (LCH). The CNSC regulatory framework uses CNSC regulatory documents (REGDOCs), Canadian Standards Association (CSA) standards, codes and other regulatory documentation to provide compliance verification criteria, additional recommendations and guidance for CFM in implementing control measures at the facility.

CFM maintains programs and plans to meet the requirements of the Safety and Control Areas (SCA) as required by its licence. These are summarized in the Facility Licensing Manual (FLM). This application for licence renewal and the referenced supporting documents describes how CFM meets licensing requirements and provides the basis for renewal of the operating licence (the licensing basis). This application, the FLM and summaries of significant reports supporting the licensing basis as described in the application are made available to the public through the FSD community website (www.camecofuel.com). Documents referred to in the application and/or FLM are not all publicly available; because they may contain confidential and proprietary information, controlled nuclear information or prescribed information as defined by the *General Nuclear Safety and Control Regulations* (GNSCR).

1.5 Application Format

This renewal application is written to describe CFM's licensing basis for its ongoing operations. The remainder of this application will provide the information required to support renewal of the licence for a period of twenty years. A detailed mapping of the licence application requirements set out in the GNSCR, *Class I Nuclear Facilities Regulations, Nuclear Substances and Radiation Devices Regulations* (NSRDR) and the *Nuclear Security Regulations* is detailed in Appendix D.

Section 2 will provide a description of CFM operations and other licensed activities.

Section 3 will provide an overview of the site's performance in the current licence period, including achievements and improvement initiatives. A detailed operational performance report for the current licence period is included as Appendix E.

Section 4 will describe the SCAs, programs to meet specific licence conditions, site performance and any improvement initiatives or future activities.

The appendices provide supporting information for the application and include the following:

- Appendix A – Standards and Guidance Relevant to Safety and Control Areas
- Appendix B – Documents Supporting the Licence Application
- Appendix C – List of Acronyms Used in the Application
- Appendix D – Licence Renewal Application Requirements Matrix
- Appendix E – Detailed Operational Performance Report for Ffol-3641.0/2022

2.0 DESCRIPTION OF OPERATIONS AND OTHER LICENSED ACTIVITIES

2.1 Organization and Responsibilities

CFM is a corporation governed by a board of directors. Operationally, CFM is part of the Cameco's FSD, which is led by a Vice-President. The Vice-President, FSD is also a Vice-President for CFM and reports directly to Cameco's Chief Operating Officer, who is the Chair and President for CFM. The organizational structure is further discussed in section 4.1.1.

CFM's Chair and President is ultimately responsible to ensure that the facility is operated in accordance with the conditions of the licence, the NSCA and associated regulations. The licensing authority in accordance with subsection 15(a) of the GNSCR for the facility is the Vice President, FSD. Day-to-day compliance activities are the responsibility of the site General Manager with support and direction from the site regulatory compliance staff. Divisional compliance responsibilities for FSD are handled by the Director, of Regulatory Compliance and Licensing, with support and direction from divisional compliance and licensing staff. Corporately, Cameco has a Safety, Health, Environmental and Quality (SHEQ) department led by the VP, SHEQ and Regulatory Relations that provides support and oversight for licensed activities. All personnel with the authority to act for CFM in dealings with the CNSC are identified as described in the FLM.

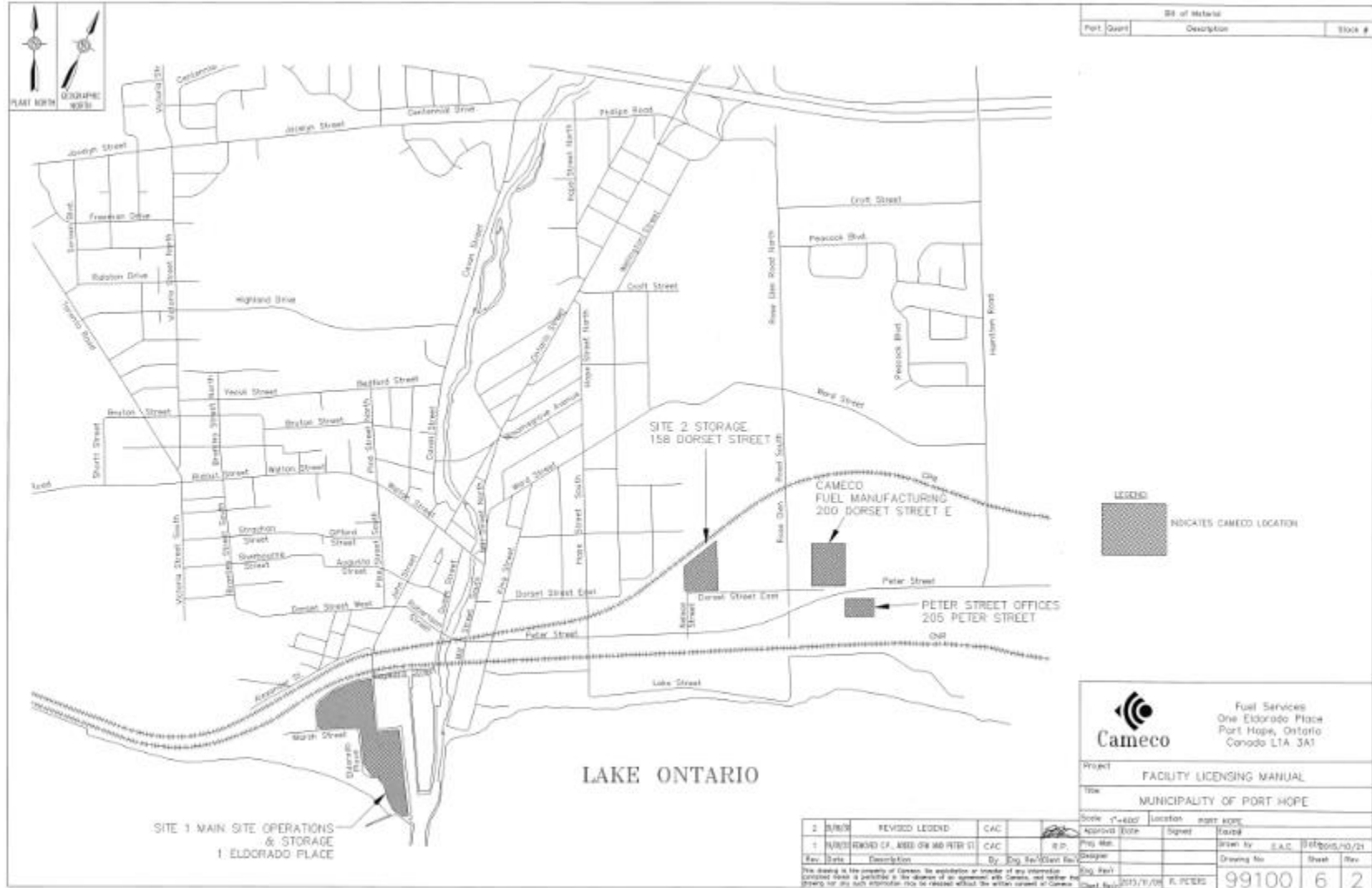
2.2 Facility Location and Layout

As shown in Figure 1 and Figure 2, the facility is located at 200 Dorset Street East, Port Hope, Ontario, adjacent to Peter Street (formally Highway #2), which links the MPH and the Town of Cobourg. The MPH is situated on the north side of Lake Ontario approximately 100 kilometers east of Metropolitan Toronto.

The licensed facility is on part of Lot 2, Concession 1, Municipality of Port Hope, County of Northumberland and more particularly described in Instrument Number 89833 Parts 1 & 2 deposited in the Land Registry Office for the Registry Division of Port Hope, on the 4th of November, 2005. Figure 3 is a public version of the licensed area drawing with confidential information removed.

CFM also owns 12 hectares of property to the north and east of the licensed facility described above. This land is not being used for any activity at this time. Figure 4 provides information regarding the CFM property.

Figure 1 – Location of Cameco Fuel Manufacturing



Bill of Material		
Part	Quant	Description
		Sheet #

Fuel Services
 One Eldorado Place
 Port Hope, Ontario
 Canada L1A 3A1

Project: FACILITY LICENSING MANUAL
 Title: MUNICIPALITY OF PORT HOPE

NO	REVISED LEGEND	CAC	DATE	APPROVAL DATE	SIGNATURE	REVISION
1	REVISIONS OF, AND ON, INTER IT	CAC				
Rev. Date	Description	By: [Signature]	Checked By:	Approved By:	Checked By:	Approved By:

Scale: 1"=400'	Location: [Map]	Sheet: 6	Of: 2
Approval Date: [Date]	Signature: [Signature]	Drawn by: [Name]	E.A.C. [Date]
Checked By: [Name]	Checked By: [Name]	Drawing No: 99100	Sheet No: 6
Checked By: [Name]	Checked By: [Name]	Checked By: [Name]	Checked By: [Name]

Figure 2 – Aerial View of Cameco Fuel Manufacturing



Figure 3 - Facility Licenced Area

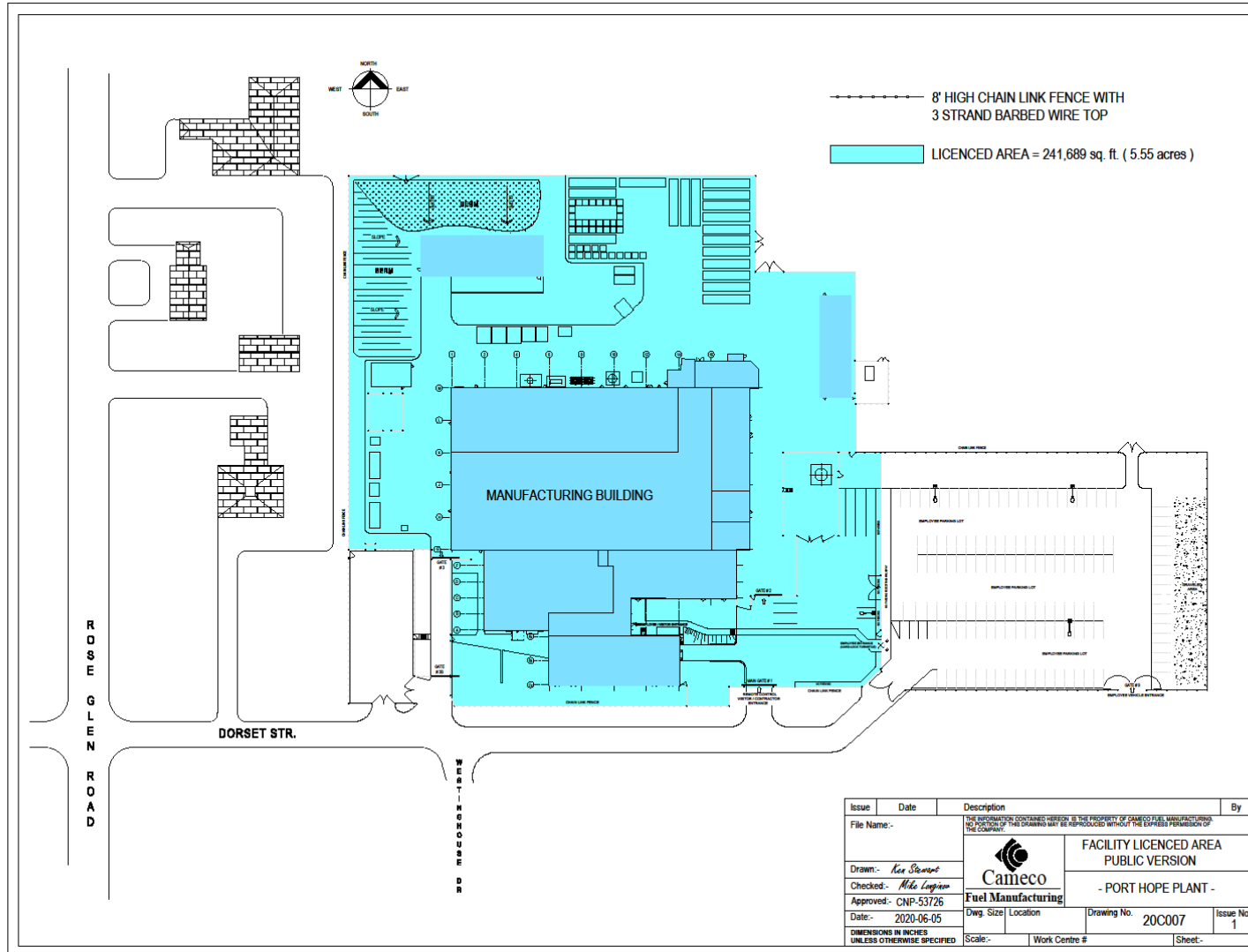
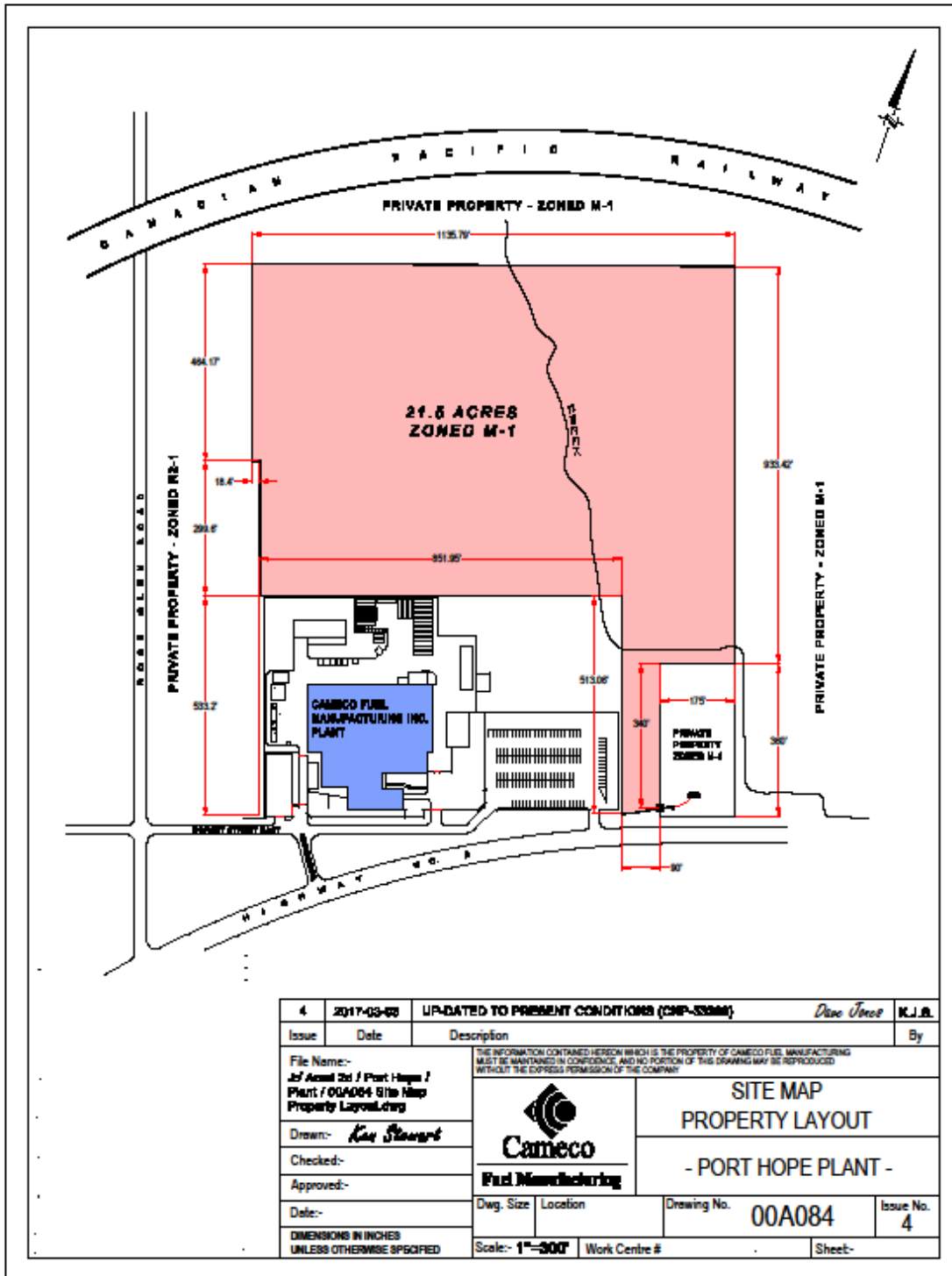
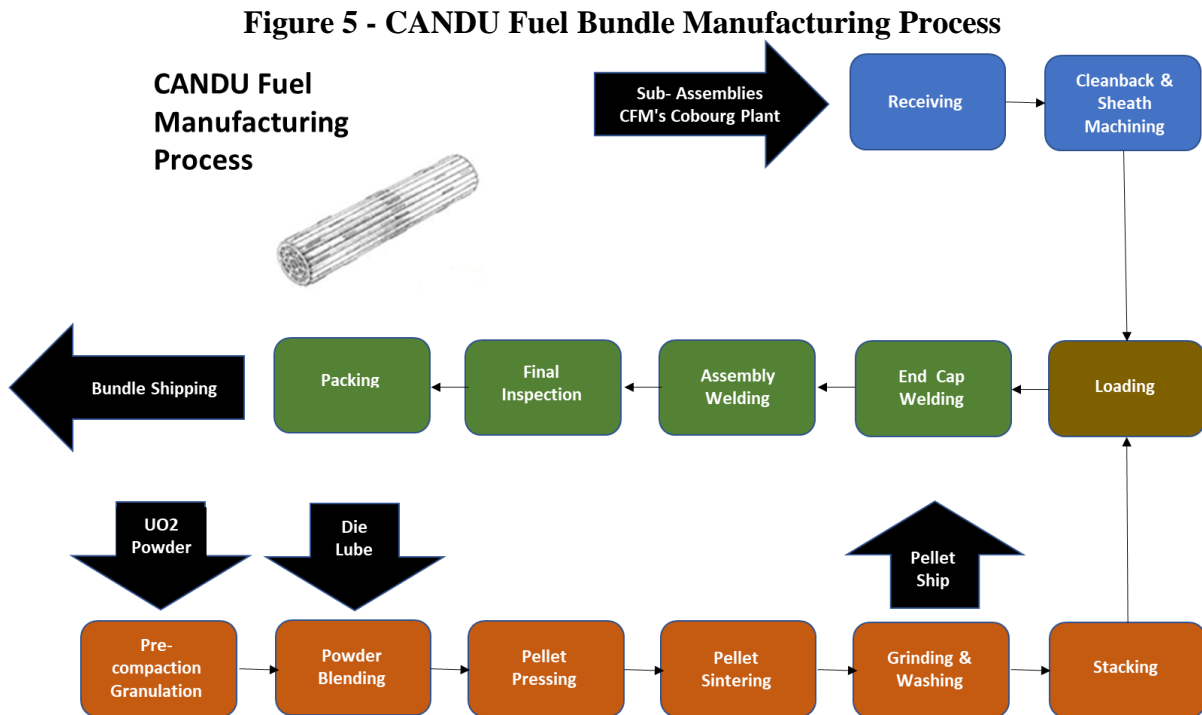


Figure 4 – Cameco Fuel Manufacturing Property Layout



2.3 Processes and Materials

A simplified block diagram of the fuel fabrication process is provided in Figure 5 - CANDU Fuel Bundle Manufacturing Process.



Note: Intermediate products at various stages of the manufacturing process are, at times and dependent upon market conditions, packaged and sold to other nuclear fuel producers.

2.3.1 UO₂ Pellet Operations

UO₂ (natural or depleted) is received in drums and transferred into processing vessels and, along with any recycled material that might need to be added to it, is subjected to pre-compaction, granulation and blending operations in order to condition the powder for the pellet pressing operation. The conditioning is performed by conventional powder processing techniques. The conditioned powder is then transferred in its processing container to the pellet pressing operation.

Using conventional pharmaceutical tablet presses, the conditioned powder is compressed within a die cavity to produce a cylindrical pellet compacted to the appropriate size. The pressed pellet compact is of relatively low density and friable under severe handling conditions until it is passed through an electrically heated sintering furnace within a hydrogen atmosphere. This operation reduces the pellet compact to stoichiometric UO₂

composition and converts the pellet's physical form to a hard, high density, non-friable ceramic pellet.

Sintered pellets are ground using a through feed, conventional centreless grinders to produce a cylindrical part that conforms to the specification requirements for diameter and surface finish. Ground pellets then are washed, dried and inspected. Pellets may be packed into shipping containers for shipment to customers or stacked end to end to create pellet stacks of appropriate length for bundle assembly operations.

2.3.2 Bundle Assembly Operations

The stacks of UO₂ pellets are inserted into zirconium tube subassemblies received from CFM's Cobourg facility. A zirconium alloy end cap is resistance welded to each end of the subassembly tube containing a stack of fuel pellets. Prior to welding the endcaps, the ambient air around the pellets within the tube is purged with helium and the resistance weld hermetically seals the fuel element.

After verification of the quality of the weld, individual fuel elements are assembled into a fixture that holds them in the required configuration while the zirconium alloy end plates are permanently attached to the element ends by resistance welding to create fuel bundles. Completed bundles are inspected via a series of non-destruction visual and dimensional tests. Accepted bundles are placed into an approved shipping container, and then moved to a secured storage area to await shipment.

2.3.3 Pre-Press and Granulate Process

CFM also processes UO₂ powder through the pre-press and granulate (PP&G) process for the Port Hope Conversion Facility (PHCF). The PP&G UO₂ is required to meet specific customer specifications. This involves receiving the UO₂ in drums and pre-compacting it and granulating it in CFM's powder processing equipment and repackaging it for return to PHCF.

2.3.4 Enriched Uranium Operations

CFM maintains a reduced scope Nuclear Criticality Safety Program in order to process custom orders for enriched UO₂ powders for research and special projects. CFM currently possesses a small quantity of fissionable materials (up to 80% of the appropriate smallest critical mass) in accordance with the current LCH. Operations with enriched materials are controlled as described in Section 4.7.13.

2.3.5 Nuclear Substances and Radiation Devices

CFM maintains an inventory of sealed sources and tracks and reports their transfer as required by REGDOC 2.12.3: *Security of Nuclear Substances: Sealed Sources and Category I, II, and III Nuclear Material, Version 2* as described in Section 4.7.12.

2.4 Public Information Program

The objective of the FSD Public Information Program (PIP) is to ensure local target audiences with an interest in Cameco's FSD CNSC-licensed facilities are informed on a timely basis about operations, planned activities, and potential effects on the environment and the health and safety of persons, and thereby build the trust and support of stakeholders. This includes a commitment to and protocol for ongoing, timely communication of information related to the licensed facilities during the licence periods. As a publicly traded company, Cameco must comply with strict disclosure requirements under securities laws both in Canada and the United States. These requirements may affect the content and timing of information releases to the public.

The PIP is designed to fulfill the requirements of the CNSC's REGDOC 3.2.1, *Public Information and Disclosure*.

2.4.1 Public Engagement Strategies

CFM's engagement processes are led by FSD. FSD's overall public engagement process is guided by best practices garnered over decades of experience. These strategies are:

- Open Channels for Communication
 - FSD engages with target audiences through a variety of channels with the goal of building understanding and acting upon concerns.
- Clear and Uncomplicated Communications
 - Deliver fact-based, uncomplicated, and clear communications through the creation of communication materials to help ensure audiences can effectively build their understanding of the information.
- Adaptive Communications
 - Adapt communications to the target audiences and address/support any topics/issues identified through polling.

2.4.2 Target Audiences

The primary audience for the PIP includes the following in Port Hope:

- Workers
- Local community residents in Ward 1 and Ward 2 of Port Hope, including those neighbouring CFM and PHCF;
- Local schools
- Municipal Council and staff;
- Local business organizations, such as the Chambers of Commerce and other relevant industry associations;
- Special interest groups;
- Local non-governmental organizations; charities and community groups;
- Past intervenors in CNSC proceedings;
- Local media; and
- Indigenous Groups
 - Mississaugas of Scugog Island First Nation
 - Hiawatha First Nation
 - Alderville First Nation
 - Curve Lake First Nation

There are no First Nations communities located within the MPH. Two First Nations communities, Hiawatha First Nation and Alderville First Nation, are located just to the north of Port Hope.

FSD considers other groups and members of the general public to be the secondary audience, and include the following in Port Hope:

- Northumberland County residents, businesses and community groups/organizations
- Other interested persons/groups/organizations
- Indigenous Groups
 - Chippewas of Beausoleil First Nation
 - Chippewas of Georgina Island First Nation
 - Chippewas of Rama First Nation
 - Mohawks of the Bay of Quinte
 - Métis Nation of Ontario Region 7

2.4.3 Engagement Mechanisms

FSD uses the following tools to reach its primary and secondary audiences and provide information to the public.

- Website
 - In addition to its corporate website (www.cameco.com), FSD maintains a dedicated community website (www.camecofuel.com) to broadly communicate information about its Ontario operations.
- Social media
 - FSD uses social media to provide news and information about FSD's activities in Ontario, promote community events and engagement activities and drive traffic to Cameco's website. FSD's social media channels are Facebook, Twitter, LinkedIn and Instagram.
- Advertising
 - FSD uses radio, print and online advertising to support its communication initiatives in Ontario. Advertising is typically used to promote upcoming events and to deliver key messages.
- Media Relations
 - Requests for information from news media regarding Ontario operations are handled through divisional staff located in Port Hope. FSD monitors news coverage of its operations and the nuclear industry generally on an ongoing basis through subscriptions to media monitoring services as well as search-engine monitoring of news coverage undertaken by FSD staff.
- Public Inquiries
 - FSD aims to respond to inquiries in a timely manner and to provide access for subject matter experts when needed.
 - FSD has a variety of mechanisms in its PIP to provide target audiences with opportunities to comment or ask questions about its CNSC licensed Ontario operations as well as for FSD to respond to issues raised. These include but are not limited to:
 - Social media channels
 - Public inquiry number (905.800.2020)
 - Email inquiry on [camecofuel.com](mailto:cameco_ontario@cameco.com) (cameco_ontario@cameco.com)
 - FSD leadership and subject matter experts at community or FSD-led events/activities
 - FSD technical liaison contact information provided to CNSC staff for intervenor/public inquiries

2.4.4 Information Products

FSD makes the following information available to all members of the public through its corporate and/or community websites.

- Technical Reports and Licensing Documentation
 - Summaries of significant reports supporting the licensing basis of the facilities are available on the dedicated community website, including environmental risk assessment, derived release limit assessment, safety report and preliminary decommissioning plans.
 - Documents supporting licensing activities and other select reports are also available to the public on the community website.
- Quarterly and Annual Compliance Reports
 - Quarterly Monitoring and Operational Performance Reports and Annual Compliance Reports are posted on camecofuel.com. The respective reports are also sent to the MPH, Mississaugas of Scugog Island First Nation, Hiawatha First Nation, Alderville First Nation, and Curve Lake First Nation.
 - The quarterly environmental monitoring results are also provided to the MPH council.
- Videos
 - FSD may choose to develop and deploy videos to help highlight various aspects of its operations and/or community activities. These videos may be utilized on its website and/or social media or used at off-site events.
- Printed Material
 - Print material is available for all visitors to FSD facilities and made available at off-site information sessions. Other information products are made available through the community website, which is promoted through online, social media, print and / or radio advertisements.
- Information Boards
 - FSD may choose to use information boards to help highlight various aspects of its operations and community investment activities. These boards may be deployed at community or FSD-led events.

Additional information may be requested at any time through the public inquiry options described above.

2.4.5 Indigenous Engagement

FSD is committed to provide opportunities to engage with First Nation and Métis communities regarding its operations in Ontario. In support of this application, CFM has submitted an Indigenous Engagement Report* which fulfills the requirements set out in REGDOC-3.2.2.

CFM provides its Quarterly Compliance Monitoring and Operational Performance Report and Annual Compliance Report to the Mississaugas of Scugog Island First Nation, Hiawatha First Nation, Alderville First Nation, and Curve Lake First Nation.

CFM has also identified Indigenous groups in its secondary target audience. Efforts to engage with these groups include:

- Issuing an annual letter/email to determine interest in further engagement including meetings and/or facility tours.
- Informing of any licensing activities.
- As with any interested party, CFM will review and respond accordingly to any request from an interested Indigenous group.

In the second quarter of 2021, following an expression of interest by Curve Lake First Nation (CLFN), representatives from FSD began monthly meetings with CLFN. These meetings will continue to discuss areas of interest, such as licensing activities, environmental monitoring, and public disclosure.

The activities described in this licence application reflect a change to current licensed activities in the form of a change to the production limits. The proposed change does impact the conclusions of the Environmental Risk Assessment and are therefore not likely to result in new impacts to the environment nor the potential for new adverse impacts on an Indigenous group's asserted or established Indigenous and/or treaty rights. Letters are being sent to the Indigenous groups identified in section 2.4.2 to advise of the submission of the licence application and invite their participation in the process.

*CFM letter – Self-Assessment of REGDOC-3.2.2, Indigenous Engagement for Cameco Fuel Manufacturing – October 4, 2021

2.5 Financial Guarantee

CFM has a Preliminary Decommissioning Plan (PDP), which was prepared based on guidance provided in CSA N294.0-19 *Decommissioning of facilities containing nuclear substances* and CNSC Regulatory Guide G-219: *Decommissioning Planning for Licensed Activities*. The plan outlines the general requirements for returning the site to the status of unrestricted use and outlines the controls required for the protection of the environment during the decommissioning process. The PDP forms the basis for the financial guarantee as in accordance with CNSC regulatory document G-206 *Financial Guarantee for the Decommissioning of Licensed Activities*.

The PDP and associated cost estimate were revised and submitted to CNSC in May 2021. The PDP and cost estimate for a revised financial guarantee of \$10.8 million were accepted by CNSC staff in September 2021. The proposed changes to the amount of the financial guarantee will be considered by the Commission in the one-year licence renewal hearing scheduled for December 2021. Once approved by the Commission, CFM will secure an irrevocable letter of credit to cover the full amount required by the updated cost estimate.

2.6 Nuclear Liability Insurance

CFM maintains nuclear liability insurance for the facility as required under the Nuclear Liability Act (NLA).

3.0 SITE PERFORMANCE OVERVIEW

This section describes operational highlights and improvement initiatives during the current licence period (Q1 2012 – Q4 2020).

3.1 Performance in the Current Licence Period

CFM is committed to the safe, clean and reliable operation and continually strives to improve safety performance and processes to ensure the safety of both its workers and local residents. 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. CFM's operations have maintained worker radiation exposures well below the regulatory dose limits. Environmental emissions and public radiation exposures are controlled to levels that are a fraction of the regulatory limits.

In its annual performance reports to the Commission, CNSC staff has rated CFM's performance as Satisfactory in all SCAs each year of the current licence period. Routine inspections by CNSC staff continue to confirm that CFM is in overall compliance with the CNSC regulatory and licensing requirements. Notices of non-conformance and recommendations made by CNSC inspectors and specialists are reviewed and used to strengthen existing programs and controls to ensure that safety, security and the environment are not compromised.

CFM is committed to continuous improvement. In the current licence period, CFM enhanced its effective site programs to align with new and/or updated CSA standards and new REGDOCs. Requirements from more than 20 standards and REGDOCs have been incorporated into site programs since 2012.

3.2 Facility Operation and Physical Design

Throughout the licence period, CFM operated routinely with no major operating issues related to CFM's operation of the facility. CFM shuts down annually in the summer for scheduled maintenance work and worker vacation time.

Modifications to the facility during the current licence period included:

- relocation of:
 - change rooms,
 - production office areas
 - bundle manufacturing system
- installation of new:
 - powder receiving and preparation area
 - stacking cell

- pellet grinding, washing and drying area
- waste treatment services

All of these activities were carried out utilizing the internal change and design control process. These activities did not required written approval from the Commission or a person authorized by the Commission.

3.3 Radiation Protection

The well-established Radiation Protection Program at CFM has been demonstrated to be effective in the prevention of unreasonable risk to the health and safety of workers. The total effective dose (TED) for all workers is shown in Table 1 which are well below the annual regulatory limit set out in the *Radiation Protection Regulations* of 50 mSv/yr.

Table 1 Total Effective Dose in Current Licence Period

2012 - 2020 Total Effective Dose				
Year	Number of Individuals	Minimum Dose (mSv)	Average Dose (mSv)	Maximum Dose (mSv)
2012	365	0	0.7	6.0
2013	330	0	0.7	8.6
2014	317	0	1.3	8.5
2015	336	0	1.2	12.6
2016	278	0	1.0	7.8
2017	270	0	0.7	6.4
2018	267	0	1.1	8.0
2019	256	0	1.1	8.4
2020	247	0	0.9	6.2

The five-year regulatory limit of 100 mSv established in the *Radiation Protection Regulations* applies to unique five-year periods. The periods relevant to the current licence period extend from January 1, 2011 to December 31, 2015 and January 1, 2016 to December 31, 2021. For the January 2011 to December 2015 period, the maximum TED for a single individual for all five years was 36.2 mSv. For the January 2016 to December 2020 period, the TED for the highest individual was 30.6 mSv.

3.4 Conventional Health and Safety

CFM has a mature occupational Health and Safety Program with an overriding strong commitment to safety. The focus on safety is demonstrated by the achievement of 3 years without a lost time injury at the Port Hope site in August 2021.

In November 2020, a COVID-19 outbreak was declared at CFM Port Hope by the Haliburton Kawartha Pine Ridge District Health Unit following the identification of three cases at the facility. CFM worked with its company medical team and public health

authorities to support the affected employees and ensure a safe workplace when the facility resumed operations.

3.5 Environmental Protection

CFM controls and monitors all releases of nuclear and hazardous materials from the facility. Effluent and environmental monitoring is described in the Environmental Protection Program (EPP). During the current licence period, environmental action levels were exceeded four times: sanitary sewer in 2014 and 2018, stack emissions in 2016 and fenceline gamma in 2017. These instances were reported to CNSC staff, investigated by CFM and corrective actions were implemented. There was no impact on the public or the environment as a result of these events.

In addition, during the licence period, the EPP and supporting documents were updated to incorporate requirements from the CSA N288 suite of environmental standards, including those for derived release limits, environmental monitoring, effluent monitoring, groundwater protection and development of action levels.

3.6 Public Information and Community Engagement

As detailed above, FSD has a mature PIP to provide relevant information to the community on how activities at CFM affect the environment and the health and safety of workers and the community. The program is dynamic and utilizes traditional radio and print media, community-based activities, as well as web-based and social media to communicate with the public.

FSD maintains a dedicated community website (www.camecofuel.com) to broadly communicate information about its Ontario operations. The site provides information about the PHCF, CFM and Blind River Refinery (BRR) facilities, environmental programs, and community involvement. Documents supporting licensing activities, compliance reports, and other select reports or technical summaries are also available to the public on the community website.

FSD is committed to providing information to interested Indigenous groups and proactively reaches out to provide information or extend invitations to FSD initiatives.

Over the past decade, FSD has retained outside expertise to measure public opinion in Port Hope to help determine the effectiveness of its PIP. The annual public opinion polling has consistently demonstrated a continued high level (~90%) of community support for FSD's continued operations in Port Hope.

4.0 SAFETY AND CONTROL AREAS

4.1 Management System

The management system program at CFM is the framework that currently guides the processes and programs required to ensure safety objectives are achieved, performance is monitored, and a healthy safety culture is maintained. The Management System Program Manual (CFM-MS) meets the requirements of CSA N286-12 (R2017): *Management System Requirements for Nuclear Facilities* and REGDOC 2.1.1: *Management System*.

The management system is based on the following principles, which are described in more detail in CFM-MS and applied in a graded manner commensurate with risk:

- Safety is the paramount consideration guiding decisions and actions;
- The business is defined, planned and controlled;
- The organization is defined and understood;
- Risks are identified and managed;
- Resources, generally captured as financial, human and infrastructure, are identified and managed;
- Communication is necessary and must be effective to achieve business objectives;
- Information is identified and managed;
- Work is identified and managed;
- Problems are identified, assessed for significance and resolved as appropriate to the significance;
- Changes are identified and controlled;
- Assessments are performed;
- Experience is sought, shared and used;
- The management system is continually improved; and
- Corporate oversight is defined and performed to ensure the management system meets the business needs.

CFM-MS also applies to supplier(s) contracted to perform the life-cycle activities of design, supply chain, construction, commissioning, operation, and decommissioning, as appropriate, as they relate to CFM. However, CFM's top management remains accountable to ensure the requirements of this program are met.

An annual site management review is held with site, divisional and corporate leadership to review the suitability, adequacy, and effectiveness of corporate Safety, Health, Environment and Quality Policy (SHEQ Policy) policy and site programs and procedures to ensure conformance to both corporate and CNSC requirements. These reviews include assessing opportunities for improvement and the need for changes to site programs, including objectives and targets. Actions are assigned and tracked in the Cameco Incident Reporting System (CIRS).

4.1.1 Organizational Structure

The organizational structures of FSD and CFM are shown in Figure 6 - Organizational Structure – Fuel Services Division and Corporate that Support CFM Figure 6 and Figure 7. The Vice-President, FSD, directs the operation of and maintains corporate responsibility for CFM. The General Manager, CFM, has the responsibility of operating the facility in accordance with the corporate policies, principles and operating budgets approved by the company's board of directors. To facilitate administrative control within the facility, workers have been organized into a number of departments. Production and service-oriented departments have been segregated, but all departments report to the general manager.

Designated personnel are responsible for all operations within their departments which must be carried out in a manner consistent with company policies, programs, plans and procedures. In accordance with Section 15 of the GNSCR, the persons who have authority to act for CFM in dealings with the Commission, and the name and position titles of the persons who are responsible for the management and control of the licensed activities are documented in writing and provided to CNSC staff. *

*CFM letter – Persons Having Authority to Act for CFM in Dealings with the CNSC – April 17, 2020.

Figure 6 - Organizational Structure – Fuel Services Division and Corporate that Support CFM

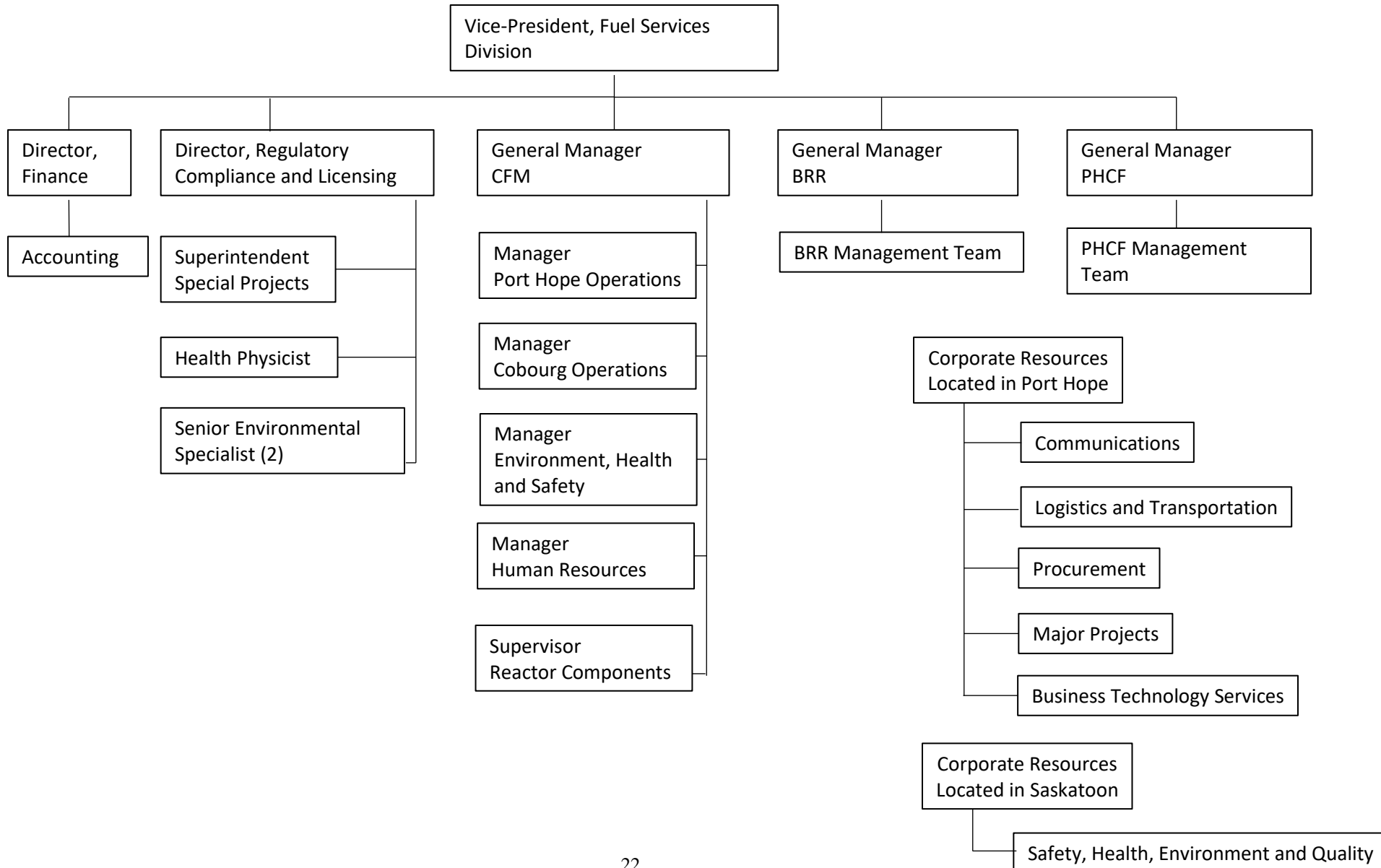
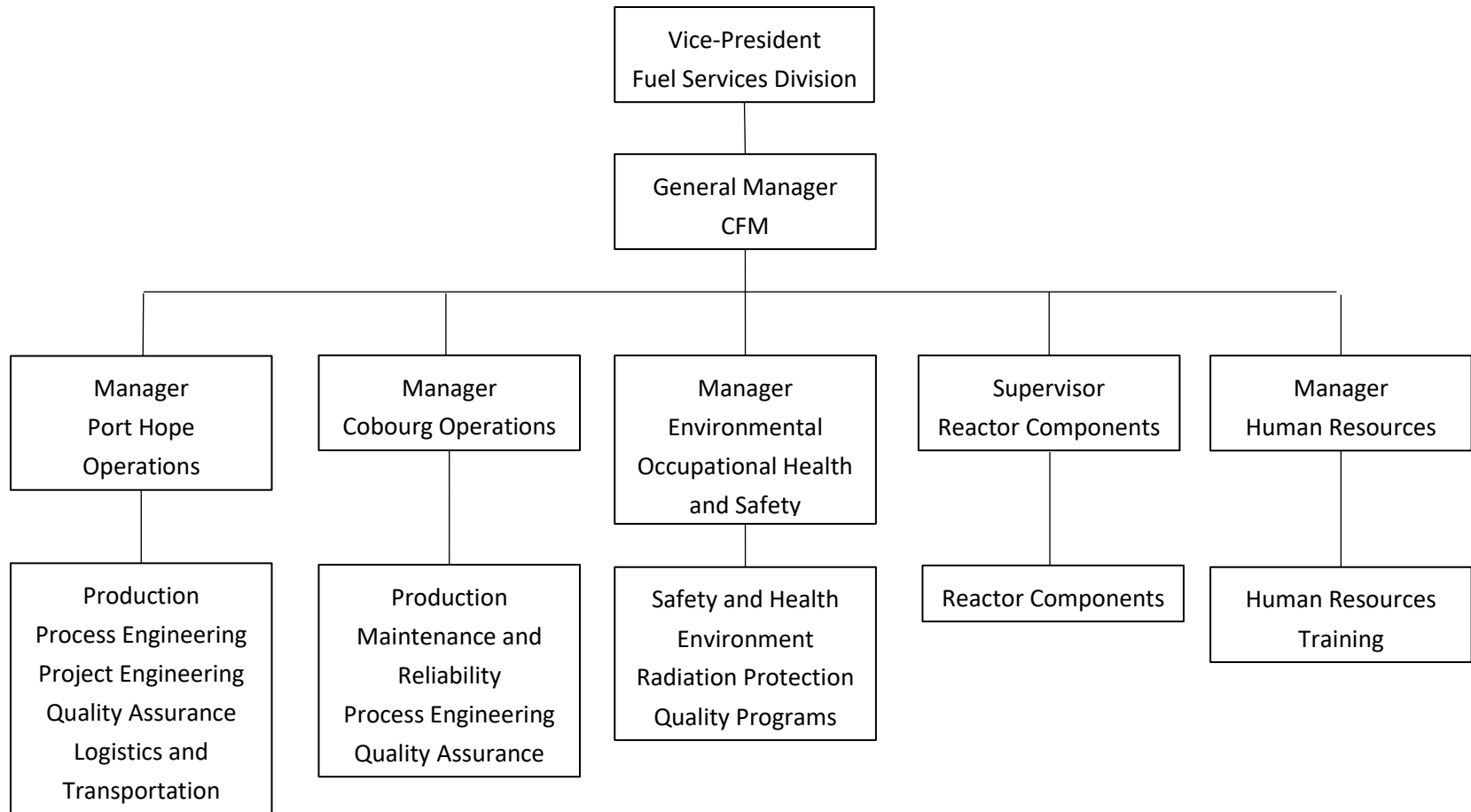


Figure 7 - CFM Organizational Structure



4.1.2 Safety, Health, Environment and Quality Policy (SHEQ Policy)

Consistent with its vision, values and measures of success, Cameco emphasizes that the health and safety of workers and the public, protection of the environment, and quality of its processes are the highest corporate priorities during all stages of its activities, which include exploration, development, operations, restoration, decommissioning and reclamation. As such, Cameco is striving to be a world class performer in all aspects of our business through a strong safety culture, environmental leadership, operational excellence and our commitment to the following:

- Preventing injury, ill health, and pollution;
- Fulfilling regulatory, contractual and corporate requirements as well as commitments to local communities (defined as compliance obligations);
- Keeping risks at levels as low as reasonably achievable, taking into account economic and societal factors (ALARA);
- Ensuring quality of processes, products, and services; and
- Continually improving our overall performance.

These commitments are reflected in the SHEQ Policy, which is publicly available on the corporate website (www.cameco.com). These commitments are approved and supported by Cameco's board of directors. The officers, senior management and all workers are accountable for the performance of their jobs in compliance with this policy and all relevant legislation.

4.1.3 Safety Culture

Focus on management system through governance, quality and safety culture drives accountability and oversight at all operations. Divisional oversight and collaboration are enhancing the FSD's safety culture through consistency, management system enhancements and/or divisional program development, to improve safety and environmental performance.

Safety culture surveys (also called safety culture assessments) are conducted approximately every five years at all FSD sites. These surveys gauge the perception of workers in relation to safety culture in a scientifically meaningful way. From these surveys/assessments, CFM develops action plans in areas where opportunities for improvement are identified. Action plans are entered into CIRS for tracking and follow-up. The most recent safety culture assessment was completed in 2016 and currently, a safety culture assessment is scheduled for the fourth quarter of 2021.

The broad areas of focus following the last safety culture assessment at CFM were to give better alignment of the documented management system so that safety requirements are clearer from the program-level to work instructions and also improve the "shop-floor" value generation and hence engagement with the business. The work on providing clarity to the documented management system has involved a revamp of its overall organization

and has worked to identify gaps in the provision of clear safety instructions and expectation for the workers. The efforts to increase “shop floor” engagement in business processes has helped to ensure that the workforce is actively contributing to making improvements to both safety and other practices. This active engagement in the process of improvement helps with the implementation of new ideas.

The CFM and FSD leadership teams are committed to enhancing a sustainable safety culture and will continue to work diligently to ensure that all workers remain engaged to the extent possible.

4.2 Human Performance Management

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

Work instructions and operating documents are developed in consideration of the physical interaction of people and the production plant equipment or systems. Various risk assessment tools are used as part of continual improvement, project design and implementation and change control to identify and control error-likely situations.

Some human performance management tools in place at CFM include:

- Corporate requirements for self-check, personal accountability, fitness for duty, and safety and radiation protection
- Cameco’s Competency Model which defines expectations for performance and behaviour
- Ladder of Self-Responsibility and Accountability is used to promote behaviours and self-reflection to achieve goals
- Human Performance Program under which supervisors coach their employees

4.2.1 Training Program

The CFM training program describes the processes in place for a Systematic Approach to Training (SAT). The Systematic Approach to Training-Training Plan, CFM-HR-01, meets the requirements of REGDOC 2.2.2, *Personnel Training, Version 2*. Operation of CFM requires both professional and non-professional workers for which on-the-job training is required. CFM also has training programs for specific areas such as emergency response, radiation safety, environment and health and safety. The goal of training is to develop and maintain a competent work force that can continue to safely operate the facility in compliance with licensing requirements.

The CFM training program:

- Ensures workers are competent on the basis of appropriate education, skills, experience and behaviour(s);
- Provides a means of measuring, monitoring and improving the capability of workers to meet organizational objectives;
- Ensures all training is as efficient and effective as possible;
- Provides a continuous improvement mechanism for the training program.

CFM provides training to meet legislative and internal company requirements to ensure that workers have adequate knowledge and skills to fulfill their roles and responsibilities. Worker training plans identify initial and continual qualification requirements of positions. Training plans include position specific, site specific, corporate, progression, and role specific requirements where applicable.

CFM uses this systematic approach to training to ensure that workers who carry on activities, including licensed activities and SHEQ activities, are qualified to do the work assigned to them.

4.3 Operating Performance

An operating program includes an up-to-date set of operating limits for the facility and activities authorized under the licence, including production limits and an inventory of nuclear substances possessed under the licensee's operating licence.

The FLM provides an overview of all the programs in place at CFM to ensure that it operates in a safe manner in compliance with its licence conditions. The performance of these programs is regularly assessed to assure the site management that these programs are implemented, adequate and effective. Corporate personnel perform audits of the site management programs on a regular basis to verify that site performance meets both corporate requirements and complies with all applicable regulatory requirements.

4.3.1 Operating Limits

Operating limits are defined in the licensing basis upon which the Commission rendered their decision to renew CFM's operating licence in 2012. The current licensed production limit is 125 Megagrams (Mg) of UO₂ as pellets during any calendar month, which equates to an annual maximum of 1500 tonnes of UO₂ as pellets.

CFM is requesting a change in the licensed limit to 1650 tonnes of uranium as uranium dioxide pellets annually. This change aligns the nomenclature used in setting operating limits across the FSD facilities (i.e., tonnes uranium per year). The proposed change to the limit would reflect the production capacity of the equipment installed at CFM under a seven-day operating week. In its review of the proposed increase to production, CFM has

assessed the change under its licensing basis* for the 14 SCAs as well its licensing basis for other regulatory areas. This assessment has concluded that the proposed production increase falls within the current licensing basis for the facility, including the Safety Analysis Report, Derived Release Limit Report and Environmental Risk Assessment.

Environmental release limits and radiation protection limits are established to ensure the protection of workers, the public and the environment. Radiation protection limits are set out in the *Radiation Protection Regulations* and documented in the Radiation Protection Program, CFM-RP. Environmental release limits are documented in the Environmental Protection Program, CFM-EP and further discussed in Section 4.9.

Radioisotope sources are used at the facility. The Radioisotope Source Control Procedure, HSI-048 describes the inventory of sealed sources, and tracking and reporting requirements in accordance with REGDOC-2.12.3, Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2.

*CFM Letter. Justification for Licence Term and Production Increase. October 4, 2021

4.3.2 Operating Plan

CFM develops three-year plans for strategic planning for the immediate future, with 20-year plans for business development purposes. As domestic and international customers refurbish existing reactors and potential new markets for pellets and/or fuel bundles become available, CFM is positioning to respond to a potential increase in the market demand for its products. Increased production capacity may be achieved using existing equipment through an increase in the number of operating days each year. This proposed change has been evaluated against the licensing basis for CFM which has been submitted to CNSC staff in support of this application*.

*CFM Letter. Justification for Licence Term and Production Increase. October 4, 2021

4.3.3 Reporting Requirements

CFM reports information to the Commission as required under the NSCA, its regulations, and REGDOC- 3.1.2 *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*.

Quarterly compliance reports and an annual compliance and performance report are submitted to CNSC staff as in accordance with the LCH. These reports are available to the public on the FSD community website (www.camecofuel.com).

Non-routine reporting includes incidents related to facility operations, action level exceedances and environmental releases and other events as defined in sections 29-32 of the GNSCR, section 27 of the NSCA, REGDOC-2.12.3 and the LCH. All non-routine reporting is included in the quarterly and annual reports. The Public Disclosure Protocol

for Ontario Operations provides that, the following events should also be posted to the FSD community website:

- unusual operational events at FSD facilities that may have off-site consequences or that would be of interest to the target audience.
- environmental event that triggers a notification to the CNSC under section 29 of the GNSCR.
- summaries of non-routine environmental incidents that are required to be reported to the Ontario Spills Action Centre.

4.3.4 Regulated Activities

CFM is federally regulated by the CNSC as a Class 1B nuclear facility. However, CFM is also regulated by other government agencies through statute, regulation, permit, approval and/or licence. Table 2 provides a list of key regulatory authorities along with an overview of the key activities they regulate as they pertain to CFM.

Table 2 Agencies with Jurisdiction over CFM Operations

Agency	Activities Under Jurisdiction
Environment and Climate Change Canada (ECCC)	National Pollutant Release Inventory, halocarbons, spills reporting, deleterious substances specific sections under the <i>Fisheries Act</i>
Ministry of the Environment, Conservation and Parks (MECP)	Discharges to air and associated approvals, Permit to Take Water for groundwater wells and spills reporting
Municipality of Port Hope	By-laws related to noise and sanitary sewer discharges
Department of Employment and Social Development Canada (ESDC)	Industrial Relations (Part I), Occupational Health and Safety (Part II), and Standard Hours, Wages, Vacations and Holidays (Part III) of the Canada Labour Code
Ontario Ministry of Labour (MOL)	Contractors at the facility may fall under provincial health and safety regulation
Ontario Technical Standards and Safety Authority (TSSA)	Regulation of boiler and pressure vessels and associated piping
Transport Canada	Transportation of dangerous goods (TDG), including and Emergency Response Assistance Plan (ERAP)

4.4 Safety Analysis

The design, construction and operation 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. The hazards, preventative measures and mitigating controls associated with the licensed activities at CFM have

been systematically reviewed and documented from several perspectives, including but not limited to the following assessments:

- CFM Safety Analysis Report (SAR)
- Fire Hazard Analysis
- Environmental Risk Assessment
- Derived Release Limit
- Exposure Based Release Limits
- Spill Prevention and Contingency Plan
- Environmental Aspects Registry

4.4.1 Safety Analysis Report

CFM has used a What-If analysis technique to systematically determine potentially hazardous scenarios in terms of safety, the environment and plant operability. Hazards were evaluated to establish the probability of occurrence and potential consequence(s). In addition, a listing of safety equipment and systems for preventing or mitigating each hazard was prepared. From these, a Safety Analysis Report (SAR) was generated that describes the conditions, safe boundaries, and hazard controls that ensure operational safety. The SAR is used to show, for all systems including systems that could be hazardous to the worker, public, and/or the environment, that adequate safety systems are in place to prevent unreasonable risk to persons and the environment. The SAR includes an analysis of the probable worst-case release event. CFM updated and revised the SAR in 2021, which has been accepted by CNSC staff.

The SAR contains technical detailed information that is considered confidential and proprietary and includes controlled nuclear technology. It is therefore not publicly available. A technical summary of the updated SAR will be available on Cameco's community website in November 2021.

4.5 Physical Design

CFM is required to have a program for physical design of the facility to assess the ability of structures, systems and components to meet and maintain their design basis given new information arising over time and manage changes to ensure that safety is maintained.

4.5.1 Facility Design

Site details are provided in Section 2.2. The licensed area is secured by a metal fence that encloses the entire perimeter.

Modifications to the facility are made in accordance with the *National Building Code of Canada, 2015*, the *National Fire Code of Canada, 2015* and *National Fire Protection Association, CSA N393-13 (R2018)*, *Fire protection for facilities that process, handle, or store nuclear substances*.

4.5.2 Facility and Process Changes

CFM's Change Control, MSP 13-02 describes the process used to identify and manage changes at site in a manner appropriate to the type and significance of the change. The change control review process involves subject matter experts and identifies potential implications with respect to operability, health and safety and the environment, including any regulatory and/or code implications.

4.5.3 Third Party Review for Fire Protection

Modifications for which the initial assessment indicates a potential impact on fire protection design basis, goals, or criteria shall be subject to a qualified third-party review as in accordance with CSA N393-13 (R2018): *Fire protection for facilities that process, handle, or store nuclear substances*. All third-party reviews are conducted by qualified persons from organizations whose management and financial operations are independent of the design organization. CFM submits all third-party fire reviews are submitted to CNSC staff as required by the licence and LCH.

4.5.4 Pressure Boundary Program

As required by its operating licence, CFM maintains an agreement with an Authorized Inspection Agency (AIA) for the registration, inspection and other activities related to pressure systems. The AIA is the Technical Standards and Safety Authority (TSSA) for CFM. Pressure Containing Components, MSP 27-16, describes CFM's process for ensuring safe operation of pressure retaining components and to maintain compliance with CSA B51: *Boiler, Pressure Vessel, and Pressure Piping Code*.

4.6 Fitness for Service

CFM is required to have a program for maintenance of the facility and a program for periodic inspection and testing for the facility. This area includes programs that ensure all equipment is available to perform its intended design function when called upon to do so.

4.6.1 Maintenance Program

CFM has an established preventative maintenance program as described in the Preventative Maintenance Execution Management, AP 018. All preventative maintenance work is initiated and documented through the work notification system in SAP. The site maintenance program ensures that equipment functions as designed, remains available, meet the design intent in the safety report and that equipment failures are minimized. This is accomplished by completion of corrective and preventative maintenance activities along with routine inspections on system components to ensure that they remain in good operating condition.

4.6.2 Periodic Inspection and Testing for Fire Protection Systems

Fire protection systems are tested according to an established schedule developed using the National Building Code and National Fire Code. Reviews of aspects of the fire protection systems are completed as required by CSA N393-13 (R2018).

4.7 Radiation Protection

Radiation protection measures are in place to minimize and control the potential for radiation exposure to both workers and members of the public arising from the operation of CFM. This exposure is due to the alpha, beta and gamma radiation emitted from the depleted, natural and enriched uranium compounds received and processed at the facility. Exposure can be from beta or gamma radiation outside the body, or alpha, beta or gamma radiation from inside the body as a result of inhalation, ingestion or absorption through the skin of uranium bearing materials.

This section will focus on radiation exposure for workers at the facility. Radiation exposure for the public is discussed as part of the Environmental Protection SCA in Section 4.9.

4.7.1 Radiation Protection Program

The Radiation Protection Program, CFM-RP describes how CFM meets the requirements of the *Radiation Protection Regulations* and ensures that contamination levels and radiation doses received by individuals are monitored, controlled and maintained As Low As Reasonably Achievable, social and economic factors taken into account (ALARA).

CFM-RP describes written procedures used to ensure that radiation exposures and doses are kept ALARA, social and economic factors taken into account. This is accomplished by various means including: worker training and awareness; the using of specialized handling and personal protective equipment; the developing and implementing of specialized procedures and monitoring methods; and by having a system in place to develop, implement and monitor the effectiveness of these means.

Radiation exposure for workers is monitored through a comprehensive dosimetry program that includes internal and external dosimetry monitoring. FSD maintains a dosimetry services licence issued by the CNSC for the urine analysis and lung counting programs.

4.7.2 Potential Radiological Hazards

Radiation hazards at CFM are primarily associated with natural, depleted and enriched uranium. The hazards associated with natural uranium are of greater focus due to the quantities processed. Working in the presence of uranium, internal exposure can result from inhalation, ingestion or contamination of an open wound. The primary health concerns are chemical damage to the kidney, radiation dose to the bone, and radiation dose to the lung. CFM-RP further details the dose implications of uranium compounds found at CFM.

4.7.3 In-Plant Monitoring

Regular gamma surveys of the plant and storage areas are performed and areas with dose rates above 25 $\mu\text{Sv/h}$ are posted. This posting informs workers that the time spent in this area should be minimized.

CFM monitors uranium in air is monitored using an in-plant air sampling system. The air sampling results from these stations provide an indication of air quality, and the performance of engineering controls. This data is used to determine whether respiratory protection is required.

In addition to the in-plant air sampling system, CFM has continuous air monitoring systems in the areas where powder is handled. These units operate continuously and are set to alarm when uranium concentrations approach levels requiring respiratory protection.

4.7.4 Nuclear Energy Workers

Workers or contractors that have a reasonable probability of receiving a radiation dose greater than 1 mSv annually are designated as Nuclear Energy Workers (NEWs). As required by the *Radiation Protection Regulations*, all NEWs are notified in writing of this designation, the risks associated with radiation that they may be exposed to in the course of their work and the applicable effective and equivalent dose limits. Female NEWs are also notified in writing of their rights related to pregnancy and breast feeding, including the benefits of notifying CFM, as soon as they are aware of their pregnancy or planning to breast feed.

All NEWs receive training in radiation safety when first hired or returning to work after an extended absence. Regular refresher training is completed on a set frequency.

4.7.5 Personal Dosimetry

The annual dose assignment of NEW's working at CFM consists of both external and internal dosimetry inputs. The annual total effective dose is the sum of a worker's whole body dose as measured by dosimeter badges plus their dose from their lung burden. Dose from uranium in urine may be assigned for significant uptakes of uranium. Each of the three components of the personal dosimetry program is described below.

4.7.6 External Dosimetry

Individually assigned dosimeters are used to determine external dose as both deep-dose equivalent and shallow-dose equivalent exposure from external sources of radiation. The external dosimetry service for FSD is provided through a CNSC approved external dosimetry service provider. Action levels for external dosimetry are shown in Table 3. These action levels are also referenced in CFM-RP and in the appropriate radiation

protection procedures. Extremity dose measurements are also performed using ring-type dosimeters that are processed in the same manner as the conventional dosimeters.

Table 3 Action Levels for External Dosimetry

External Dosimetry Parameter	Frequency	Regulatory Action Level (mSv)
Whole Body Exposure	Monthly -- NEW	1.6
	Quarterly - NEW	1.0
	Quarterly – non-NEW	0.2
Skin Exposure	Monthly - NEW	20.0
	Quarterly - NEW	5.0
	Quarterly – non-NEW	2.0
Extremity Exposure	Quarterly – NEW	55.0

4.7.7 Internal Dosimetry

FSD holds a licence from the CNSC that authorizes FSD to provide internal dosimetry services to PHCF, BRR and CFM. Additional information regarding this program may be found in FSD’s Technical Basis Document (TBD).

Internal dose is assessed and assigned through two programs – urine analysis and lung counting. Urine analysis is used to assign dose for exposure to fast (soluble) uranium material. Lung counting is used to assign dose for exposure to slow (insoluble) uranium material. UO₂, which is the form of uranium present at CFM is a slow uranium material.

4.7.8 Urine Analysis

Because of the solubility of the form of uranium present at CFM, lung counting will capture all internal doses because there is very little uranium present in the urine for low intakes. However, urine analysis samples can be used to screen for potential kidney toxicity, for an indication of upset or unusual conditions and for the dose assessment of abnormal intakes together with lung counting results. CFM-RP and site procedures describes which workers are required to submit routine urine samples for the analysis of uranium. Non-routine urine samples can be provided by any individual at any time. The action level for Urine Analysis is shown in Table 4.

Table 4 Action Level for Urinalysis

Frequency	Action Level
Bi-Weekly Pre shift (CFM Workers)	10 µg U/L

4.7.9 Lung Counting

The dose assessment of uranium in lung is performed using a germanium detector-based lung counting system. A group-counting technique is used for dose assignment where all workers in a similar work group are assigned an average internal dose. This method involves creating appropriate groupings of individuals based on similar exposure potential and measuring and assessing each individual's spectrum, taking detection criteria and physical conditions (e.g., individual chest wall thickness) into account.

The frequency of lung counting of NEWs is based on the work group to which the workers belongs and is described in CFM-RP. Individuals who are not lung counted, such as administrative support staff and contractors have internal dose based on lung exposure determined through prorating the average dose from the production group.

Individuals with lung count results above the detection criteria are assigned an individual dose and this dose is not included in the group average. Dose from lung counting is assigned annually as part of their annual dose report. Individuals with a lung burden above the detection criteria are informed of their assigned dose as soon as possible after completion of all required lung counts. The action level for dose due to lung burden has been set at 5 mSv/year.

4.7.10 Contamination Control

CFM maintains zone control and monitoring programs as described in CFM-RP to identify areas of potential contamination and prevent the spread of radioactive contamination from these areas. The site has been divided into four control zones (1-4) and the possibility of contamination increases with increasing zone numbers. The effectiveness of the facility zone control program is assessed through floor contamination surveys, swipe sampling and monitoring of worker hands and feet.

4.7.11 Monitoring at the Point of Final Exit

In order to prevent possible contamination of the surrounding environment with radioactive material, materials are monitored prior to being removed from the pelleting area. Items such as contractor equipment leaving the licensed portion of the site are monitored prior to being removed from site.

All vehicles entering the plant are checked in and out by trained security guards. The guards are trained in the use of radiation monitoring equipment.

Portal monitors are installed at the front entrance of CFM. All workers, contractors and visitors are required to use them prior to exiting the facility.

4.7.12 Radioisotope Control

The facility uses a number of radioisotopes that are regulated under the CNSC *Nuclear Substances and Radiation Devices Regulation*. CFM maintains a record of the specific radioisotope sources on site that are present above an exemption quantity, the radioisotope used, and the maximum activity of the device as described in HSI-048. These sources are typically used as calibration sources and are classified as category 4/5 low risk radioisotopes.

4.7.13 Nuclear Criticality Control

The Nuclear Criticality Safety Program Manual (CFM-NC) has been developed to guide the generation and implementation of CFM's criticality prevention practices as they pertain to licensing and criticality prevention issues. This document is structured to meet the requirements of REGDOC 2.4.3 Nuclear Criticality Safety.

Where practicable, the design of processing facilities and equipment handling enriched material includes geometric limitations to prevent a criticality accident. A key limitation to prevent a criticality accident is the present limit on the mass of enriched nuclear materials permitted on site at any one time. CFM-NC applies to all CFM equipment and operations that are licensed by the CNSC with respect to the handling of fissile materials.

The manual has been designed into two main categories depending on the potential risk associated with enriched uranium dioxide and criticality. These categories are as follows:

- Partial Scope – this category addresses the issues with handling enriched uranium material with an on-site possession of less than 0.8 smallest critical masses (SCM).
- Full Scope – this category addresses the issues with handling enriched uranium material with an on-site possession of greater than and equal to 0.8 SCMs. This category ensures that the operations with enriched uranium materials such that the upper sub critical limits established in the Nuclear Criticality Safety Program Manual will not be exceeded under both normal and credible abnormal conditions.

4.8 Conventional Health and Safety

This SCA 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. A program of this nature has been in place for many years at CFM. The foundation of the program is based on the NSCA and its regulations as well as Part II of the *Canada Labour Code*.

4.8.1 Safety and Health Program

The safety and health management program fosters and promotes a strong sustainable safety culture with a safe, healthy and rewarding workplace. There are five key principles that form the framework of how safety is managed. These are:

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

The health and safety of workers at CFM is ensured through the Safety and Health Program, CFM-SH, which meets the requirements of REGDOC-2.8.1 *Conventional Health and Safety*. Key components of the program include:

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

4.8.2 Hazards

CFM is a Class IB nuclear facility. There are radiological hazards associated with the uranium processed at the facility. Chemicals at site include bulk hydrogen as well as smaller quantities of laboratory chemical, water treatment chemicals and materials used for maintenance activities.

There are also a variety of physical hazards that are monitored and controlled at the site such as heat, lighting, noise, vibration, traffic and extreme weather.

4.8.3 Work Controls

All site personnel have a general awareness of the occupational health and safety hazards that exist at the site and the various means of minimizing these risks. All groups attend regular department safety meetings where workers are encouraged to discuss safety issues or concerns. Safety awareness, training and re-training are completed through in-class sessions, safety meetings, and computer-based training depending on the topic.

Hazardous materials are labeled or identified to meet applicable regulations. The proper identification of hazardous materials decreases the likelihood of improper use, handling and disposal, which reduces potential risks and negative consequences.

Work instructions, procedures, and job hazard analysis (JHA) are some of the tools used to identify and control hazards in the workplace.

Personal Protective Equipment (PPE) is provided as necessary and is specified in the work instruction or JHA for the job. All PPE is approved to ensure that the correct PPE is available for each job. Respiratory protection with appropriate respirator cartridges are available for tasks where inhalation of uranium, chemicals and/or dust is possible above specified exposure limits. CFM's use of respiratory protection meets the requirements of CSA Z94.4-11 *Selection, use and care of respirators*.

Personal and area monitoring is performed to assess workplace exposures. These include in-plant uranium in air levels, and urine analysis program for uranium. Monitoring for other parameters (e.g., asbestos, lead in paint, heat, lighting) is performed on an "as needed" basis.

4.8.4 Health and Safety Committee

CFM has a Joint Health and Safety Committee (JHSC) that is implemented and maintained in accordance with the legal requirements outlined under Part II of the *Canada Labour Code*.

The intent of the committee is to provide a forum whereby worker and management representatives can come together on a regular basis to identify and resolve health and safety concerns and to work together on preventative-type actions that will improve overall health and safety in the workplace.

4.9 Environmental Protection

CFM is required to have in place a program that identifies, controls and monitors all releases of radioactive and hazardous substances from the facility.

4.9.1 Environmental Protection Program

CFM maintains an EPP that meets the requirements of CNSC REGDOC-2.9.1: *Environmental Protection: Environmental Principles, Assessments and Protection Measures (Version 1.1)*, as well as the following CSA environmental standards:

- CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*
- CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*

- CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.8, *Establishing and implementing action levels for releases to the environment from nuclear facilities.*

The FSD Environmental Management System, FSD-PGR-EMS-001 (EMS) describes the higher tier program elements that meet the requirements of the ISO 14001 standard and applicable CSA N288 series standards. CFM's EPP, CFM-EP describes site-specific aspects associated with the environmental sampling that is carried out in support of the EMS and the Environmental Risk Assessment (ERA). This monitoring data is then compared to applicable action levels and limits to ensure operations remain in compliance with applicable regulations and licence limits.

4.9.2 Environment Risk Assessment

CFM maintains an ERA in accordance with the requirements of CSA N286.6: *Environment Risk Assessments at Class 1 Nuclear Facilities and Uranium Mines and Mills*. The 2016 ERA found there were no undue risks to the environment or to human health as a result of CFM operations. In accordance with N288.6-12, a review of the ERA* was completed in 2021 to identify and assess any risks that might have emerged since the last ERA review and to address areas for follow-up identified in the previous review. The 2021 review concluded there were no new environmental risks and that there were no changes identified which required a full update of the ERA. The 2016 ERA and 2021 ERA review were revisited within the context of an increase in emissions of 25% resulting from the additional operating days that would be required to achieve the requested production increase. The extrapolated increase in air and sanitary sewer emissions would not impact the conclusions of either the 2016 ERA or the 2021 ERA review**.

A summary and a redacted version of the 2016 ERA, as well as the 2021 ERA review are available on the FSD community website.

* CFM letter – Review of Environmental Risk Assessment for Cameco Fuel Manufacturing. May 11, 2021

** CFM letter - Justification for Licence Term and Production Increase. October 4, 2021

4.9.3 Environmental Regulation

Airborne and liquid effluent discharge quality is defined and regulated by federal and provincial regulators. For CFM, the main federal regulatory agencies are the CNSC and ECCC. Provincial regulation is by the Ontario MECP. The acts (and associated regulations) enforced by these agencies include the *NSCA, Canadian Environmental Protection Act, 1999, Fisheries Act, Ontario Water Resources Act* and the *Environmental Protection Act*. CFM must also comply with applicable municipal bylaws.

CFM currently maintains the following approvals from the MECP:

- Permit to Take Water (PTTW) for groundwater takings
- Environmental Compliance Approval (ECA) – air

4.9.4 Airborne Emission Program

The primary air emissions associated with CFM operations is uranium. These contaminant emissions are measured using source monitoring and/or estimated using emission calculations based on emission rates established in the Emission Summary and Dispersion Modelling Report (ESDM).

Source Monitoring

CFM's facility is designed with discrete discharge points along the production line and from building ventilation. The airborne effluent monitoring program therefore is designed so that each stack in the production line is monitored when that area of the plant is operating. The details of this program are provided in CFM-EP.

Air emissions are also regulated by the MECP under O. Reg. 419/05 *Air Pollution - Local Air Quality*. Site air emissions are documented and compared against point of impingement standards in the site ESDM. The ESDM predicts contaminant concentrations from the facility at the facility fence line and into the community using a developed worst-case emission scenario and an air dispersion model that meets the requirements of O. Reg. 419/05. CFM updates the ESDM report as required to reflect the most recent air emissions data.

Ambient Monitoring

In support of the source sampling program, an ambient air sampling program has been established to measure the concentration of uranium in the air in the vicinity of the facility. Four high-volume (hi-vol) sampling stations are located inside the perimeter fence line.

The hi-vol method involves drawing a large volume of air through a filter housing for a fixed period of time. Particulate is collected on a filter and analyzed for uranium. The provincial Point of Impingement (POI) standard ($0.03 \mu\text{g}/\text{m}^3$ uranium PM^{10} – annual POI) is used as criteria to assess performance.

4.9.5 Liquid Emission Program

The waterborne effluent from the CFM facility is discharged to the MPH sanitary sewer system and is monitored in accordance with operating licence requirements. Automatic, composite sampling based on an equal volume/time sampling methodology is used to collect representative samples of the combined discharges to the sanitary sewer from the uranium processing portion of the facility and the groundwater treatment system. An additional output to the sanitary sewer from non-production areas exits on the west side of the facility. The groundwater treatment system inlet and outlet are also sampled twice annually for uranium and VOCs.

CFM maintains a groundwater treatment system to address a legacy trichloroethylene (TCE) issue related to an underground tank in use prior to 1999. The system consists of a

groundwater collection network and an above-ground treatment system. Groundwater collection is regulated under a Permit to Take Water (PTTW) from the MECP.

Groundwater sampling and groundwater level monitoring is completed semi-annually at numerous monitoring wells and pumping wells within the licensed and unlicensed portions of the CFM property. Semi-annual groundwater sampling and groundwater level monitoring is also completed at monitoring wells on adjacent properties bordering Peter Street. A comprehensive review of the groundwater monitoring is completed and submitted to the CNSC and MECP annually. Enhancements were made to the groundwater program in 2021* to align with the requirements of CSA N288.7-15.

The aquatic environmental monitoring program is intended to collect data to monitor stormwater discharges to municipal infrastructure and the Gages Creek tributary, in addition to monitoring surface water quality within the Gages Creek tributary. An environmental consultant collects ambient water samples three times per year from up to nine sampling points beyond the licensed facility.

*CFM letter – Cameco Fuel Manufacturing Groundwater Protection Program and Groundwater Monitoring Program Summary Report – September 30, 2021

4.9.6 Terrestrial Monitoring Program

The terrestrial environmental monitoring program is intended to collect data for uranium (as an indicator of all emissions) to assess whether airborne effluent emissions from the CFM are accumulating in soil.

Other parameters potentially impacting the terrestrial environment from CFM operations are noise and gamma radiation.

Soil Monitoring

In order to support the periodic review of the ERA, CFM collects soil samples at 23 monitoring locations on a periodic basis at least every 3 years. Half of the sample locations are within the CFM fenceline and the remainder are in close proximity to the facility. FSD has committed to develop a new soil monitoring program within the Municipality of Port Hope that will be used to support the periodic review of the ERAs for PHCF and CFM following the clean-up of the municipality by the Port Hope Area Initiative (PHAI).

Gamma Monitoring

Gamma radiation emissions from the licensed sites can cause radioactive dose to members of the public via external gamma radiation exposure. Fenceline gamma measurements are performed around the facility each month using optically stimulated luminescence dosimeters (OSLDs).

Noise

The facility's ECA (Air and Noise) issued by the MECP requires that CFM maintain compliance with Noise Pollution Control (NPC) guidelines, NPC 300 Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning. Accordingly, CFM has an Acoustic Assessment Report (AAR) that demonstrates that these regulatory requirements are satisfied and is reviewed as required to verify compliance with current MECP MPC guidelines.

4.9.7 Estimated Dose to the Public

The Derived Release Limit (DRL) for a given radionuclide is defined as the release rate that would cause an individual of the most highly exposed group to receive and be committed to a dose equal to the regulatory annual dose limit of 1 mSv. As part of the periodic review of the DRL, the most exposed receptor locations for each receptor activity are determined to identify the critical receptor. A person located at this receptor, given their proximity to the facility and the theoretical length of time that could be spent at this location, would be expected to receive the highest possible radiation dose that any member of the public could receive.

The DRL for CFM was revised in 2021 and is based on three components: dose to the public from air emissions; water discharges; and, gamma radiation. For CFM, dose to the public from air and water emissions constitutes a very small fraction of the public dose limit and the gamma component represents virtually all the estimated public dose. The critical receptor is an infant who resides in a nearby end-of-life care facility and is represented by the environmental dosimeter 12, located on the north fence line. The dose at this receptor location is used in the calculation of dose to the public. This is a change from the previous DRL and will represent a more conservative estimated dose to the public.

4.9.8 Setting of Authorized Release Limits for Effluent Discharges

Release limits for radionuclides were previously established based upon the DRL for the facility. As part of the one-year licence renewal, new limits were developed using Exposure-Based Release Limit (EBRL) methodology. EBRLs are concentration-based release limits that are based on meeting endpoint parameters which consider radiotoxicity, chemical toxicity, and protection of aquatic life.

The environmental release limits for this licence period* are shown in Table 5 and Table 6.

*CFM letter – Proposed Release Limits for Cameco Fuel Manufacturing – April 9, 2021

Table 5 Release Limit - Air Discharge

Source	Parameter	Averaging Period	Limit	Applicable Licence
Site-wide Uranium Discharge	Uranium	Annual	10.5 kg U/yr	FFL – 3641.0/2023
Process stacks and building ventilation emission points	Uranium	Annual	1.2 g U/hr	Current Application

*Note that 10.5 kgU/yr is equivalent to 1.2 g U/hr. Upgrades to monitoring equipment and calculations in 2021 and 2022 will enable reporting in units of gU/hr in 2023.

Table 6 Release Limit – Liquid Discharges

Parameter	Frequency	EBRL
Uranium	Twice Weekly Composite Discharge	1.7 mg U/L

4.9.9 Setting of Action Levels

As per CSA N288.8-17 *Establishing and implementing action levels for release to the environment from nuclear facilities*, action levels are considered for the releases of contaminants or physical stressors, which are measured at the final discharge point as part of an effluent monitoring program or estimated using upstream measurements. For CFM, action levels are emission rates (for air) or a concentration (for water) that when reached, might indicate a loss of control of part of the environmental protection program and will require specific action to be taken.

In 2017, CFM established action levels following the guidance of N288.8-17 which were accepted by CNSC staff. In support of licence renewal activities, a review of these action levels was completed in 2021* to ensure they remained appropriate for CFM. The environmental action levels for the facility are shown in Tables 7, 8 and 9.

*CFM letter – Review of Environmental Action Levels for Cameco Fuel Manufacturing. April 30, 2021.

Table 7 Action Levels for Airborne Emissions

Release Source	Substance	Action Level	Frequency and Averaging Period
Stack Emissions	Uranium	2 µg/m ³	Daily 24 hours
PP2 Area Building Ventilation	Uranium	0.5 g/h	Daily 24 hours
Pelleting Area Building Ventilation	Uranium	1 g/h	Daily 24 hours

Table 8 Action Levels for Liquid Emissions

Release Source	Substance	Action Level	Frequency and Averaging Period
Liquid Effluent	Uranium	0.1 mg/L	Twice weekly composite

Table 9 Action Levels for Gamma Emissions

Parameter	Action Level	Frequency
Fenceline Gamma (New Critical Receptor – Location 12)	1.0 µSv/h	Quarterly
Fenceline Gamma (Old Critical Receptor Location 1)	0.2 µSv/h	Quarterly
Fenceline Gamma (Location 2)	0.2 µSv/h	Quarterly
Fenceline Gamma (All other locations)	1.0 µSv/h	Quarterly

4.9.10 Reporting of Environmental Information

CFM makes information related to the environment and the public available through a variety of methods. Quarterly and annual compliance reports that are submitted to the CNSC are posted to the community website, and a record of spills and other events that may be of interest to the public is also maintained on the website. CFM also provides its Quarterly Compliance Monitoring and Operational Performance Report and Annual

Compliance Report to interested parties as described in section 3.6. Additional updates are provided to the Municipality when needed.

4.10 Emergency Management and Fire Protection

CFM is required to maintain an emergency preparedness plan and a fire protection program to ensure that licensed activities do not result in an unreasonable risk to the health and safety of persons and the environment.

4.10.1 Emergency Response Plan

The CFM Emergency Response Plan (ERP), MSP 30-02 is compliant with the requirements of REGDOC 2.10.1: *Nuclear Emergency Preparedness and Response*.

4.10.2 Emergency Preparedness and Response Organizations

Depending on type and magnitude of an incident, the site may activate any or all of the following response organizations for the protection of human health, the environment and property: Immediate Responders, Emergency Response Organization (ERO), Local Crisis Management Team, and Corporate Crisis Management Team. Each of these organizations has a manual and/or procedures or guidance documents to ensure that the organizational response to an emergency situation is systematic and meets the regulatory requirements commensurate with the nature of the emergency.

4.10.3 Emergency Response Assistance Plan

An Emergency Response Assistance Plan is on file with Transport Canada. This plan has been approved by Transport Canada, pursuant to federal transportation of dangerous goods requirements, and applies to transportation emergencies. Transportation activities related to the shipping and receiving of goods at or from CFM are included in the plan. CFM reviews and updates the Emergency Response Assistance Plan as required.

4.10.4 Fire Protection Program

The Fire Protection Program (FPP), MSP 30-07 has been developed and implemented to comply with the requirements of the National Fire Code, National Building Code, and with CSA N393-13: *Fire Protection for facilities that process, handle, or store nuclear substances* (CSA N393-13).

The FPP consists of the following main elements: the Fire Hazard Analysis (FHA), the Fire Safety Plan (FSP), MSP 30-03, Pre-incident Plans and related fire safety procedures. These documents are reviewed and updated on a periodic basis by qualified personnel, as required.

Routine inspections and testing of the fire protection system are conducted by or under the direction of CFM personnel. A system is in place to enable detection and notification of

fire. Emergency pull stations are located strategically throughout the facility. Areas with potential fire hazards are equipped with appropriate fire detection and/or suppression systems. Fire safety equipment is maintained with the use of preventive maintenance and periodic inspections.

4.10.5 Fire Hazards Analysis

CFM's FHA meets the requirements of CSA N393-13 and supporting reference materials. The FHA evaluates the impact of fire on the facility and demonstrates that the fire protection objectives can be met under foreseeable fire events. To satisfy this objective, safety significant systems and equipment as well as fire hazards have been identified. An analysis has been made of the potential for a worst-case fire event to impact safety related systems and equipment.

4.10.6 Fire Safety Plan

The FSP is a key element of the site Fire Protection Plan and is intended to be a companion document to the site FHA. While the objective of the FHA of the site buildings is to identify fire hazards and fire protection features intended to meet nuclear and life safety requirements, the objective of the FSP is to define the administrative controls required to maintain fire safe conditions and help the occupants in utilizing life safety features in the buildings, ensure an orderly evacuation at the time of an emergency and provide a maximum degree of flexibility to achieve the necessary fire safety for the buildings. fire safety features required by the FHA.

The following controls are documented in the FSP:

- Fire protection systems;
- Inspection, testing and maintenance program;
- Impairments;
- Fire separations;
- Emergency response plan;
- Emergency organization; and,
- Pre-incident plans.

4.10.7 Emergency or Fire Recovery Plan

The emergency recovery plan will depend on the nature of the emergency situation, i.e., whether the emergency is local (within the plant), external (off-site) or a transportation event. Depending on the situation, the recovery plan may require regulatory review and approval. Recovery plans would be developed to minimize the impact to personnel involved in the clean-up, the environment and the general public. Guidance on what is to be included in a recovery plan is provided in the ERP.

4.11 Waste Management

CFM is required to maintain a waste management program at the facility which covers the internal waste-related programs which form part of the facility's operations up to the point where the waste is removed from the facility. It also covers the planning for decommissioning.

4.11.1 Waste Management Program

The waste management program for CFM is described in the FSD Waste Management Program, FSD-PGR-WM-01, and site Waste Management Program, CFM-EP-02. The program meets the requirements for management of radioactive waste in solid, liquid or gaseous states as defined by CSA Standard N292.3-14 *Management of low- and intermediate-level radioactive waste*, CSA Standard N292.0-14 *General principles for the management of radioactive waste and irradiated fuel* and for hazardous waste as defined by Ontario Regulation 347 General – *Waste Management*.

The waste management activities are conducted with the following objectives:

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

4.11.2 Current CFM Waste Streams

Recoverable Uranium Materials

CFM sends natural uranium scrap material to the BRR for recovery of the uranium. This prevents these materials from becoming waste. Depleted scrap material is transferred to PHCF for consolidation of the depleted uranium inventory within FSD. Enriched scrap material is maintained onsite pending transfer to an appropriate receiving facility.

Conventional Waste

CFM also has processes in place for the collection, storage and disposal of non-contaminated, non-hazardous waste materials such as cardboards, plastics, clean chemical drums and lunchroom refuse. Materials that are sent to conventional landfill or recycling are scanned to ensure they are free of uranium contamination prior to release from the facility.

Contaminated Waste Materials (Radioactive Waste)

Waste materials contaminated with uranium are stored onsite until appropriately managed.

Contaminated combustible waste materials are sent to BRR for incineration.

Drums containing contaminated solid material are stored in designated areas, pending disposal at an appropriately licensed facility in the United States or decontamination of the material for recycle.

Contaminated equipment and other items are stored in trailers pending further processing prior to uranium recovery and/or disposal at an appropriately permitted facility.

All waste materials remain in safe, secure storage until acceptable permanent disposal or recycle options have been identified.

Hazardous Waste Materials

Non-contaminated hazardous waste materials are managed and disposed of in accordance with the requirements under the provincial waste management regulation, O. Reg. 347. CFM maintains a Generator Registration Number for a small number of hazardous waste classes that are registered through the MECP Hazardous Waste Information Network (HWIN). Wherever possible, some hazardous wastes are sent to recyclers for recycling rather than disposal (i.e. fluorescent light tubes, batteries, etc.).

Miscellaneous Contaminated Wastes

Miscellaneous radioactive contaminated wastes that do not have a current processing strategy or disposal outlet will be stored onsite in a safe manner. Radioactive waste that is also hazardous must be disposed of at a facility permitted for both the radioactive and chemical hazards. Any waste materials that are not managed by one of the programs listed will require the development of a specialized plan for disposal or management following the requirements of the FSD Waste Management Program (FSD-PGR-WM-01) and associated documents.

4.11.3 Preliminary Decommissioning Plan

CFM has a Preliminary Decommissioning Plan (PDP)*, which meets the requirements provided in CSA N294.0-14 *Decommissioning of facilities containing nuclear substances*. The PDP outlines the general requirements for returning the site to the status of unrestricted use and outlines the controls required for the protection of the environment during the decommissioning process. The PDP forms the basis for the financial guarantee as per CNSC regulatory document G-206 *Financial Guarantee for the Decommissioning of Licensed Activities* discussed in section 2.5. A technical summary of the PDP is available on FSD's community website.

* CFM letter Cameco Fuel Manufacturing Inc Preliminary Decommissioning Plan, May 4, 2021

4.12 Security

CFM maintains a security program to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information.

4.12.1 Security Plan

CFM's Physical Security Plan, MSP 30-01 presents an overview of the security operations at CFM and identifies the systems and processes in place to meet security program objectives. MSP 30-01 meets the requirements of REGDOC-2.12.3 *Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2*. Accordingly, this document is considered prescribed information and is subject to the requirements of the GNSCR. The objective of the security plan is to ensure safe and secure operation of the facility, by maintaining protection through use of equipment, personnel, and procedures. The CFM Security Plan has continued to evolve in order to meet all regulatory requirements and commitments over the period of the current operating licence.

4.13 Safeguards and Non-Proliferation

CFM is required to have a program in place that ensures all obligations arising from the Canada/International Atomic Energy Agency (IAEA) Safeguards agreement are met. The objective of the Canada-IAEA safeguards agreements is for the IAEA to provide assurance on an annual basis to Canada and to the international community that all declared nuclear materials are in peaceful, non-explosive uses and that there is no indication of undeclared nuclear materials or activities.

4.13.1 International Obligations

CFM complies with the obligations arising from the Canada/International Atomic Energy Agency (IAEA) safeguards agreements, as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons*. Safeguards involves inspection and other verification activities undertaken by the IAEA to evaluate compliance with obligations under safeguards agreements with the IAEA.

4.13.2 Inventory and Reporting

CFM complies with REGDOC 2.13.1 *Safeguards and Nuclear Material Accountancy* as described in FSD Safeguards Program (FSD-PGR-SG-01). The facility maintains a natural uranium inventory system in which receipts and shipments are recorded. Monthly inventory reports are distributed to the CNSC that include safeguarded natural uranium as well as the inventory of non-safeguarded material.

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

4.14 Handling, Storing, Packaging and Transport

CFM is required to have a packaging and transport program that meets the requirements set out in the *Packaging and Transport of Nuclear Substances Regulations, 2015* and the *Transportation of Dangerous Goods Regulations*.

4.14.1 Packaging and Transport Program

As described in the FSD Packaging and Transportation Program (FSD-PGR-TRN-001), Corporate standards and site procedures cover the safe packaging and transport of nuclear substances to and from licensed facilities. All radioactive materials are transported in a package designed for its' contents. The contents, isotopic level and physical/chemical properties will determine the type of package.

The site has procedures related to the handling, storing, loading, transporting and receipt of nuclear substances and other dangerous goods. Workers are trained in the safe handling, packaging and shipping of dangerous goods commensurate with their responsibilities.

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

Other materials such as laboratory samples, other uranium-containing materials, and wastes (conventional, hazardous, radioactive or mixed) are packaged and safety marks applied in accordance with the appropriate regulations.

Appendix A – Standards and Guidance Relevant to the Safety and Control Areas

This appendix lists the REGDOCs, standards and other regulatory documents listed in the LCH for the facility. Compliance Verification Criteria (CVC) imply implementation of the requirements of the document as they are used by CNSC staff to verify and oversee CFM’s compliance with the licence conditions. Guidance is non-mandatory information on how CFM may comply with the licence conditions. New revisions to existing CVC or guidance documents or new REGDOCs or standards may be added throughout the term of the licence in accordance with the CNSC regulatory framework.

SCA	Document Title	Document Reference	CVC or Guidance	Status
General	Regulatory Fundamentals	REGDOC-3.5.3 (2018)	Guidance	N/A
Management System	Management System Requirements for Nuclear Facilities	CSA N286-12 (R2017)	CVC	Implemented
	Management System	REGDOC-2.1.1 (2019)	Guidance	N/A
	Commentary on N286-12, Management systems requirements for nuclear facilities	CSA N286.0.1 (2014)	Guidance	N/A
	Safety Culture	REGDOC-2.1.2 (2018)	CVC	June 1, 2022*
	Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	REGDOC-3.1.2 (2018)	CVC	Implemented
	Public Information and Disclosure	REGDOC-3.2.1 (2018)	CVC	Implemented
Human Performance Management	Personnel Training, Version 2	REGDOC-2.2.2 (2016)	CVC	Implemented
	Minimum Staff Complement	REGDOC-2.2.5 (2019)	Guidance	N/A

SCA	Document Title	Document Reference	CVC or Guidance	Status
Operating Performance	Boiler, pressure vessel, and pressure piping code	B51-2014	CVC	B51-2014 Implemented B51-2019 December 31, 2021
Safety Analysis	Safety of Nuclear Fuel Cycle Facilities	IAEA SSR-4 (2017)	Guidance	N/A
	Nuclear Criticality Safety	REGDOC-2.4.3 (2019)	CVC	Implemented
Physical Design	National Building Code of Canada 2015	NRCC 56190	CVC	Implemented
	National Fire Code of Canada 2015	NRCC 56192	CVC	Implemented
	Fire Protection for Facilities that Process, Handle or Store Nuclear Substances	CSA N393-13 (R2018)	CVC	Implemented
	General Design Considerations: Human Factors	REGDOC-2.5.1 (2019)	Guidance	N/A
Fitness for Service	National Fire Code of Canada 2015	NRCC 56192	CVC	Implemented
	Fire Protection for Facilities that Process, Handle or Store Nuclear Substances	CSA N393-13 (R2018)	CVC	Implemented
Radiation Protection	Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	REGDOC-3.1.2 (2018)	CVC	Implemented
	Keeping Radiation Exposures and Doses “As Low As Reasonably Achievable (ALARA)”	CNSC G-129 Rev 1 (2004)	Guidance	N/A
	Developing and Using Action Levels	CNSC G-228 (2001)	Guidance	N/A
	Selection, use and care of respirators	CSA Z94.4-18	CVC	Implemented

SCA	Document Title	Document Reference	CVC or Guidance	Status
Conventional Health and Safety	Conventional Health and Safety	REGDOC-2.8.1 (2019)	Guidance	N/A
Environmental Protection	Environmental Protection Policies, Programs and Procedures	CNSC REGDOC 2.9.1 (2020)	CVC	Implemented
	Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	REGDOC-3.1.2 (2018)	CVC	Implemented
	Guidelines for Calculating Derived Release Limits for Radioactive Material in Airborne and Liquid Effluents for Normal Operation of Nuclear Facilities	CSA N288.1-14 (2014)	CVC	Implemented
	Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills	CSA N288.4-10 (R2015)	CVC	Implemented
	Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills	CSA N288.5-11 (R2016)	CVC	Implemented
	Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills	CSA N288.6-12 (R2017)	CVC	Implemented
	Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills	CSA N288.7-15 (2015)	CVC	Implemented
	Establishing and implementing action levels for releases to the environment from nuclear facilities	CSA N288.8-17 (2017)	CVC	Implemented
Emergency Management and Fire Protection	Nuclear Emergency Preparedness and Response	REGDOC 2.10.1 (2016)	CVC	Implemented
	National Building Code of Canada 2015	NRCC 56190	CVC	Implemented

SCA	Document Title	Document Reference	CVC or Guidance	Status
	National Fire Code of Canada 2015	NRCC 56192	CVC	Implemented
	Fire Protection for Facilities that Process, Handle or Store Nuclear Substances	CSA N393-13 (R2018)	CVC	Implemented
Waste Management	General Principles for the Management of Radioactive Waste and Irradiated Fuel	CSA N292.0-14 (2014)	CVC	Implemented
	Management of Low- and Intermediate –level Radioactive Waste	CSA N292.3-14 (2014)	CVC	Implemented
	Managing Radioactive Waste	CNSC P-290 (2004)	Guidance	N/A
	Decommissioning of Facilities Containing Nuclear Substances	CSA N294-19 (R2019)	CVC	Implemented
	Decommissioning Planning for Licensed Activities	CNSC G-219 (2000)	Guidance	N/A
	Financial Guarantees Guide for the Decommissioning of Licensed Activities	CNSC G-206 (2000)	Guidance	N/A
Security	Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2	REGDOC-2.12.3 (2020 v2.1)	CVC	Implemented
Safeguards and Non-Proliferation	Safeguards and Nuclear Material Accountancy	REGDOC-2.13.1 (2018)	CVC	Implemented
Packaging and Transport	Information Incorporated by Reference in Canada’s Packaging and Transport of Nuclear Substances Regulations, 2015	REGDOC-2.14.1 (2016)	Guidance	N/A

SCA	Document Title	Document Reference	CVC or Guidance	Status
Facility Specific – Financial Guarantee	Financial Guarantee for the Decommissioning of Licensed Activities	CNSC G-206 (2000)	Guidance	N/A

Appendix B – Documents Supporting the Licence Application

CFM has identified the following documents to be relevant to supporting this application for the renewal of its Fuel Facility Operating Licence (FFOL-3632.0/2022)

Document Title	Document Type	Available on Website
Safety, Health, Environment and Quality Policy	Corporate Policy	Yes
Facility Licensing Manual (CFM-FLM)	Site Program	Yes
Management System Program Manual (CFM-MS)	Site Program	Description in FLM
Systematic Approach to Training Program (CFM-HR-01)	Site Program	Description in FLM
Radiation Protection Program (CFM-RP)	Site Program	Description in FLM
Environmental Protection Program (CFM-EP)	Site Program	Description in FLM
Nuclear Criticality Safety Program Manual (NCSPM)	Site Program	Description in FLM
Safety and Health Program (CFM-SH)	Site Program	Description in FLM
Fire Protection Program (MSP 30-07)	Site Program	Description in FLM
CFM Waste Management Program (CFM-EP-02)	Site Program	Description in FLM
Internal Dosimetry Technical Basis Document (TBD)	Divisional Program	No
Public Information Program (FSD-PGR-PIP-001)	Divisional Program	Summary available
FSD Environmental Management System (FSD-PGR-EMS-001)	Divisional Program	No
FSD Waste Management Program (FSD-PGR-WM-01)	Divisional Program	Summary available
FSD Safeguards Program (FSD-PGR-SG-01)	Divisional Program	No
FSD Packaging and Transportation (FSD-PGR-TRN-01)	Divisional Program	No
Facility Licensed Area Drawing, 05C144	Site Drawing	A public version (20C007) with confidential information removed is available in the FLM as Figure 3
Site Map Property Layout 00A084	Site Drawing	Available in in FLM as Figure 2



Document Title	Document Type	Available on Website
Radioisotope Source Control (HSI-048)	Site Procedure	No
Change Control (MSP 13-02)	Site Procedure	No
Preventative Maintenance Execution Management (AP 018)	Site Procedure	No
Pressure Retaining Components (MSP 27-16)	Site Procedure	No
Authorized Inspection Agency Services Agreement	Procurement Document	No
Security Plan (MSP 30-01)	Site Plan	No
Emergency Preparedness Plan and Response Procedure (MSP 30-02)	Site Plan	No
Fire Safety Plan (MSP 30-03)	Site Plan	No
Environmental Aspects Registry	Site Plan	No
Safety Analysis Report (SAR)	Supporting Study	Summary Available
Derived Release Limit (DRL)	Supporting Study	Summary Available
Fire Hazard Analysis (FHA)	Supporting Study	No
2016 Environmental Risk Assessment (ERA)	Supporting Study	Yes
Review of Environmental Risk Assessment for Cameco Fuel Manufacturing	Supporting Study	Yes
Review of Environmental Action Levels to Support the Environmental Protection Program	Supporting Study	No
Preliminary Decommissioning Plan (PDP)	Supporting Study	Summary Available

Appendix C - List of Acronyms Used in the Application

AIA	Authorized Inspection Agency
ALARA	As low as reasonably achievable
BRR	Blind River Refinery
Cameco	Cameco Corporation
CFM	Cameco Fuel Manufacturing Inc.
CIRS	Cameco Incident Reporting System
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CVC	Compliance Verification Criteria
DRL	Derived Release Limit
ECCC	Environment and Climate Change Canada
ECA	Environmental Compliance Approval
EMS	Environmental Management System
EPP	Environmental Protection Program
ERA	Environmental Risk Assessment
ERO	Emergency Response Organization
ERP	Emergency Response Plan
ESDC	Department of Employment and Social Development Canada
ESDM	Emission Summary and Dispersion Model
FFL	Fuel Facility Licence
FFOL	Fuel Facility Operating Licence
FHA	Fire Hazards Analysis
FLM	Facility Licensing Manual
FPP	Fire Prevention Program
FSD	Fuel Services Division
FSP	Fire Safety Plan
GNSCR	<i>General Nuclear Safety and Control Regulations</i>
Hi-vol	High volume (air monitor)
IAEA	International Atomic Energy Agency
JHSC	Joint Health and Safety Committee
JHA	Job Hazard Analysis
LCH	Licence Conditions Handbook
MECP	Ministry of the Environment, Conservation and Parks
MOL	Ontario Ministry of Labour
mSv	Millisievert

NEW	Nuclear Energy Worker
NSCA	<i>Nuclear Safety and Control Act</i>
NSRDR	<i>Nuclear Substance and Radiation Devices Regulations</i>
O. Reg.	Ontario Regulation
OSL	Optically stimulated luminescence
PDP	Preliminary Decommissioning Plan
PHCF	Port Hope Conversion Facility
PIP	Public Information Program
PIT	Physical Inventory Taking
PIV	Physical Inventory Verification
PPE	Personal Protective Equipment
PTTW	Permit to Take Water
REGDOC	CNSC regulatory document
SAT	Systematic Approach to Training
SCA	Safety and Control Area
SHEQ	Safety, Health, Environment and Quality
SNRI	Short Notice Random Inspection
SAR	Safety Analysis Report
TBD	Technical Basis Document
TED	Total Effective Dose
TSSA	Ontario Technical Standards and Safety Authority
UO ₂	Uranium dioxide
µg	microgram

Appendix D – Licence Renewal Application Requirements Matrix

Pursuant to subsection 3 of the General Nuclear Safety and Control Regulations Licences – General Application Requirements

Section 3. the <i>General Nuclear Safety and Control Regulations</i> Licences – General Application Requirements (1) An application for a licence shall contain the following information:	Location in Application or Supporting Document(s)
(a) the applicant’s name and business address;	Sections 1.1 , 1.2 and 1.3
(b) the activity to be licensed and its purpose;	Sections 1.3 and 2.3 Facility Licensing Manual
(c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence;	Sections 1.3 , and 2.3
(d) a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence;	Sections 1.3 , 2.2 and 2.3
(e) the proposed measures to ensure compliance with the Radiation Protection Regulations, the Nuclear Security Regulations and the Packaging and Transport of Nuclear Substances Regulations, 2015;	Documents referenced in Appendix B FLM, CFM-RP, MSP 30-01, FSD-PGR-TRN-001
(f) any proposed action level for the purpose of section 6 of the Radiation Protection Regulations;	Sections 4.7.6 , 4.7.8 , 4.7.9
(g) the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information;	Sections 4.7 and 4.12 FLM, CFM-RP, MSP 30-01
(h) the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information;	Section 4.12 MSP 30-01
(i) a description and the results of any test, analysis or calculation performed to substantiate the information included in the application;	Sections 4.4 , 4.7 , 4.9 and 4.11 FLM, DRL, ERA, SAR
(j) the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed or disposed of at the site of	Sections 4.4 and 4.11 FLM, SAR, FSD-PGR-WM-01, CFM-EP-02

the activity to be licensed, and the proposed method for managing and disposing of that waste;	
(k) the applicant’s organizational management structure insofar as it may bear on the applicant’s compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority;	Sections 2.1 and 4.1.1 Supporting Documents – FLM CFM letter. Persons Having Authority to Act for CFM in Dealings with the CNSC. April 17, 2020
(l) a description of any proposed financial guarantee relating to the activity to be licensed; and	Sections 2.5 and 4.11.3 PDP
(m) any other information required by the Act or the regulations made under the Act for the activity to be licensed and the nuclear substance, nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.	All relevant information is contained within the application, the FLM and supporting documents referenced in Appendix B.

Pursuant to subsection 3(1.1) of the General Nuclear Safety and Control Regulations and Other Information Requested by CNSC Staff

Subsection 3(1.1)¹ of the <i>General Nuclear Safety and Control Regulations and Other Information Requested by CNSC Staff</i>	Location in Application or Supporting Document(s)
Summary of programs and supporting documentation needed to support the licence application organized under each SCA, including other matters of regulatory interest (see Attachment 1). The programs and supporting documentation should be sufficiently detailed to describe the safety and control measures that will be implemented at the facility for each SCA.	Section 4.0 (incl. 4.1 – 4.14) Appendix B Facility Licensing Manual
Description of CFM’s approach to safety, including reference to corporate and facility specific documents which enunciate the safety policies and standards to which CFM must adhere.	Section 4.8 CFM-SH
Documents describing the organizational structure, roles and responsibilities of organizational units and management, including documents governing the day-to-day operation and conduct of the organization.	Application Sections 2.1 and 4.1.1 FLM

¹ The Commission or a designated officer authorized under paragraph 37(2)(c) of the Act, may require any other information that is necessary to enable the Commission or the designated officer to determine whether the applicant: (a) is qualified to carry on the activity to be licensed, or (b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

Information on CFM’s performance for each SCA during the current licence period, relative to CFM’s expectations, including any trends	Appendix 5 2012-2020 Operational Performance Report and Forward Outlook in Support of the Renewal of FFL-3641.0/2023
Assessment of existing and future safety challenges, along with a safety improvement plan to address these challenges during the next licence period	2012-2020 Operational Performance Report and Forward Outlook in Support of the Renewal of FFL-3641.0/2023
Describe opportunities for improvements and any safety improvement plans to address identified safety challenges	2012-2020 Operational Performance Report and Forward Outlook in Support of the Renewal of FFL-3641.0/2023
A description of the proposed operating plan for the next licensing period	Sections 1.3 and 4.3 2012-2020 Operational Performance Report and Forward Outlook in Support of the Renewal of FFL-3641.0/2023
Information on significant activities envisaged beyond the end of the next licensing period, if any	No known significant activities beyond the next licensing period
Provide a list of federal, provincial, municipal or other regulations, other than the regulations pursuant to the NSCA, which CFM must abide by	Section 4.9.3 FLM, CFM-EP
Provide a description of any obligations for municipal, provincial or other federal authorities and any obligations for public and/or private organizations.	Sections 4.3 and 4.9.3 FLM, CFM-EP
Provide a self-assessment to determine if the licence applications could have any new adverse impacts on Indigenous or treaty rights and therefore raise the duty to consult and trigger the requirements of REGDOC-3.2.2, <i>Indigenous Engagement</i> . REGDOC-3.2.2 also outlines what to consider when conducting this activity.	Section 2.4 CFM letter. Self-Assessment of REGDOC-3.2.2, <i>Indigenous Engagement</i> for Cameco Fuel Manufacturing. October 4, 2021
Provide a description of outreach activities to engage Indigenous groups and members of the public with respect to licence renewal.	Section 2.4 CFM letter. Self-Assessment of REGDOC-3.2.2, <i>Indigenous Engagement</i> for Cameco Fuel Manufacturing. October 4, 2021



	<p>Indigenous Engagement Report for Production Increase for Cameco Fuel Manufacturing</p> <p>FSD-PGR-PIP-01</p>
<p>Provide a list of any permits, certificates and licences issued by authorities other than the CNSC.</p>	<p>Section 4.9.3 FLM, CFM-EP</p>
<p>Provide updated Derived Release Limits and Operating Release Limit reports for the facility</p>	<p>CFM letter. Derived Release Limit Report for Cameco Fuel Manufacturing. March 3, 2021</p> <p>CFM letter. Proposed Release Limits for Cameco Fuel Manufacturing. April 9, 2021</p>
<p>Provide Cameco’s plans and schedule, including dates, with respect to complying with each of the standards, codes and CNSC regulatory documents required for implementation as per Attachment 1 (unless recommended to be included under recommendations and guidance), including transition measures as appropriate.</p>	<p>Already addressed in current LCH. Additional comments in the performance report.</p>
<p>Summary of the current status of all open actions items, as well as issues and requests that were discussed during the last CFM Commission hearings or meetings, including a plan and date for resolution.</p>	<p>2012-2020 Operational Performance Report and Forward Outlook in Support of the Renewal of FFL-3641.0/2023</p>
<p>A description of any planned major facility modification projects during the proposed licence period, including the schedule for these projects and, if known, the hazards associated with these projects and the safety and control measures CFM will plan to implement to mitigate those hazards.</p>	<p>There are no major modifications planned but a production increase has been requested.</p> <p>CFM Letter. Justification for Licence Term and Production Increase for Cameco Fuel Manufacturing Inc. October 4, 2021</p>
<p>Demonstration that Cameco possesses active nuclear liability insurance for CFM.</p>	<p>CFM email. Certificate of Insurance. June 8, 2021</p>

Pursuant to subsection 5 of the General Nuclear Safety and Control Regulations: Licences – Application for Renewal of Licence

Subsection 5 of the <i>General Nuclear Safety and Control Regulations</i> – Application for Renewal of Licence	Location in Application or Supporting Document(s)
5. An application for the renewal of a licence shall contain	
(a) The information required to be contained in an application for that licence by the applicable regulations made under the Act; and	This document and identified supporting documentation.
(b) A statement identifying the changes in the information that was previously submitted.	N/A

Pursuant to subsection 15 of the General Nuclear Safety and Control Regulations: Obligations – Representatives of Applicants and Licensees.

Subsection 15 of the <i>General Nuclear Safety and Control Regulations</i>: Obligations – Representatives of Applicants and Licensees 15. Every applicant for a licence and every licensee shall notify the Commission of	Location in Application or Supporting Document(s)
(a) The persons who have authority to act for them in their dealings with the Commission;	Sections 2.1 and 4.1.1 Supporting Documents – FLM CFM letter. Persons Having Authority to Act for CFM in Dealings with the CNSC. April 17, 2020
(b) The names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence; and	Sections 2.1 and 4.1.1 Supporting Documents – FLM CFM letter. Persons Having Authority to Act for CFM in Dealings with the CNSC. April 17, 2020
(c) Any change in the information referred to in paragraphs (a) and (b), within 15 days after the change occurs.	FLM CFM letter. Persons Having Authority to Act for CFM in Dealings with the CNSC. April 17, 2020

Pursuant to subsection 3 of the Class I Nuclear Facilities Regulations: Licence Applications – General Requirements

Subsection 3 of the <i>Class I Nuclear Facilities Regulations</i>: Licence Applications – General Requirements 3 An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the General Nuclear Safety and Control Regulations:	Location in Application or Supporting Document(s)
(a) A description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;	Section 2.2 CFM Facility Licenced Area Drawing 05C144 Site Map Property Layout Drawing 00A084 CFM Letter Submission of Updated Site Layout Drawings for Cameco Fuel Manufacturing. July 13, 2020
(b) Plans showing the location, perimeter, areas, structures and systems of the nuclear facility	CFM Facility Licenced Area Drawing 05C144 Site Map Property Layout Drawing 00A084 CFM Letter Submission of Updated Site Layout Drawings for Cameco Fuel Manufacturing. July 13, 2020
(c) evidence that the applicant is the owner of the site or has authority from the owner of the site to carry on the activity to be licensed;	CFM Letter. Deeds for Cameco Fuel Manufacturing Inc. March 8, 2021
(d) the proposed management system for the activity to be licensed, including measures to promote and support safety culture;	Section 4.1 FLM, CFM-MS
(d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers’ fitness for duty.	Section 4.2 FLM, CFM-HR-01
(e) the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on;	Section 4.4 FLM, SAR, ERA, DRL
(f) the proposed worker health and safety policies and procedures;	Section 4.8 CFM-SH
(g) the proposed environmental protection policies and procedures;	Section 4.9



<p>Subsection 3 of the <i>Class I Nuclear Facilities Regulations</i>: Licence Applications – General Requirements</p> <p>3 An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the General Nuclear Safety and Control Regulations:</p>	<p>Location in Application or Supporting Document(s)</p>
	CFM-EP
(h) the proposed effluent and environmental monitoring programs;	Section 4.9 CFM-EP
(i) If the application is in respect of a nuclear facility referred to in paragraph 2(b) of the <i>Nuclear Security Regulations</i> , the information required by section 3 of those Regulations;	Not applicable to CFM
(j) the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed; and	Section 2.4 FSD-PGR-PIP-01
(k) the proposed plan for the decommissioning of the nuclear facility or of the site.	Sections 2.5 and 4.11.3 FLM, PDP

Pursuant to subsection 6 of the Class I Nuclear Facilities Regulations: Licence Applications – Licence to Operate

Subsection 6 of the <i>Class I Nuclear Facilities Regulations</i>: Licence Applications – Licence to Operate An application for a licence to operate a Class I nuclear facility shall contain the following information in addition to the information required by section 3:	Location in Application or Supporting Document(s)
(a) a description of the structures at the nuclear facility, including their design and their design operating conditions;	Sections 2.2 , 2.3 , 4.4 , 4.5 and 4.6 FLM, SAR Detailed information on specific structures and their design and operation was previously submitted to the CNSC (AECB) at the time the structures were commissioned.
(b) a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions;	Sections 2.2 , 2.3 , 4.4 , 4.5 and 4.6 FLM, SAR Detailed information on specific structures and their design and operation was previously submitted to the CNSC (AECB) at the time the structures were commissioned.
(c) a final safety analysis report demonstrating the adequacy of the design of the nuclear facility;	Section 4.4 SAR
(d) the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility;	Sections 4.1 , 4.2 , 4.3 , 4.5 , and 4.6 FLM, CFM-MS and referenced documents
(e) the proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances;	Sections 4.2 , 4.3 , 4.7 , and 4.14 FLM, CFM-RP, FSD-PGR-TRN-01
(f) the proposed measures to facilitate Canada’s compliance with any applicable safeguards agreement;	Section 4.13 FLM, FSD-PGR-SG-01
(g) the proposed commissioning program for the systems and equipment that will be used at the nuclear facility;	Sections 4.1 and 4.5 FLM, CFM-MS, MSP 13-02
(h) the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects;	Sections 4.4 , 4.7 and 4.9 FLM, ERA, SAR, DRL
(i) The proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the	Sections 4.4 and 4.9 FLM, SAR, ERA, DRL, CFM-EP

Subsection 6 of the <i>Class I Nuclear Facilities Regulations</i>: Licence Applications – Licence to Operate An application for a licence to operate a Class I nuclear facility shall contain the following information in addition to the information required by section 3:	Location in Application or Supporting Document(s)
environment, including their physical, chemical and radiological characteristics;	
(j) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;	Sections 4.4 and 4.9 FLM, SAR, ERA, DRL, CFM-EP
(k) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to	Sections 4.4 , 4.9 and 4.10 FLM, SAR, ERA, DRL MSP 30-02, MSP 30-03, MSP 30-07
(i) Assist off-site authorities in planning and preparing to limit the effects of an accidental release,	Sections 4.4 , 4.9 and 4.10 FLM, SAR, ERA, DRL MSP 30-02, MSP 30-03, MSP 30-07
(ii) Notify off-site authorities of an accidental release or the imminence of an accidental release,	Sections 4.4 , 4.9 and 4.10 FLM, SAR, ERA, DRL MSP 30-02,
(iii) Report information to off-site authorities during and after an accidental release,	Sections 4.4 , 4.9 and 4.10 FLM, SAR, ERA, DRL MSP 30-02
(iv) Assist off-site authorities in dealing with the effects of an accidental release, and	Sections 4.4 , 4.9 and 4.10 FLM, SAR, ERA, DRL MSP 30-02
(v) Test the implementation of the measures to prevent or mitigate the effects of an accidental release;	Sections 4.4 , 4.9 and 4.10 FLM, SAR, ERA, DRL MSP 30-02
(l) the proposed measures to prevent acts of sabotage or attempted sabotage at the nuclear facility, including measures to alert the licensee to such acts	Section 4.12 MSP 30-01

Subsection 6 of the <i>Class I Nuclear Facilities Regulations</i>: Licence Applications – Licence to Operate An application for a licence to operate a Class I nuclear facility shall contain the following information in addition to the information required by section 3:	Location in Application or Supporting Document(s)
(m) The proposed responsibilities of and qualification requirements and training program for workers, including the procedures for the requalification of workers; and	Section 4.2 CFM-HR-01
(n) The results that have been achieved in implementing the program for recruiting, training and qualifying workers in respect of the operation and maintenance of the nuclear facility.	Section 4.2 CFM-HR-01

Pursuant to Subsection 3 of the Nuclear Substances and Radiation Devices Regulations: Licence Applications – General Requirements

Subsection 3 of the <i>Nuclear Substances and Radiation Devices Regulations</i>: Licence Applications – General Requirements 3(1) An application for a licence in respect of a nuclear substance or a radiation device, other than a licence to service a radiation device, shall contain the following information in addition to the information required by section 3 of the <i>General Nuclear Safety and Control Regulations</i>:	Location in Application or Supporting Document(s)
(a) the methods, procedures and equipment that will be used to carry on the activity to be licensed;	Sections 2.3 , 4.4 , 4.7 , 4.9 and 4.10 FLM, CFM-RP, CFM-EP, MSP 30-02
(b) The methods, procedures and equipment that will be used while carrying on the activity to be licensed, or during and following and accident, to	Sections 2.3.5 , 4.7 and 4.9 FLM, CFM-RP, CFM-EP, MSP 30-02
(i) Monitor the release of any radioactive nuclear substance from the site of the activity to be licensed,	
(ii) Detect the presence of and record the radiation dose rate and quantity in bequerels of radioactive nuclear substances at the site of the activity to be licensed,	Sections 2.3.5 , 4.7 and 4.9 FLM, CFM-RP, CFM-EP, MSP 30-02

Subsection 3 of the <i>Nuclear Substances and Radiation Devices Regulations</i>: Licence Applications – General Requirements 3(1) An application for a licence in respect of a nuclear substance or a radiation device, other than a licence to service a radiation device, shall contain the following information in addition to the information required by section 3 of the <i>General Nuclear Safety and Control Regulations</i>:	Location in Application or Supporting Document(s)
(iii) Limit the spread of radioactive contamination within and from the site of the activity to be licensed, and	Sections 2.3.5 , 4.7 and 4.9 FLM, CFM-RP, CFM-EP, MSP 30-02
(iv) Decontaminate any person, site or equipment contaminated as a result of the activity to be licensed;	Sections 2.3.5 , 4.7 and 4.9 FLM, CFM-RP, CFM-EP, MSP 30-02
(c) a description of the circumstances in which the decontamination referred to in subparagraph (b)(iv) will be carried out;	Sections 4.4 , 4.7 , 4.9 , 4.10 , 4.11 FLM, CFM-RP, CFM-EP, CFM-EP-02, MSP 30-02
(d) The proposed location of the activity to be licensed, including a description of the site;	Section 2.2 CFM Facility Licenced Area Drawing 05C144 Site Map Property Layout Drawing 00A084 CFM Letter Submission of Updated Site Layout Drawings for Cameco Fuel Manufacturing. July 13, 2020
(e) The roles, responsibilities, duties, qualifications and experience of workers	Section 4.2 CFM-HR-01
(f) The proposed training program for workers;	Section 4.2 CFM-HR-01
(g) The proposed instructions for dealing with accidents, including fires and spills, in which the nuclear substance may be involved;	Sections 4.4 , 4.7 , 4.9 , 4.10 CFM-RP, CFM-EP, MSP 30-02, MSP 30-03, MSP 30-07, CFM-EP-02
(h) The proposed inspection program for the equipment and systems that will be used to carry on the activity to be licensed;	Sections 4.4 , 4.5 , 4.6 , 4.7 , 4.9 , 4.10 FLM, CFM-RP, CFM-EP, MSP 27-16, AP 018

Subsection 3 of the <i>Nuclear Substances and Radiation Devices Regulations</i>: Licence Applications – General Requirements 3(1) An application for a licence in respect of a nuclear substance or a radiation device, other than a licence to service a radiation device, shall contain the following information in addition to the information required by section 3 of the <i>General Nuclear Safety and Control Regulations</i>:	Location in Application or Supporting Document(s)
(i) The methods, procedures and equipment that will be used to calibrate radiation survey meters in accordance with these Regulations;	Sections 2.3.5 and 4.7 CFM-RP, HSI-048
(j) The methods, procedures and equipment that will be used to calibrate and verify the calibration of dosimeters referred to in paragraphs 30(3)(d) and €;	Sections 2.3.5 and 4.7 CFM-RP, HSI-048
(k) The methods, procedures and equipment that will be used to conduct the leak tests and surveys required by those Regulations;	Sections 2.3.5 and 4.7 CFM-RP, HSI-048
(l) Where the application is in respect of a nuclear substance that is in an unsealed source and that is to be used in a room, the proposed design of the room;	Sections 2.3.5 and 4.7 CFM-RP, HSI-048
(m) If the application is in respect of a nuclear substance that is contained in a radiation device, the brand name and model number of the radiation device, and the quantity of the devices;	Sections 2.3.5 and 4.7 CFM-RP, HSI-048
(n) Where the application is in respect of Category I, II or III nuclear material, as defined in section 1 of the <i>Nuclear Security Regulations</i> ,	Not applicable
i. The measures that will be taken to prevent nuclear criticality	
ii. The information required by section 3 or 4 of the <i>Nuclear Security Regulations</i> , as applicable;	
(o) If the applicant will be manufacturing or distributing radiation devices referred to in paragraph 5(1)(c) or section 6 or 7, or check sources mentioned in section 8.1, the proposed procedure for the disposal of each radiation device or check source for its return to the manufacturer	Not applicable



Pursuant to Part 2 of the Nuclear Security Regulations: Part 1 Security of Nuclear Facilities Listed in Schedule 2 – Licence Applications

Subsection 41 of the <i>Nuclear Security Regulations</i>: Licence Applications – General Requirements	Location in Application or Supporting Document(s)
An application for a licence in respect of a nuclear facility shall contain, in addition to the information required by sections 3 to 8 of the Class I Nuclear Facilities Regulations , a description of the physical protection measures to be taken to ensure compliance with sections 42 to 48.	Application Section 4.12 MSP 30-01



Appendix E – Detailed Operational Performance Report for FFOI-3641.0/2022



**2012-2020 Operational Performance Report and Forward
Outlook in Support of the Renewal of:**

**Cameco Fuel Manufacturing Inc.
Operating Licence
FFL-3641.00/2023**

Table of Contents

1.0	INTRODUCTION	1
1.1	BACKGROUND.....	1
1.2	PRODUCTION HIGHLIGHTS 2012 TO 2020.....	1
1.3	OPERATION IMPROVEMENTS 2012 TO 2020.....	1
1.4	FORWARD OUTLOOK FOR OPERATIONS.....	2
1.5	SAFETY CHALLENGES AND OPPORTUNITIES FOR IMPROVEMENT	2
2.0	SAFETY AND CONTROL AREAS	3
2.1	MANAGEMENT SYSTEM	3
2.2	HUMAN PERFORMANCE MANAGEMENT	4
2.3	OPERATING PERFORMANCE	4
2.4	SAFETY ANALYSIS	6
2.5	PHYSICAL DESIGN.....	6
2.6	FITNESS FOR SERVICE	7
2.7	RADIATION PROTECTION.....	8
2.8	CONVENTIONAL HEALTH AND SAFETY	13
2.9	ENVIRONMENTAL PROTECTION.....	14
2.10	EMERGENCY MANAGEMENT AND RESPONSE	26
2.11	WASTE MANAGEMENT.....	26
2.12	NUCLEAR SECURITY	28
2.13	SAFEGUARDS AND NON-PROLIFERATION	28
2.14	PACKAGING AND TRANSPORT	29
3.0	OTHER MATTERS OF REGULATORY INTEREST	30
3.1	PUBLIC INFORMATION PROGRAM.....	30
3.2	INDIGENOUS ENGAGEMENT.....	30
3.3	FINANCIAL GUARANTEE	31
4.0	CONCLUDING REMARKS	38

1.0 INTRODUCTION

1.1 Background

As described within this report, the performance of this facility over the current licence period demonstrates that Cameco Fuel Manufacturing (CFM) is qualified to carry out the activities permitted under the Licence for an extended licence period. This report reaffirms CFM's commitment 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, and the necessary measures to facilitate Canada's compliance with international safeguards obligations.

1.2 Production Highlights 2012 to 2020

Detailed plant production information is considered confidential and proprietary and is submitted to the Canadian Nuclear Safety Commission (CNSC) on an annual basis under a separate cover. The following production summarizes CFM operating performance between 2012 and 2020:

- The annual production of uranium dioxide (UO₂) as pellets did not exceed the licensed limit of 125 Megagrams (Mg) during any calendar month

1.3 Operation Improvements 2012 to 2020

As part of a focus on continual improvement, CFM has undertaken modernization of the facility during this licence period, continually improving safety of both employees and the public, product quality and efficiency. Each internal production process at the facility - from receipt of UO₂ powder through to final fuel bundle assembly has been upgraded.

More specifically, CFM upgraded receipt and processing of UO₂ powder from a system that utilized a manual wand and air transfer system to a separately enclosed and ventilated automatic drum tipping operation. Further to this, movement of prepared UO₂ powder vessels, an operation that was performed in the past with a series of manual carts and overhead cranes has been replaced with an automatic guided vehicle. CFM has replaced the manual assembly of pressed pellets into carriers in preparation for sintering with an operation that now performs this operation robotically. These upgrades have resulted in reduced employee injury risk, improved ergonomics and improved dose rates.

The pellet sintering and grinding operations have also received several safety system and equipment upgrades. CFM has upgraded the control systems on all sintering furnaces to remain current with all safety standards as well as to provide improvements to ergonomics. Pellet grinding, including washing and drying, has been upgraded with the addition of robotics and other technologies to eliminate the need for operators to manually carry trays of pellets; a process that was taxing ergonomically and from a human performance and error prevention perspective. Changes implemented in this area also facilitated improvements to uranium emissions both to air and water.

In alignment with the strategy to improve safety, ergonomics and lower employee dose, CFM also re-engineered the bundle assembly area. Manual operations such as pellet

stacking, tube loading and bundle assembly have been replaced with robotic operations that provide vastly improved ergonomics, lower employee dose rates and improve product conformance to customer requirements.

1.4 Forward Outlook for Operations

CFM's production plans in the coming licence period are anticipated to increase to meet the annual target based on the UO₂ pellet and fuel bundle demands of Canadian and international customers. CFM is requesting a change to the licensed production limit from 125 Megagrams (Mg) of uranium dioxide (UO₂) as pellets during any calendar month to 1,650 tonnes of uranium (tU) as uranium dioxide as pellets per year. This represents an annual uranium throughput increase of 24 % and aligns the licenced production limit with the capacity of the current equipment. This change will be accomplished through an increase in operating days and require no new equipment to be installed. This change is further discussed in section 4.3 of the application. In its review of the proposed increase to production, CFM has assessed the change under its licensing basis for the 14 SCAs as well its licensing basis for other regulatory areas. This assessment* has concluded that the proposed production increase falls within the current licensing basis for the facility, including the Safety Analysis Report, Derived Release Limit Report and Environmental Risk Assessment.

*CFM Letter. Justification for Licence Term and Production Increase. October 4, 2021

1.5 Safety Challenges and Opportunities for Improvement

The CFM facility is a mature operation with a strong safety record and environmental performance. The facility's strong safety record, excellent training program, well established programs and procedures, support the strong culture of safety in Port Hope.

2.0 SAFETY AND CONTROL AREAS

2.1 Management System

This safety and control area (SCA) covers the framework that 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.

Operational Performance

During the current licence period, CFM replaced its Integrated Management System with the Management Systems Program Manual (CFM-MS). The program manual was designed to meet the requirements of *CSA N286-12 Management System Requirements for Nuclear Facilities* for a quality program. The CFM-MS also meets the requirements of REGDOC 2.1.1 Management System. The CFM-MS provides the controls to ensure all processes are conducted in a safe manner and that processes applying to licensed activities are conducted in accordance with applicable CNSC quality and other regulatory requirements.

Audits and inspections completed during the licence period (including 80 external audits and 27 CNSC inspections) did not identify any significant non-conformances to various criteria. All findings were assessed, and corrective actions developed, as appropriate; to continually improve all aspects of site performance. CFM had a number of third-party reviews on compliance with the National Fire Code 2010 and the National Fire Protection Association NFPA-801, 2008.

In 2016, CFM completed a Safety Culture assessment, which re-affirmed that the facility has a strong commitment to safety and that there is a high degree of trust and confidence in site leadership. A Safety Culture assessment is scheduled for the fourth quarter of 2021, which will include security culture. This assessment will complete the implementation of all aspects of REGDOC-2.1.2 – *Safety Culture* at CFM.

Consistent with the management system requirements, management review was completed annually during the licence period to review suitability, adequacy and effectiveness of policies and programs as well as site performance. Opportunities for improvement were identified and incorporated into site objectives and actions were entered into the Cameco Incident Reporting System (CIRS).

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Management System SCA.

Forward Outlook

Looking ahead to the next licensing period, CFM will implement changes through its continual improvement process to continue to improve its management system.

2.2 Human Performance Management

This SCA covers activities that enable effective human performance through the development and implementation of processes that 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.

Operational Performance

During the current licence period, CFM has maintained a highly trained and competent workforce through its Systematic Approach to Training (SAT) based training program which meets the requirements of REGDOC-2.2.2, *Personnel Training, Version 2*.

Summary statistics for the training program during the current licence period are provided in Table 1. Yearly fluctuations are the result of changes to personnel (new hires, job transfers, return to work) or training program requirements (requalification periods, new qualifications).

Table 1 Training Statistics for Current Licence Period

Year	Total Training Hours	Number of Qualifications Granted	% Qualifications Held
2012	2,263	3,460	91.8%
2013	2,020	3,188	88.1%
2014	1,378	3,086	85.1%
2015	2,850	4,384	85.5%
2016	3,745	5,761	91.7%
2017	6,658	10,243	89.0%
2018	4,329	4,968	97.5%
2019	5,199	5,650	95.6%
2020	2,635	5,866	95.8%

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Human Performance Management SCA.

Forward Outlook

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

2.3 Operating Performance

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

Operational Performance

During the current licence period, CFM has operated in a manner that supports safe, clean and reliable production and in compliance with applicable acts and regulations, corporate,

divisional and site programs and procedures. Production rates were within the monthly limits during the current licence period. Detailed plant production information is considered “proprietary” and is submitted to CNSC staff on an annual basis under separate cover. Typically for three weeks in July and August and one week between Christmas and New Year’s, the facility has planned shutdowns to complete maintenance and project work, conduct physical inventory and allow for worker vacation.

CFM reports action level exceedances, unplanned events and occurrences as required by the *Nuclear Safety and Control Act* (NSCA), its regulations and the licence conditions (Table 2). During the current licence period, CFM reported transportation incidents, radiation protection action level exceedances, and injuries reportable under the *Canada Labour Code*. These incidents were investigated in accordance with Cameco’s corrective action process and corrective actions were identified, tracked and implemented.

Table 2 Reportable Incidents in the Current Licence Period

Year	Transportation	Action Levels	Environmental Releases	Other	Total
2012	0	1	0	0	1
2013	1	2	0	0	3
2014	0	3	0	0	3
2015	0	2*	0	0	2
2016	1	1	0	0	2
2017	0	2	0	0	2
2018	0	1	0	0	1
2019	0	1	0	0	1
2020	0	0	1	0	1
2021 YTD	0	1	0	0	1

*Please note that CFM reported three action levels in the year of 2015; however it was determined during the investigation that due to calculation error the action level was not exceeded.

Regulatory actions from CNSC staff inspections and follow-up activities from CNSC staff reviews of CFM submissions, including those from event reports are tracked in CIRS. As of the end of September 2021, the facility had 7 open actions and no open recommendations related to CNSC inspections and reviews. There are no open actions arising from the last CFM Commission hearing. The status of open actions are routinely discussed with the project officer.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Operating Performance SCA.

Forward Outlook

Looking ahead to the next licensing period, CFM has requested an increase to the production limit to reflect the production capacity of the licensed facility. This is discussed in section 4.3 of the application.

2.4 Safety Analysis

This SCA covers the maintenance of the safety analysis, which supports the overall safety case for the facility. This 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.

Operational Performance

CFM has a safety analysis report (SAR) that summarizes the systematic review of site operations to identify and assess hazards and potential risks to the public and environment from the facility. A What-If methodology was utilized to systematically determine the potentially hazardous scenarios. The SAR demonstrates that adequate safety systems are in place to prevent an unreasonable risk to persons and the environment and includes an analysis of the probable worst-case release event. The SAR was updated and submitted to CNSC staff in 2014 and 2021.

The 2021 version of the SAR submitted in May 2021 incorporated information from other supporting studies of the facility to better align with the guidance provided in the International Atomic Energy Agency (IAEA) standard SSR-4, *Safety of Nuclear Fuel Cycle Facilities*. It was submitted to the CNSC as part of the suite of documents supporting the licence renewal application.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Safety Analysis SCA.

Forward Outlook

REGDOC-2.4.4 *Safety Analysis for Class 1B Facilities* is expected to be published in the next licence period. There is an established process for review of new standards and REGDOCs and their incorporation as Compliance Verification Criteria (CVC) or guidance in the LCH. In accordance with this process, CFM will identify and address any gaps in the facility safety analysis on a schedule accepted by CNSC staff.

2.5 Physical Design

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

Operational Performance

Changes to the physical design of equipment, processes and the facility with the potential to impact safety are evaluated through a design control process from initial planning through to completion of the project. This review identifies impacts and potential impacts to the environment, radiation protection, health and safety and fire protection. A site design control procedure is in place, which ensures that any equipment changes or modifications will not have an adverse effect on the environment, on the health and safety of employees or on members of the public.

In the current licence period, CFM implemented a new CSA standard N393-13 (R2018), *Fire protection for facilities that process, handle, or store nuclear substances* and implemented the changes in a new version of CSA B51-14, *Boiler, pressure vessel, and pressure piping code*.

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

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Physical Design SCA.

Forward Outlook

While the site pressure boundary program meets the requirements of CSA B51-14 *Boiler Pressure Vessel and Pressure Piping Code*, the 2019 version of the code will be fully implemented by December 31, 2021.

2.6 Fitness for Service

This SCA covers activities that impact on the physical condition of SSCs, 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.

Operational Performance

In the licence period, CFM completed an Operational Reliability Self-Assessment and developed an Operational Reliability Improvement plan. Objectives for improving fitness for service are contained within this plan and regular progress reviews continue at the site and divisional levels.

CFM tracks Key Performance Indicators (KPIs) to monitor the effectiveness of the program. Detailed information regarding KPIs is considered protected proprietary and are not made publicly available. Overall, the KPIs reflected strong performance with improvements to the site uptime availability and overall equipment effectiveness, improvements in preventative maintenance schedule compliance and a decrease in the amount of reactive maintenance work.

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 deleterious effects of aging.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Fitness for Service SCA every year.

Forward Outlook

Looking ahead to the next licensing period, the facility plans to make improvements to this SCA through the Operational Reliability program and recommendations developed during management review of KPI performance.

2.7 Radiation Protection

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

Operational Performance

CFM has an extensive Radiation Protection Program in place to meet the requirements of the *Nuclear and Safety Control Act* and the *Radiation Protection Regulations* and ensure exposures are kept to levels as low as reasonably achievable, social and economic factors considered (ALARA). Review of worker dose data between 2012 and 2020 indicates that the program is highly effective in the prevention of unreasonable risk to the health and safety of Nuclear Energy Workers (NEWs, which includes CFM employees and contractors). All worker doses were well below the CNSC regulatory limits for effective dose for NEWs of 50 millisieverts (mSv) per year and no more than 100 mSv over a specified five-year period.

CFM uses a licensed dosimetry service provider that is accredited by the CNSC for external dosimetry. Internal doses are assigned through urine analysis and lung counting programs, which are part of FSD's licensed internal dosimetry service.

Skin Dose

Dose to skin is measured using dosimeters and compared to the corresponding equivalent dose limit of 500 mSv in the *Radiation Protection Regulations*. Figure 1 shows the average and maximum individual skin dose for NEWs in the period from 2012 to 2020. The average skin dose in this period was 1% of the dose limit. The maximum skin dose received in this period was in 2014 and was 22% of the dose limit.

Figure 1 Skin Dose 2012-2020



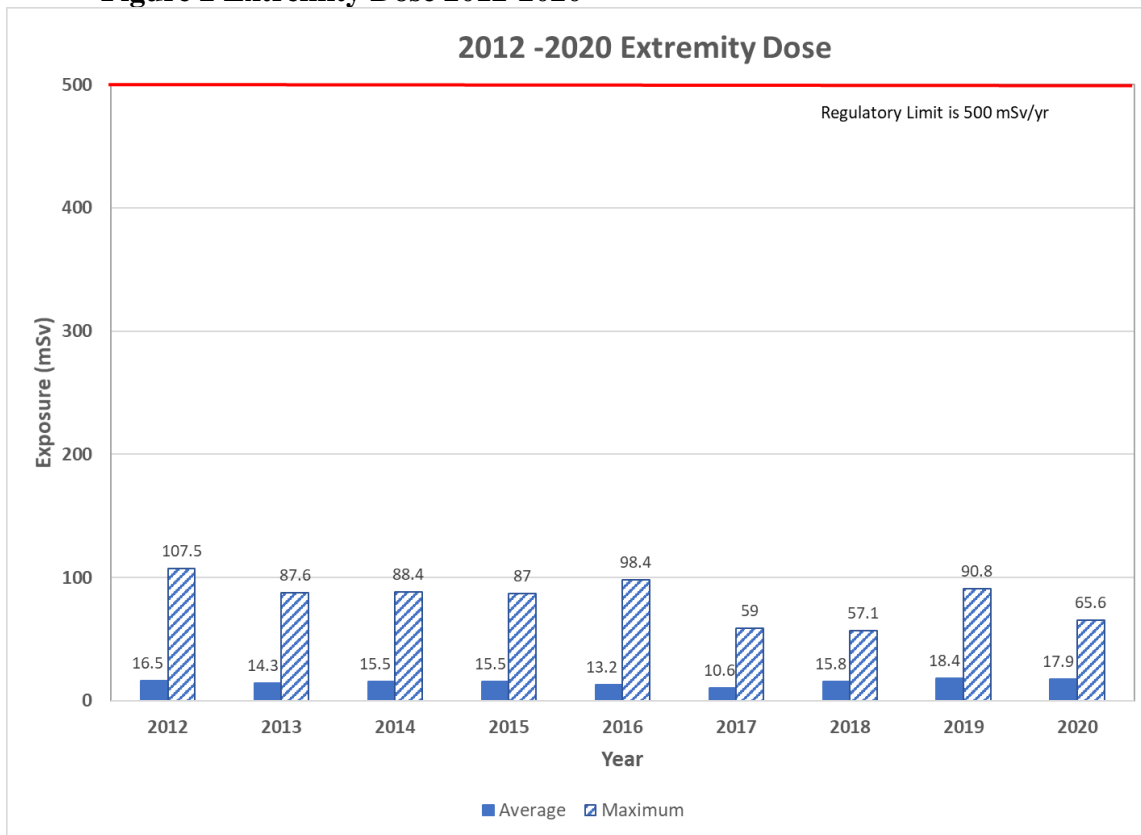
Extremity Dose

Extremity Dose is measured using ring dosimeters and compared to the corresponding equivalent dose limit of 500 mSv in the *Radiation Protection Regulations*. Figure 2 shows the average and maximum extremity dose for NEWs in the period from 2012 to 2020. There were two exceedances of the action level of 55 mSv in the licence period:

- 2015 (1 occurrence) this was attributed to an incorrect conversion factor used by the dosimetry service provider and contamination on the dosimeter not representative of the actual dose to the extremity
- 2019 (1 occurrence) the investigation and follow-up studies determined that the dose assigned to the employee were not likely due to the tasks they had been assigned. A request to change the employee dose has been submitted to CNSC staff

The average annual whole-body dose for NEWs ranged from 3.1 mSv to 8.1 mSv in this period. The maximum whole-body dose in this period was 108.4 mSv in 2014. Managing external exposure dose at these levels ensures that skin dose for workers remains a small fraction of the CNSC annual limit of 500 mSv.

Figure 2 Extremity Dose 2012-2020



Eye Dose

Between 2012 and 2017 the average annual eye dose for NEWs ranged from 1.2 mSv to 1.7 mSv in this period. The maximum eye dose in this period was 22.3 mSv in 2014. A review of eye doses measured using the OSLD badges from 2018-2020 indicates the average annual dose was 1.2 mSv/year and the maximum annual dose was 26.2 mSv, over that time frame.

The *Radiation Protection Regulations* were revised near the end of 2020 and the annual dose limit for eyes lens was lowered from 150 mSv to 50 mSv for NEWs. In order to meet the new *Radiation Protection Regulations*, CFM will use the eye dose values provided by the OSLD badges to demonstrate compliance to the annual eye dose limit of 50 mSv/year. Most eye doses are very low and a maximum dose of approximately half the dose limit indicates that CFM is unlikely to have an individual approach the annual dose limit.

Effective Dose Limits

In accordance with the *Radiation Protection Regulations*, effective dose for NEWs at CFM is determined through the dose received from outside the body, as measured by optically stimulated luminescence (OSL) dosimeters as well as the dose received by and committed to the worker from sources inside the body, as measured through lung counting and/or urine analysis.

Whole Body Dose

The average whole-body doses for NEWs are consistent and extremely low during the period from 2012 to 2020. The action level for whole body dose was exceeded once in the current licence period as detailed below:

- 2017 (1 occurrence) this was deemed non-occupational as the employee had undergone a medical radiation treatment

The average annual whole-body dose for NEWs ranged from 0.4 mSv to 0.7 mSv in this period. The maximum annual whole-body dose in this period was 8.4 mSv in 2013. Managing external exposure dose at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

Lung Counting

In 2014, FSD incorporated CFM workers into the licensed dosimetry program. As part of the licensed internal dosimetry program, CFM employs the use of a lung counter to monitor internal exposure of NEWs working at CFM. The average annual internal dose from lung counting for NEWs ranged from 0.6 mSv to 1.6 mSv. The maximum dose from lung counting in this period was 3.5 mSv in 2019. Managing the internal dose from lung counting at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

Urine Analysis

Routine urine analysis samples are collected on a biweekly basis for trending purposes; if an acute uptake is noted, then it is verified using lung counting and dose assigned if required. The action level for urine analysis is 10 µg U/L was exceeded five times in the current licence period as detailed below:

- 2013 (2 occurrences) both were attributed to workplace contamination; respirator use was implemented until improved contamination control measures were installed on the equipment involved in each case
- 2014 (2 occurrences) both did not have a clear cause identified in the investigation; however, respirator use was reviewed and changes were made to the urine sample drop off system
- 2015 (1 occurrence) the most likely cause was due to respirator use

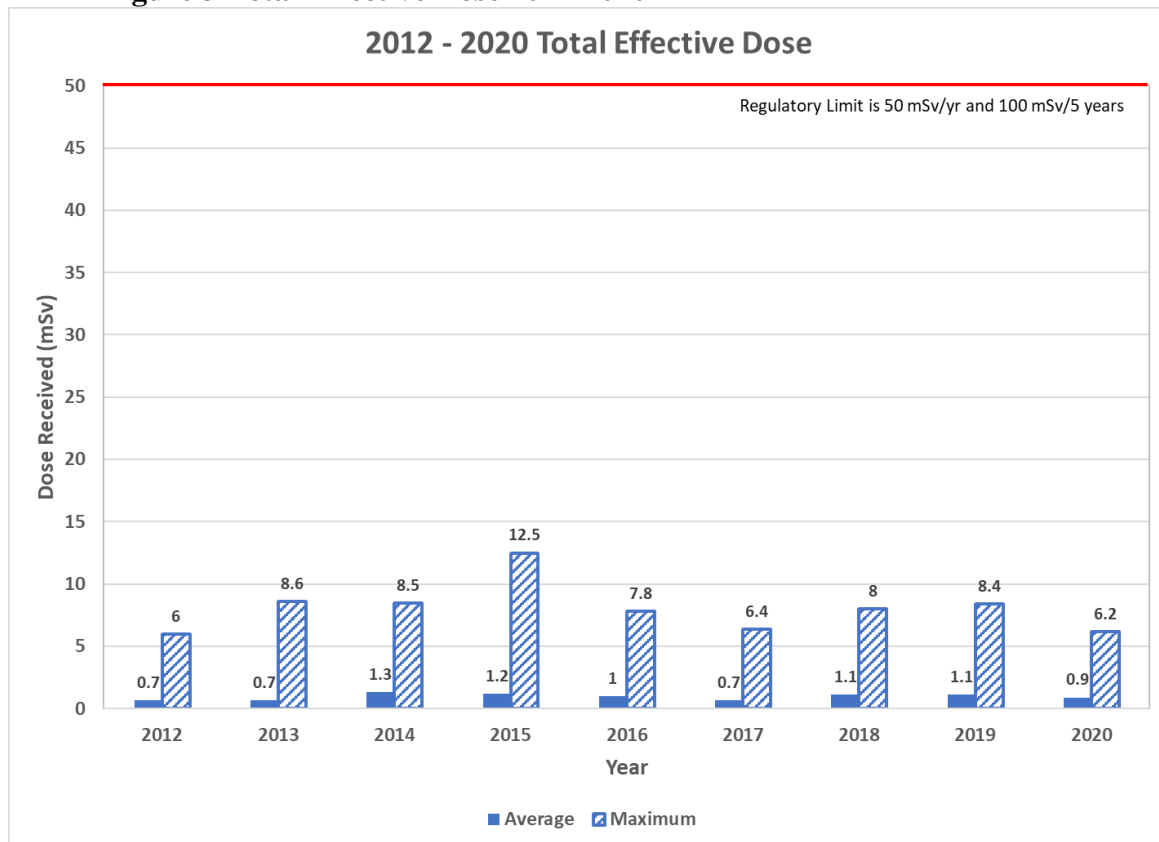
Between 2014 and 2020, internal dose from urine analysis was assigned based for these five employees. The maximum dose from urine analysis in this period was 5.7 mSv in 2015.

Total Effective Dose

Figure 3 presents the total effective dose (TED) for workers (employees and contractors) designated as NEWs during the 2012 - 2020 period. The TEDs over the period are extremely low and the regulatory limit of 100 mSv five-year effective dose was not exceeded. The five-year regulatory limit of 100 mSv established in the *Radiation Protection Regulations* applies to unique five-year periods of time. The periods relevant to the current licence periods extends from January 1, 2011 to December 31, 2015 and January 1, 2016 to December 31, 2020. For the first five-year period under this licence (January 2011 to December 2015), the maximum TED for a single individual for all five years was

12.6 mSv in 2015. For the current period (January 2016 to December 2020) the highest individual result to date is 8.4 mSv in 2019.

Figure 3 Total Effective Dose 2012-2020



Other Radiation Monitoring

The inventory of sealed and unsealed sources that are used or possessed on site was maintained between 2012 and 2020. Regular inspection and leak tests of the sealed sources were carried out and demonstrated that sources are in a state of safe operation and pose no undue risk to workers.

CFM collects between 9,800 and 19,300 in-plant air samples each year in the current licence period, of those, less than 0.2% of these samples were above the respirator level.

Approximately 2700 contamination monitoring measurements are completed each year, less than 0.1% of the samples indicated contamination from Zone 3 or Zone 4.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Radiation Protection SCA every year.

Forward Outlook

CFM’s Radiation Protection Program is mature and enables CFM to keep radiation exposures ALARA. REGDOC-2.7.1 *Radiation Protection* and REGDOC – 2.7.2 *Dosimetry Volume I: Ascertainning Occupational Dose* are expected to be published in the next licence period. There is an established process for review of new standards and REGDOCs and their incorporation as Compliance Verification Criteria (CVC) or guidance in the LCH. In accordance with the established practice, CFM will identify and address any gaps in the Radiation Protection Program on a schedule accepted by CNSC staff.

2.8 Conventional Health and Safety

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

Operational Performance

The effectiveness of the conventional health and safety program can be evaluated by the responsiveness of the site to leading safety activities such as audits, inspections, evaluations, reviews, benchmarking, training and employee participation and engagement. CFM has tracked leading and lagging safety indicators for many years. These consist of, but are not limited to, tracking safety meeting attendance, tracking the percentage of safety inspections completed and safety statistics. This data is reviewed by site and divisional management and has helped improve the overall safety performance at the refinery. Table 3 presents the safety statistics for the refinery for the current licence period.

Table 3 Health and Safety Statistics

Year/Parameter	2012	2013	2014	2015	2016	2017	2018	2019	2020
First Aid Injuries	27	22	23	12	21	14	14	911	17
Medical Diagnostic Procedures	7	3	2	1	1	2	1	3	1
Medical Treatment Injuries	5	6	2	3	6	2	2	0	2
Lost Time Injuries	0	0	0	1	0	0	0	0	0
Total Time Injury Frequency	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Lost Time Injury Severity	23.6*	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0

*Notes – Value recorded is result of a 2010 injury with lost time resulting from a medical procedure to correct the injury in 2012.

The safety culture survey in 2016 reaffirmed the facility’s strong commitment to safety.

A COVID-19 hazard prevention response procedure outlining protocols for all employees, visitors, and contractors was created in response to the pandemic in 2020. These protocols covered topics such as mask use, basic infection prevention, workplace controls, and disinfecting/cleaning methods. As new controls were introduced throughout the pandemic, the document was revised to remain current.

In November 2020, a COVID-19 outbreak was declared at CFM Port Hope by the Haliburton Kawartha Pine Ridge District Health Unit following the identification of three cases at the facility. CFM worked with its company medical team and public health authorities to support the affected employees and ensure a safe workplace when the facility resumed operations.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Conventional Health and Safety SCA.

Forward Outlook

CFM will continue to enhance its safety and health program where opportunities are identified during the upcoming licence period. CFM continues to strive for zero injuries in its operations.

2.9 Environmental Protection

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

Operational Performance

There are both federal and provincial regulatory authorities that have legislative jurisdiction over environmental protection at CFM. The facility's Environmental Protection Program (EPP) monitors the following parameters to ensure protection of people and the environment:

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

Changes to the Regulatory Framework for Environmental Protection

The facility maintains an EPP that meets the requirements of the ISO14001 standard and Cameco's corporate requirements. During the current licence period, CFM aligned its EPP with the applicable CSA N288 series standards, which provide guidance on the framework and methodology for establishing a standardized EPP that is protective of people and the environment. This included:

- an Environmental Risk Assessment (ERA) following the requirements of N288.6-12 (R2017), *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*
- an updated Derived Release Limit (DRL) following the requirements of N288.1-14 (R2019), *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*

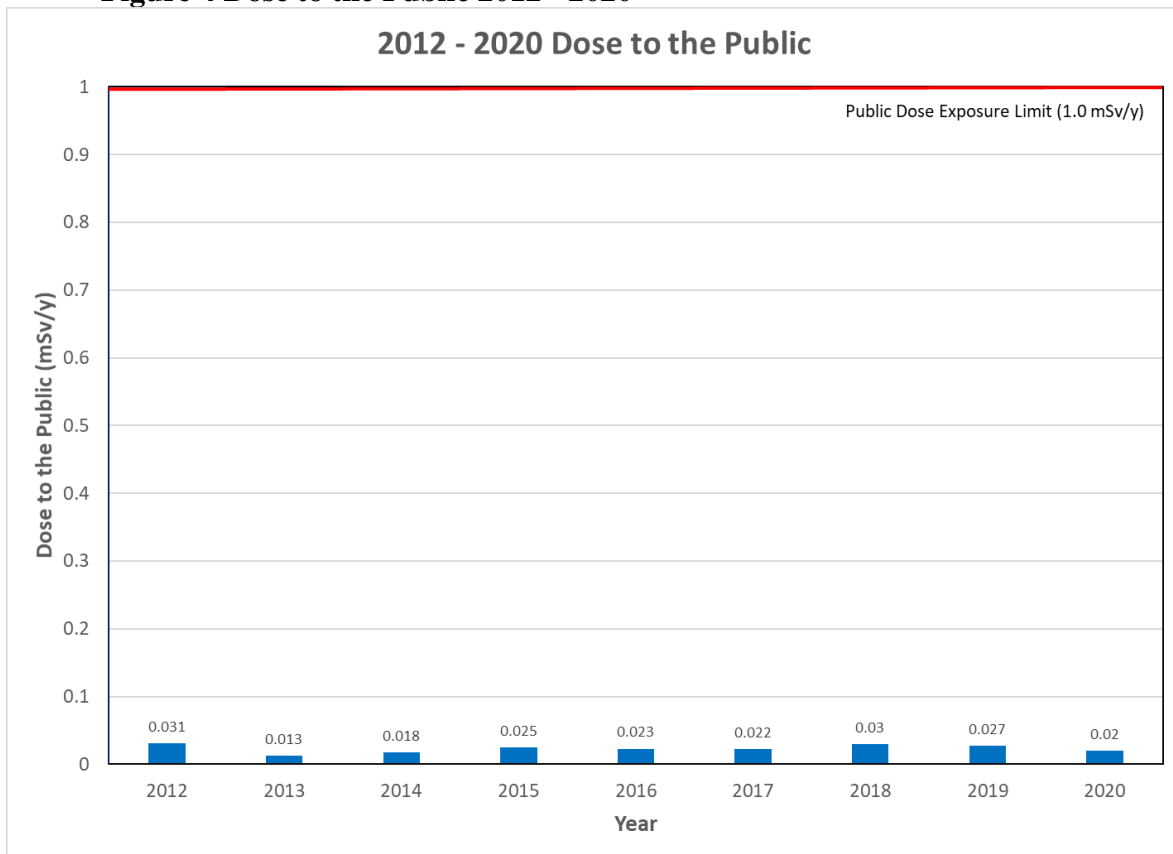
- revisions to the EPP to implement CSA N288.5-11 (R2016), *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* and CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*
- development of action levels in accordance with CSA N288.8-17, *Establishing and implementing action levels for releases to the environment from nuclear facilities*
- development of a Ground Water Protection Program in accordance with CSA N288.7-15 *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*

Estimated Dose to the Public

Within the regulatory framework the radiation doses to the public are considered in the environmental protection SCA. The annual dose limit for a member of the public is 1.0 mSv. The annual dose to the public from CFM operations is determined by the use of a critical receptor who, given their proximity to the facility and the theoretical length of time that could be spent at this location, would be expected to receive the highest possible radiation dose that any member of the public could receive.

The annual dose to the critical receptor, is shown in Figure 4. The update to the DRL in 2021 determined the critical receptor to be a resident located outside the fence line on the west side of the site. The closest gamma monitoring dosimeter at the fence line is at location #12 and represents the critical receptor location for the site. This is a change from the critical receptor from reporting periods 2012-2020 (fenceline receptor #1) due to changes in receptor locations outside of the CFM facility. The dose to the critical receptor used to estimate dose to the public from CFM's operation is only a small percentage of the public dose limit of 1 mSv/year.

Figure 4 Dose to the Public 2012 - 2020



Gamma Monitoring

Environmental dosimeters have been used to monitor fenceline gamma emissions along each of the perimeter fence lines at 12 locations since late 2012. The perimeter fence line defines the boundary of the CNSC licensed facility. The gamma emissions from the facility are extremely low as shown in Figure 4. There was one exceedance of a fenceline gamma action level in the current licence period:

- 2017 (one occurrence) – this was attributed to an increase in finished material stored in the Fuel Storage Building, near fenceline location 12. A soil berm was installed between the building and the fenceline in 2017 to shield the gamma from the storage location

Uranium Loadings

Total uranium loadings to the environment have remained low through the current licence period as seen in Table 4. Emissions to air represent a combination of uranium loadings from the process stacks as determined from the routine stack sampling program, and uranium loadings from the various process area ventilation exhaust systems, as determined by in-plant air sampling data and exhaust discharge rates. The variation in loadings is attributable to changes in annual production.

The variation in uranium loadings to water from year-to-year is attributable to changes in annual production levels and also to the volume of wastewater discharged in a given year.

Table 4 Total Uranium Loadings to the Environment

Emission	2012	2013	2014	2015	2016	2017	2018	2019	2020
Air (kg/year)	0.59	0.51	0.41	0.46	0.73	0.67	1.26	1.09	0.93
Water (kg/year)	0.95	0.83	1.58	1.24	0.85	0.64	0.84	0.39	0.34
Total (kg/year)	1.54	1.34	1.99	1.70	1.58	1.31	2.10	1.48	1.27

Emissions to Air

Process stacks are sampled and analyzed daily for total uranium emissions. 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.

As part of its continual improvement process, CFM refined the calculation for the annual uranium loadings to use daily data rather than quarterly data. This change better reflects day-to-day changes in emissions and is not influenced by extended shutdown periods. The increase in reported air emissions beginning in 2018 does not represent an actual increase in emissions but an improved accounting of the emissions from building ventilation. The annual uranium loadings from process stacks and building ventilation have remained very low as shown in Table 5.

Table 5 Total Uranium Loadings to Air

2012 – 2020 Emissions (kg/yr)										
	Release Limit	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual Stack Emissions	14	0.02	0.03	0.01	0.01	0.03	0.01	0.01	0.00*	0.01
Annual Exhaust Emissions	14	0.57	0.48	0.40	0.45	0.70**	0.57	1.25	1.09	0.92

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

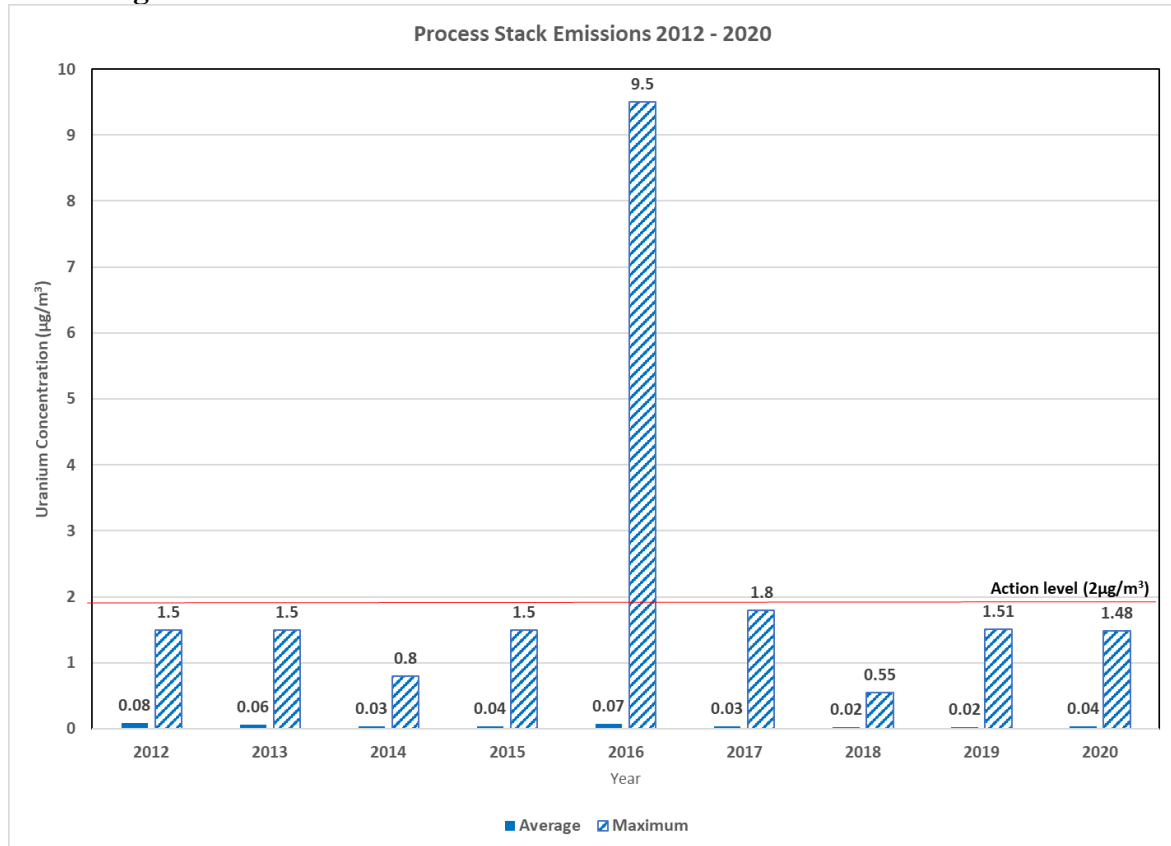
** In 2016, the annual value was calculated by adding the quarterly results causing the value to be higher than previous years due to the number of weeks used in the calculation (i.e. 52 vs 44). This does not take into account the three weeks of summer shutdown.

CFM has discrete air emission discharge points along the production line. The airborne effluent monitoring program therefore is designed so that each stack is monitored when that area of the plant is operating. A variety of pollution control equipment including baghouses, and absolute filters are used at the facility to control and reduce emissions to air. The process stack emissions during the licence period are shown in Figure 5. An action level of $2 \mu\text{g}/\text{m}^3$ is in place for process stacks. The action level was exceeded once during the licence term:

- 2016 (one occurrence) – this was attributed to a HEPA filter not being properly clamped down during installation. The filter shifted in the housing and the increased uranium emissions were detected through routine monitoring.

As part of its continual improvement process, CFM self-identified that equipment to monitor actual operating time was required to be installed in the process stacks in order to determine emission rates appropriate to shorter operating periods. This equipment installation was completed in 2021. CFM is updating the environmental software in 2022 to generate the report required to facilitate reporting all air emissions in gU/hr limit.

Figure 5 Process Stack Emissions 2012 – 2020



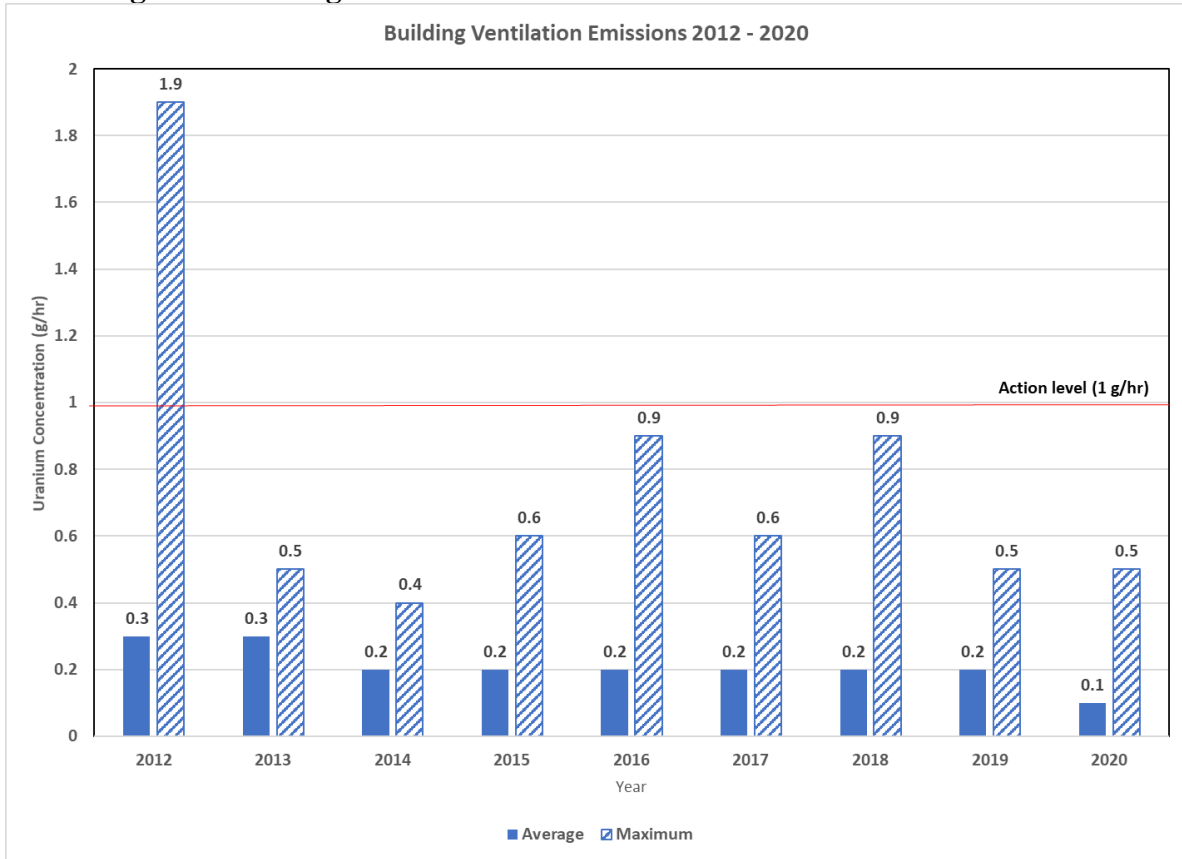
During the current licence period CFM developed a conservative method of calculating building ventilation emissions from in-plant air sampling data and exhaust discharges rates. An action level of 1g/hr was implemented in 2012. The building ventilation emissions from the current licence period are shown in

Figure 6. There was one exceedance of the building ventilation action level in the current licence period:

- 2012 (one occurrence) – this was attributed to a spill of powder caused by equipment failure when transferring powder between areas in the plant. There was no measurable exposure to workers and corrective actions were implemented

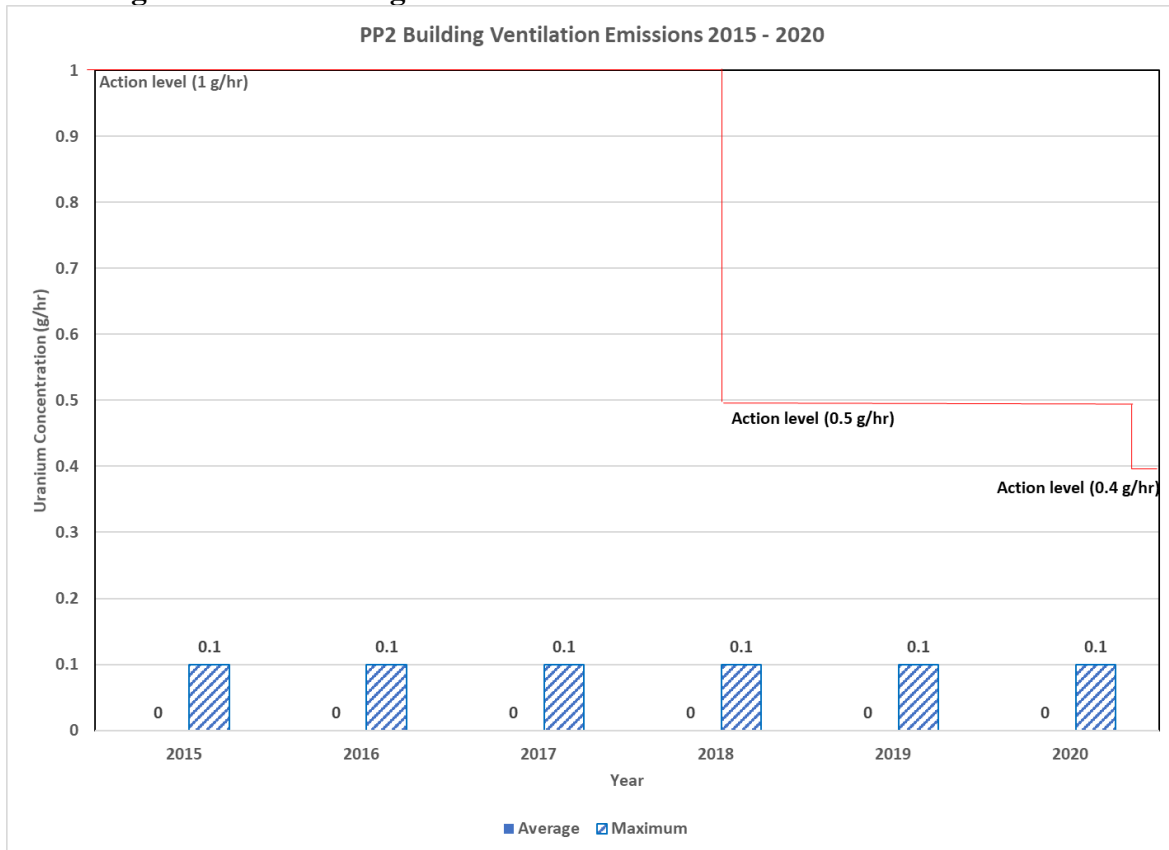
CFM continues to refine the calculations for building ventilation discharges to include real-time data that is more representative of airborne uranium that reaches the HVAC system.

Figure 6 Building Ventilation Emissions 2012-2020



In 2015, the PP2 area was brought online and building ventilation emissions for this area were calculated with CAMHEAD data and exhaust discharge rates, accounting also for the HEPA filtration on these discharges. A separate action level of 0.5 g/hr for the PP2 building ventilation was implemented in 2018. This action level was reviewed again in 2021 and has been reduced to 0.4 g/hr. The building ventilation emissions from the PP2 area are shown in Figure 7.

Figure 7 PP2 Building Ventilation Emissions 2015 – 2020

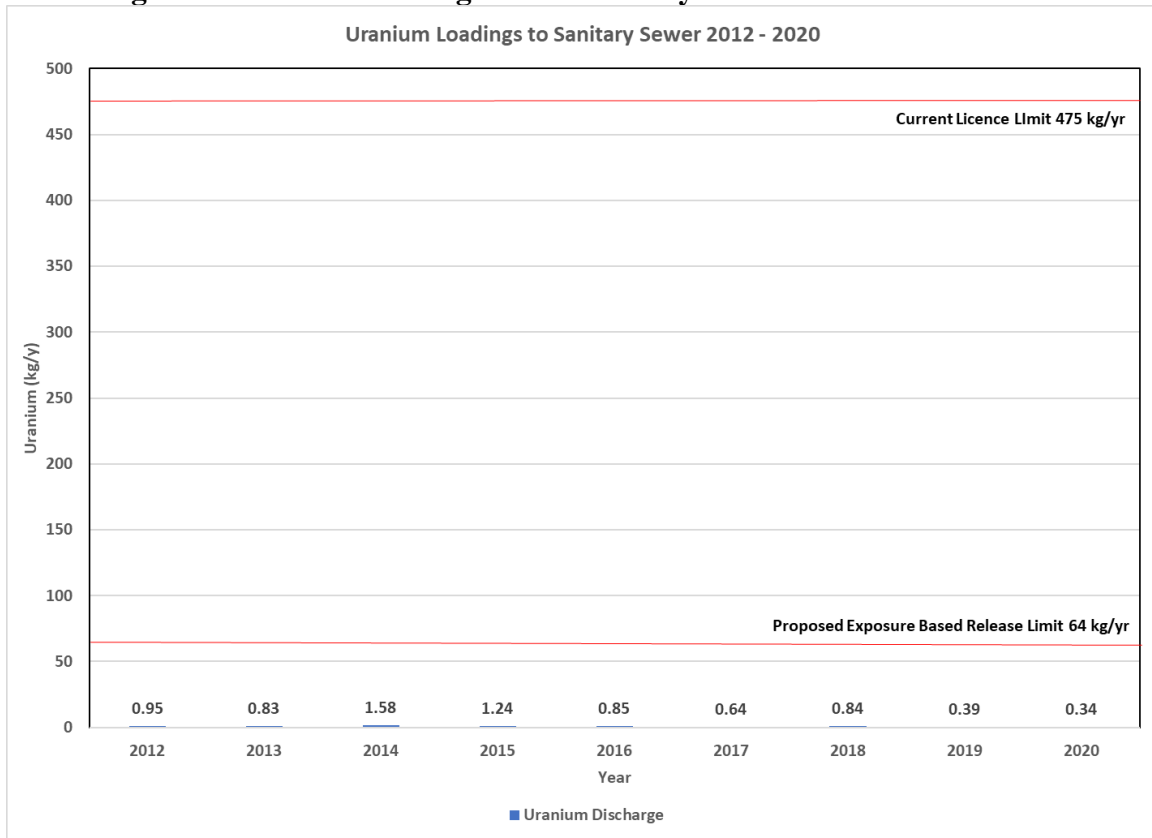


Discharge to Sewer

Liquid effluent generated from production processes is collected and treated to remove the majority of the UO_2 using an evaporator process. The evaporator sludge is sent to BRR for uranium recovery. The condensed liquid from the evaporator is sampled and analyzed prior to a controlled release to the sanitary sewer. Liquid effluent generated from sanitary sewer systems (e.g., showers and bathroom facilities, laundry facilities, etc.) are released directly to sanitary sewer. A composite sample of the discharge to sanitary sewer is taken twice a week and is analyzed for uranium concentration.

CFM's release limit to the sanitary sewer over the licence period was expressed as a total loading in kg U/year. The uranium loading to sanitary sewer is shown in Figure 8. In the next licence period an exposure-based release limit (EBRL) as a concentration of uranium per sample has been proposed. For comparison purposes, the loadings equivalent of the proposed EBRL is also shown in this figure.

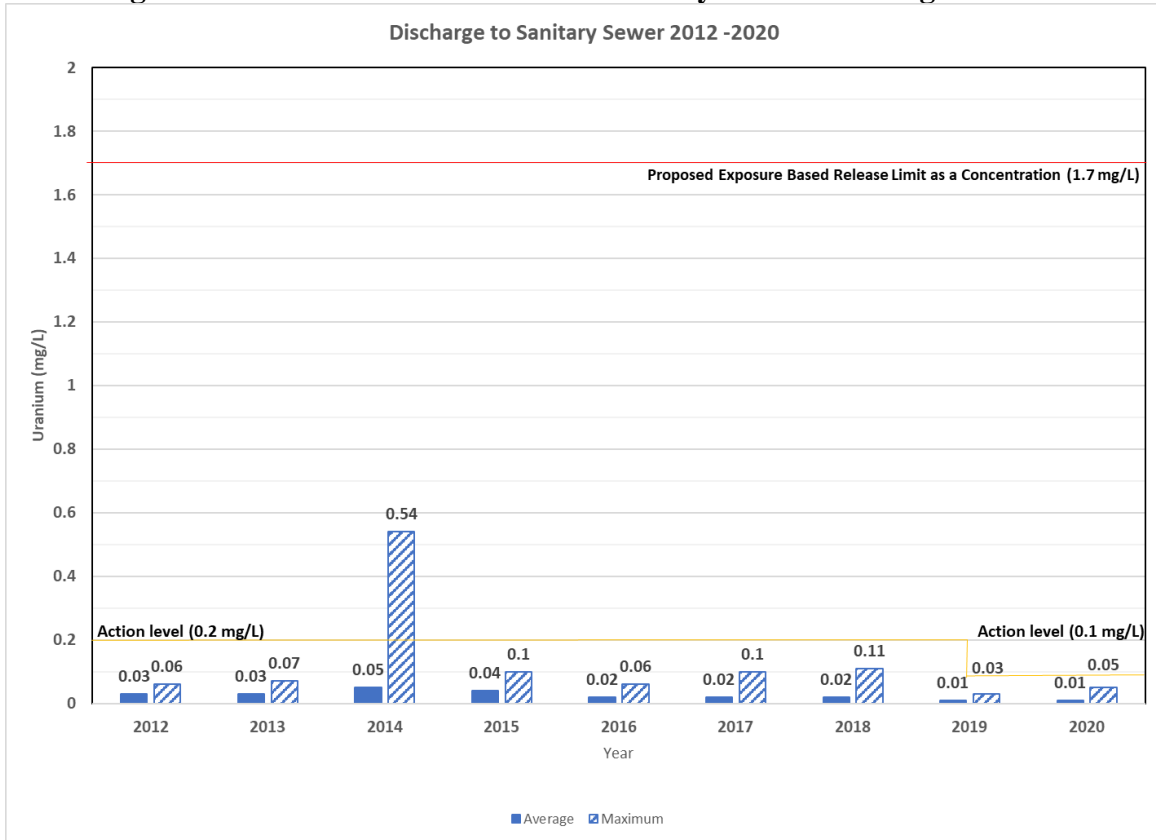
Figure 8 Uranium Loadings to the Sanitary Sewer 2012 – 2020



In the current licence period, CFM has had an action level in place for the uranium concentration in the sanitary sewer discharge. CFM decreased this action level to 0.1 mg U/L during the current licence period. For the next licence period, the proposed EBRL aligns the action level and licence limit in terms of units. Figure 9 shows the average and maximum uranium concentrations during the licence period, and the proposed EBRL is shown for reference. There were two exceedances of the applicable action level during the licence period:

- 2014 (one exceedance) - maintenance work on the furnace sanitary sewer lines dislodged historic material to the sanitary sewer. The incident was reported, investigated and corrective actions implemented.
- 2018 (one exceedance) - as of January 2018 the action level was lowered from 0.2 mg U/L to 0.1 mg U/L. That same month during the commissioning of a new grinder system the discharge to sanitary sewer was measured at 0.11 mg U/L. After investigation and concurrence from CNSC staff, the previous action level was reinstated for 12 months until the grinder project was completed to allow for some variability during commissioning of the grinder.

Figure 9 Uranium Concentration in Sanitary Sewer Discharge 2012 – 2020



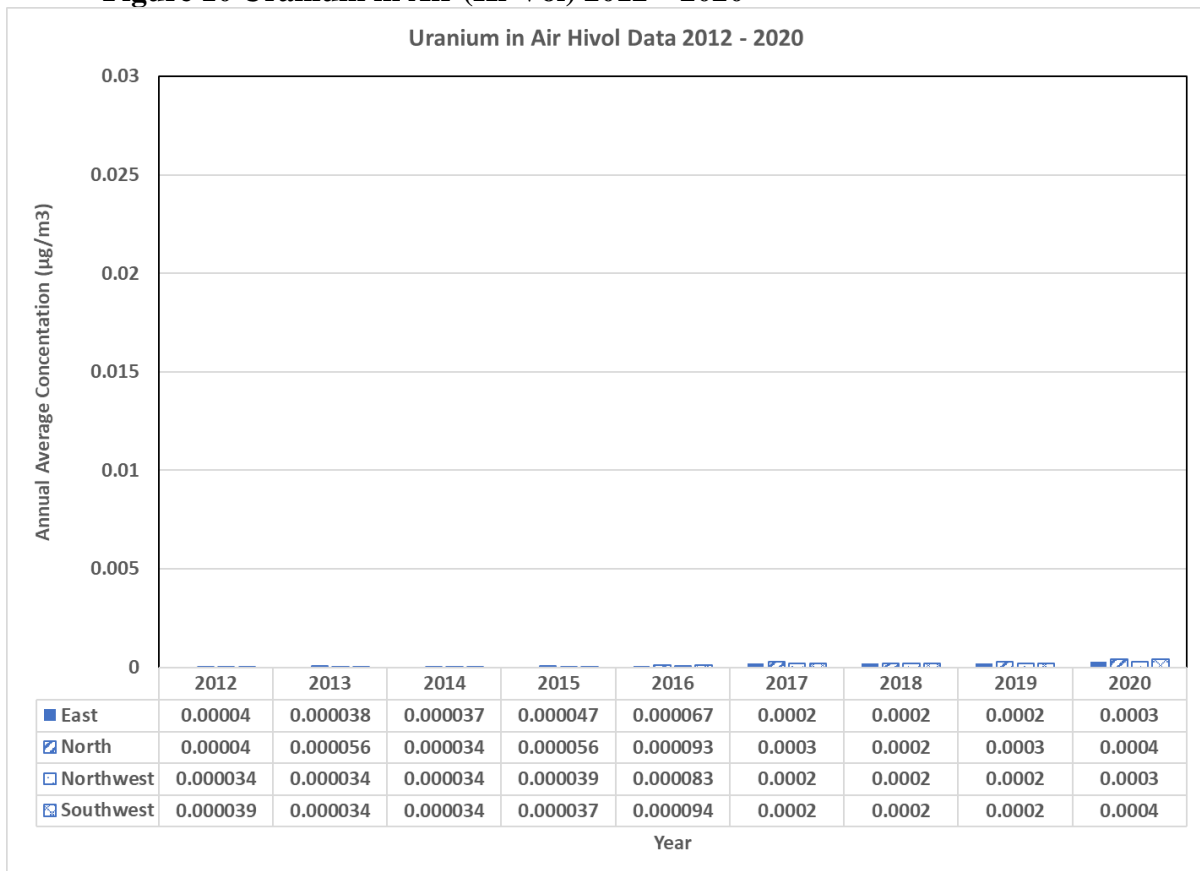
Ambient Air Monitoring

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 UO₂ that has been emitted from gaseous emissions (i.e. stack as well as fugitive 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 hi-vol monitoring data from the current licence period are shown in Figure 10. As part of the investigation into the 2016 process stack action level exceedance, an opportunity was identified to improve data reporting for hi-vols. An assessment was completed in 2017 to compare analysis techniques, and CFM switched to hi-vol analysis by ICP-MS in 2018, consistent with PHCF and BRR.

Figure 10 Uranium in Air (Hi-Vol) 2012 – 2020

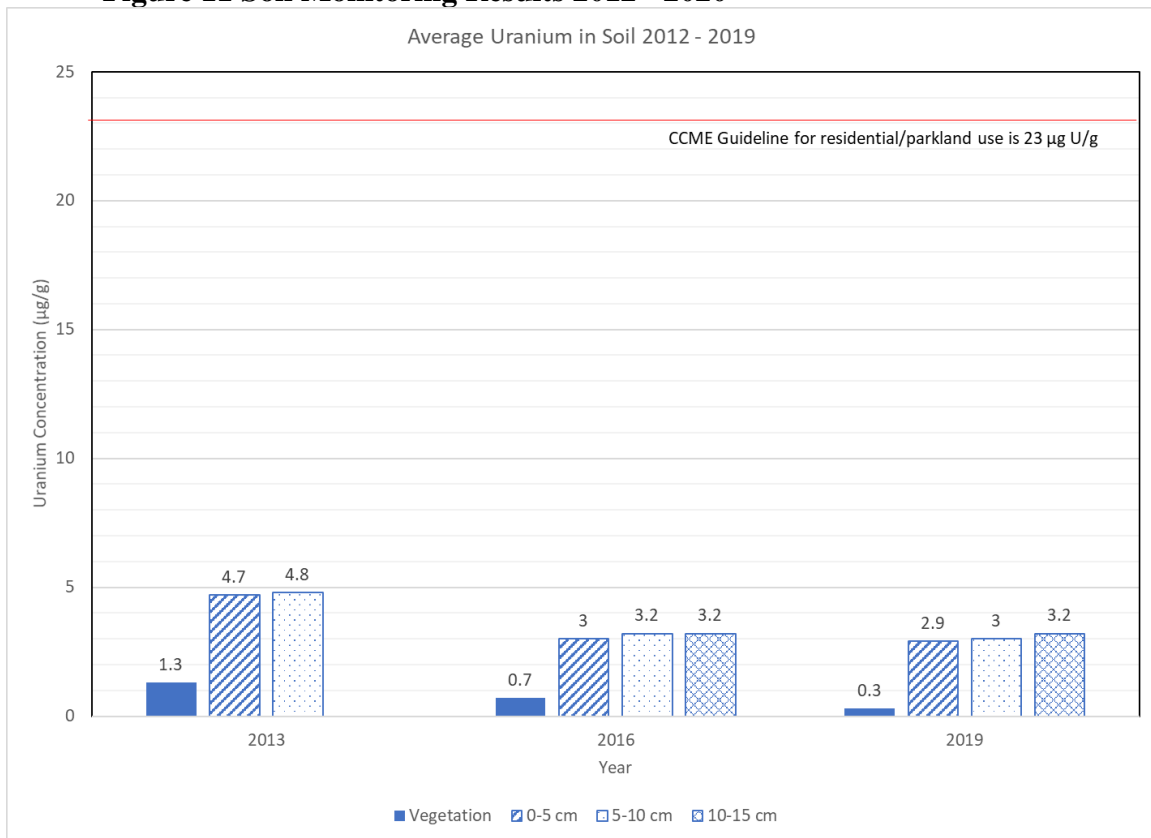


Soil Monitoring

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. A summary of soil samples collected during the licence period are shown in Figure 11. All samples were well below the Canadian Council of Ministers of the Environment (CCME) soil guideline for residential/parkland property use (23 µg U/g).

Figure 11 Soil Monitoring Results 2012 - 2020



Groundwater Monitoring

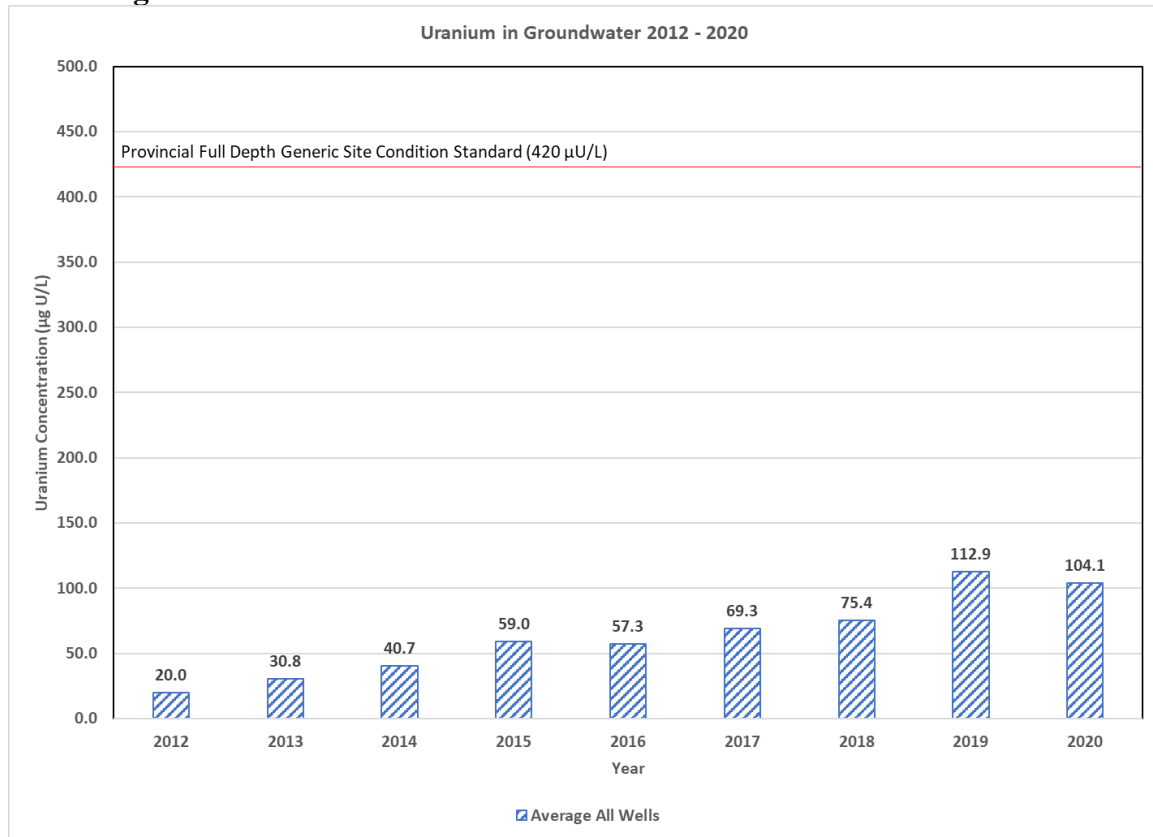
CFM has an extensive groundwater monitoring program in place. Groundwater sampling is completed at up to 70 monitoring wells, up to 12 pumping wells, up to three sumps associated with the groundwater treatment system, as well as groundwater treatment system influent and effluent. Groundwater monitoring locations are sampled semi-annually in the spring and fall of each year. Approximately 65% of the wells are located within the fenceline which defines the licensed site. Annual groundwater reports are provided to CNSC staff and MECP. A groundwater protection program to meet the requirements of CSA N288.7-17 *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* was submitted to CNSC staff in September 2021*.

*FSD letter – Cameco Fuel Manufacturing Groundwater Protection Program and Groundwater Monitoring Program Summary Report – September 30, 2021

A summary of uranium in groundwater results between 2012 and 2020 is shown in Figure 12. The annual average uranium concentration for all wells is less than the Provincial Full Depth Generic Site Condition Standards in a Non-Potable Water Condition for Industrial/Commercial/Community Property Use (Table 3 Standard). All results from offsite monitoring wells were well below the applicable Provincial Table 3 Standard of 420 µg U/L. The annual average uranium concentration increases over the licensing period due to three onsite wells where uranium in groundwater consistently exceeded the Table 3 Provincial Standard. These wells are located outside the northeast corner of the production

building, in an area with localized historical uranium in soil contamination. Although the ERA concluded there are no risks to humans or the environment from uranium in groundwater, CFM continues to monitor the uranium in groundwater results closely as part of the annual groundwater report submitted to CNSC and MECP.

Figure 12 Uranium in Groundwater 2012 – 2020



In addition, CFM submitted an Environmental Risk Assessment (ERA) dated August 2016 in accordance with the requirements of N288.6-12, *Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills*. In accordance with Section 11 of N288.6-12, a review of the Environmental Risk Assessment was completed in 2021 which concluded that new monitoring data and changes in toxicity values and approaches to evaluation of aquatic receptors do not result in changes to the 2016 ERA conclusions.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Environmental Protection SCA.

Forward Outlook

REGDOC-2.9.2 *Environmental Protection: Controlling Releases to the Environment* is expected to be published in the next licence period. There is an established process for review of new standards and REGDOCs and their incorporation as Compliance Verification Criteria (CVC) or guidance in the LCH. In accordance with that process, CFM will identify and address any on a schedule accepted by CNSC staff. It is expected that

CFM will continue to maintain and enhance as necessary - its Environmental Protection Program during the next licence period.

2.10 Emergency Management and Response

This SCA 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 and any results of emergency exercise participation.

Operational Performance

Emergency preparedness and response training is provided on an ongoing basis to ensure that responders have the knowledge and skills necessary to provide for an effective emergency response. The following response organizations for the protection of human health, the environment and property are available: Immediate Responders, Emergency Response Organization (ERO), Local Crisis Management Team, and Corporate Crisis Management Team. Each of these organizations has a manual and/or procedures or guidance documents to ensure that the organizational response to an emergency situation is systematic and meets the regulatory requirements commensurate with the nature of the emergency.

CFM conducts internal drills and training exercises to test the effectiveness of the site and the emergency response organization. CFM performed full-scale emergency response exercises including the local emergency services and hospital in 2013, 2016, and 2019.

During the current licence period, REGDOC 2.10.1: *Nuclear Emergency Preparedness and Response* and CSA N393-13: *Fire Protection for facilities that process, handle, or store nuclear substances* were published and incorporated into the licence requirements. CFM updated the Emergency Response Plan, Fire Protection Program and Fire Hazard Analysis to include new requirements from these documents to enhance its already strong emergency response program.

Between 2012 and 2020 CNSC staff has rated CFM as satisfactory in the Emergency Management and Fire Protection SCA every year.

Forward Outlook

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

2.11 Waste Management

This SCA 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/or by-product management facility. This SCA also covers the ongoing decontamination projects and planning for decommissioning activities.

Operational Performance

Ongoing wastes are those generated at the facility as a result of activities authorized by the licence. Solid wastes contaminated by uranium are reprocessed, recycled and re-used to the extent possible. Waste materials that cannot be reprocessed, recycled or re-used are safely stored on site until appropriate disposal options are available.

In the current licence period, several activities were undertaken to address the accumulated legacy radioactive waste that has been stored at CFM for many years. In 2014, CFM began routine shipments of contaminated combustible material to the Blind River Refinery for incineration. Also in 2014, two significant campaigns were undertaken to transfer approximately 900 m³ of contaminated non-combustible materials to an appropriately permitted facility in the United States. In 2019, CFM implemented a small-scale project model for routine shipments of contaminated non-combustible waste to an appropriately permitted facility in the US. Routine disposal of this material began in 2019. Between 2019 and the end of September 2021, approximately 127,000 kg of legacy waste has been safely disposed of.

During the current licence period, CFM incorporated the requirements of CSA standard N292.3-14 *Management of Low- and Intermediate-Level Radioactive Waste* and CSA standard N292.0-14 *General Principles for the Management of Radioactive Waste and Irradiated Fuel* into its waste management program.

Decommissioning Planning

CFM has a Preliminary Decommissioning Plan (PDP), which meets the requirements provided in CSA N294.0-09 *Decommissioning of facilities containing nuclear substances*. The PDP and associated cost estimate were revised and submitted to CNSC in May 2021. The PDP and cost estimate for a revised financial guarantee of \$10.8 million were accepted by CNSC staff in September 2021. The proposed changes to the amount of the financial guarantee will be considered by the Commission in the one-year licence renewal hearing scheduled for December 2021. Once approved by the Commission, CFM will secure an irrevocable letter of credit to cover the full amount required by the updated cost estimate.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Waste Management SCA every year.

Forward Outlook

REGDOC-2.11.1 *Waste Management, Volume I: Management of Radioactive Waste*, and REGDOC-2.11.2, *Decommissioning* have recently been published. There is an established process for review of new standards and REGDOCs and their incorporation as Compliance Verification Criteria (CVC) or guidance in the LCH. In accordance with this process, CFM will identify and address any gaps in the waste management program on a schedule accepted by CNSC staff.

2.12 Nuclear Security

This SCA 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.

Operational Performance

CFM maintains a comprehensive Facility Security Plan (Security Plan) which meets the requirements of the *General Nuclear Safety and Control Regulations*, the *Nuclear Security Regulations* and other CNSC requirements.

The 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, this document is considered prescribed information and is subject to the requirements of the *General Nuclear Safety and Control Regulations*. CFM ensures that security operations and procedures are reviewed (and revised as needed) in order to maintain compliance with *General Nuclear Safety and Control Regulations*, the *Nuclear Security Regulations* and other CNSC requirements.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Security SCA every year.

Forward Outlook

CFM will continue to maintain and enhance (if necessary), the Security Plan during the upcoming licence period.

2.13 Safeguards and Non-Proliferation

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

Operational Performance

During the current licence period, a new accountability system was implemented to align with electronic reporting requirements described in REGDOC-2.13.1 *Safeguards and Nuclear Material Accounting*. FSD Safeguards Program (FSD-PGR-SG-01) was developed to demonstrate how CFM meets all requirements under the REGDOC. Periodic audits of the safeguards program are conducted by the IAEA, the CNSC and by internal auditors. During the current licence period a total of 18 Short Notice Random Inspections and ten Physical Inventory Verifications were carried out by the IAEA and CNSC as part of safeguards activities.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Safeguards and Non-Proliferation SCA.

Forward Outlook

CFM will continue to maintain and enhance - if necessary, the Safeguards Program during the upcoming licence period.

2.14 Packaging and Transport

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

Operational Performance

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*.

Between 2012 and 2020, two minor transportation events were reported by CFM related to material shipped from PHCF to CFM. These were investigated, corrective actions put into place, and no environmental impacts occurred as a result.

Between 2012 and 2020, CNSC staff rated CFM as satisfactory in the Packaging and Transport SCA every year.

Forward Outlook

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

3.0 OTHER MATTERS OF REGULATORY INTEREST

3.1 Public Information Program

FSD maintains a Public Information Program (PIP) that meets the requirements of REGDOC 3.2.1, *Public Information and Disclosure*. FSD works to build and sustain the trust of local communities by acting as a good corporate citizen in its local communities. 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. These are central values for FSD and it is these values that drive the PIP.

For many years FSD has retained outside expertise to measure public opinion in Port Hope to help determine the effectiveness of the PIP. The most recent survey of more than 325 residents of Port Hope was completed by Fast Consulting in 2021. The final report is available on FSD's community website.

The survey results indicate that residents of Port Hope continue to show strong support for local FSD operations. 91% of local residents support FSD's continued operations in Port Hope. The results of the survey, remain consistent, with other significant findings including:

- The large majority of respondents (85%) agree Cameco does everything possible to protect people and environment.
- Nearly all (93%) agree Port Hope is a safe, healthy place to live, including 74% who 'strongly agree'.

The results of this public opinion research confirm that FSD's PIP is seen as effective and appropriate by the vast majority of Port Hope residents. FSD will continue to explore opportunities to enhance the public information program for target audiences.

3.2 Indigenous Engagement

FSD is committed to provide opportunities to engage with First Nation and Métis communities regarding CFM's ongoing operations.

There are no First Nations communities located within the Municipality of Port Hope. However, Mississaugas of Scugog Island First Nation, Hiawatha First Nation, Alderville First Nation and Curve Lake First Nation are included in the Port Hope primary target audience of the PIP. Efforts to engage this audience include:

- Issuing an annual letter/email to Indigenous groups to determine interest in further engagement and preferences for engagement such as meetings and/or facility tours.
- Mailing the Energize newsletter.
- Mailing a copy of the Annual Reports.
- Mailing/emailing a copy of the Quarterly Compliance Monitoring and Operational Performance Report.

- Inviting First Nations to any FSD-led activities such as information sessions or community barbeques.
- Informing of any licensing activities through letters/email.

The Chippewawas of Beausoleil First Nation, Chippewas of Georgina Island First Nation, Chippewas of Rama First Nation, Mohawks of the Bay of Quinte, and the Metis Nation of Ontario Region 7 are part of the Port Hope secondary target audience identified in the PIP. Efforts to engage with these groups include:

- Issuing an annual letter/email to determine interest in further engagement including meetings and/or facility tours.
- Informing of any licensing activities.

As with any interested party, FSD will review and respond accordingly to any request from an interested Indigenous group. FSD now meets regularly with Curve Lake First Nation to discuss areas of interest, such as licensing activities, environmental monitoring, and public disclosure.

FSD will continue outreach to the local First Nations and Métis communities throughout the licensing process and subsequent licence period.

3.3 Financial Guarantee

The CFM has a Preliminary Decommissioning Plan (PDP), which was prepared based on guidance provided in CSA N294.0-09 *Decommissioning of facilities containing nuclear substances*. The current financial guarantee, maintained in the form of irrevocable letter of credit for \$21 million reflects the PDP accepted by the Commission during the previous licensing proceedings. As part of this licence renewal, CFM is putting forward a financial guarantee of \$10.5 million.

4.0 CONCLUDING REMARKS

CFM is committed to the safe, clean and reliable operations of its facilities and continually strives to improve safety performance and processes to ensure the safety of both its employees and the people in neighbouring communities.

During the current licence period, CFM exhibited strong performance in all safety and control areas. As a result of the effective programs, plans and procedures in place, CFM was able to maintain individual radiation exposures well below all regulatory dose limits. In addition, environmental emissions continued to be controlled to levels that are a fraction of the regulatory limits, and public radiation exposures are also well below the regulatory limits.

FSD's relationship with its neighboring communities remains strong and CFM is committed to maintaining these strong relationships.

As described above, CFM is committed to continual improvement in all aspects of the CFM performance. The following have been identified as priorities for the next licensing period:

- Alignment of site programs with standardized regulatory expectations as described in REGDOCS
 - REGDOC 2.1.2 for Safety Culture
 - REGDOC 2.4.4 for Safety Analysis
 - REGDOC 2.9.2 for Environmental Protection
 - REGDOC 2.11.1 for Waste Management
 - REGDOC 2.11.2 for Decommissioning