CAMECO CORPORATION
FUEL SERVICES DIVISION

2017 LICENCE RENEWAL APPLICATION
FOR THE
PORT HOPE CONVERSION FACILITY

November 20, 2015

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1.0 INTRODUCTION

1.1 Cameco Corporation and the Fuel Services Division

Cameco Corporation (Cameco) is one of the world's largest uranium producers and is a prominent supplier of uranium processing services required to produce nuclear fuel for the generation of clean electricity. Cameco is committed to the safe, clean and reliable operation of all of its facilities and continually strives to improve safety performance and processes to ensure the safety of both its employees and the people in its neighbouring communities.

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. Cameco operates the Port Hope Conversion Facility (PHCF) and provides uranium dioxide (UO_2) and uranium hexafluoride (UF_6) conversion services for nuclear operators around the world, including all of the UO_2 needs of Canada's domestic CANDU fleet. The ISO 14001 registered facility produces UF_6 and UO_2, required in the production of fuel for light water and CANDU-type, heavy water nuclear reactors.

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 employees share in the responsibility of continually improving the workplace safety and lessening impacts on the surrounding environment. Cameco values the contribution of every employee and respects individual dignity, creativity and cultural diversity. Through personal and professional integrity, Cameco employees lead by example, earn trust, honour commitments and conduct our business ethically. Through leadership, collaboration and innovation, Cameco employees 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 Cameco remains qualified to carry out its licensed activities, in compliance with the applicable regulatory 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 Port Hope Conversion Facility

Eldorado Gold Mines Limited began operations in late 1932 on the northeastern portion of the PHCF site. The company became Eldorado Mining and Refining Limited, a federal Crown corporation when Eldorado Gold Mines was purchased by the federal government in 1944. In 1988, after its formation, Cameco became the owner and licensed operator of the facility.

The PHCF receives nuclear grade uranium trioxide (UO_3) for conversion to either UF_6 or UO_2. These compounds are used for the light and heavy water reactor programs, respectively. The PHCF is also licensed to produce uranium metal for use in a variety of industrial applications. Facilities to support uranium processing including maintenance, waste management, laboratory services, utilities and materials handling are operated within the licensing basis, as will be described in the safety and control areas. Uranium processing is primarily federally regulated and licensed by the Canadian Nuclear Safety Commission (CNSC). The PHCF is important to the generation of clean electricity domestically and globally:

- Sole supplier of natural UO_2 conversion services for domestic CANDU fuel production
- Uranium processed at the facility is responsible for ~50% of all power generated in Ontario and ~15% of all power generated in Canada
- One of only two facilities in North America producing UF_6 for enrichment and light-water power reactors worldwide

1.3 Application for Licence Renewal

The current Nuclear Fuel Facility Operating Licence (FFOL-3631.00/2017) for PHCF, issued by the CNSC is valid until February 28, 2017. This application for licence renewal and the documents listed in Appendix 1 are intended to provide the basis for renewal of the operating licence and demonstrate adherence of the PHCF's operations to 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*

In addition, CNSC regulatory documents, CSA standards, codes and other regulatory documentation are used to provide additional recommendations and guidance for the programs, plans and associated documentation Cameco maintains to ensure that it operates the facility within the licensing basis approved by the Commission. The PHCF maintains programs and plans to meet the requirements of the Safety and Control Areas (SCA) as required by its licence. In addition, PHCF has maintained strong performance in all SCAs during the current licence period as noted in the annual staff reports to the Commission. In order to improve the consistency of Class IB facilities, CNSC staff began recommending the implementation of additional regulatory documents and CSA standards during the current licensing period. Cameco is committed to integrating these new standardized requirements on an ongoing basis as part of its continual improvement program. A summary of the current recommendation and guidance documents, along with current status is provided in Appendix 2.

Within the requested licence period of 10 years, the PHCF expects to continue with current licensed operations and to carry out its Vision in Motion (VIM) project to clean up and renew the facility. This renewal application is written to describe Cameco's licensing basis for the ongoing operations and the implementation of the VIM project. Acronyms and abbreviations used throughout the application are found in Appendix 3. A matrix indicating where in the application the information required by the NSCA and regulations may be found in Appendix 4.

2.0 DESCRIPTION OF OPERATIONS AND OTHER LICENSED ACTIVITIES

The PHCF operations date back to the 1930s when the facility was originally developed to recover radium from ores mined in northern Canada. Uranium processing at the facility began in the 1940s by Eldorado Nuclear Limited and continues today. The merger of Saskatchewan Mining Development Corporation and Eldorado Nuclear Limited in 1988 resulted in the formation of Cameco Corporation, the present owner and licensed operator of the facility at Port Hope.

2.1 Facility Location and Layout

The PHCF is situated on the north shore of Lake Ontario in Ward 1 of the Municipality of Port Hope, Ontario as shown in Figure 1. The legal description of the licensed facility is provided in the Facility Licensing Manual (FLM) and Appendix 5. Copies of the land titles and lease agreements are maintained at the site.

Figure 1 – Port Hope Conversion Facility Siting

Site 1 consists of two properties, the 9.6 hectare main site property for operations and storage located at 1 Eldorado Place (designated as "Site 1 – main site operations and storage") and the 3.8 hectare Centre Pier property for storage located at 1 Hayward Street (designated as "Site 1 – Centre Pier storage"). An aerial photograph of Site 1 is shown in Figure 2 and layout drawings found in Figures 3 and 4.

Figure 2 – Site 1, Port Hope Conversion Facility and Centre Pier looking north

Figure 3 – General Plant Layout Site 1 – Main Site Operations and Storage

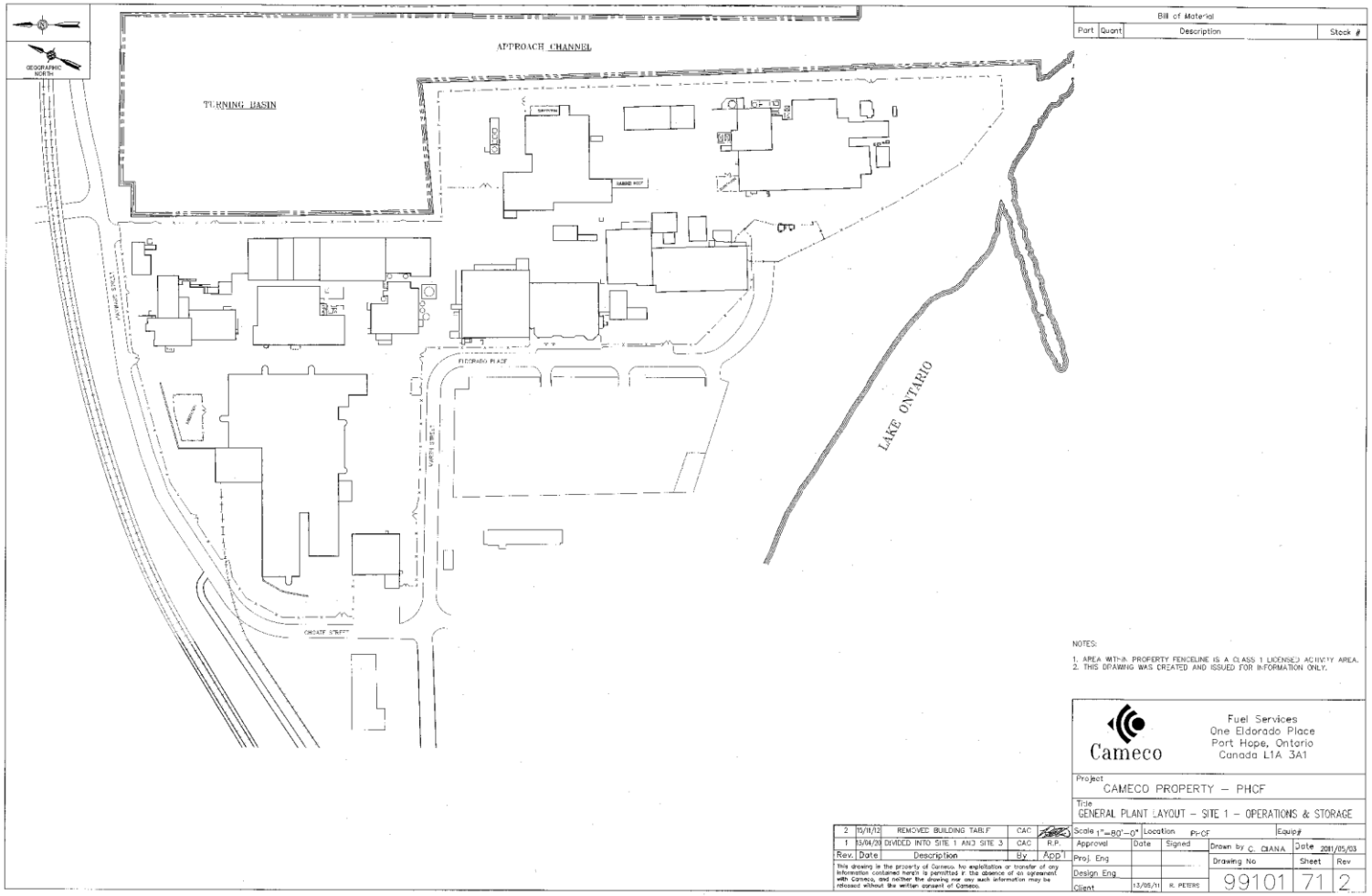
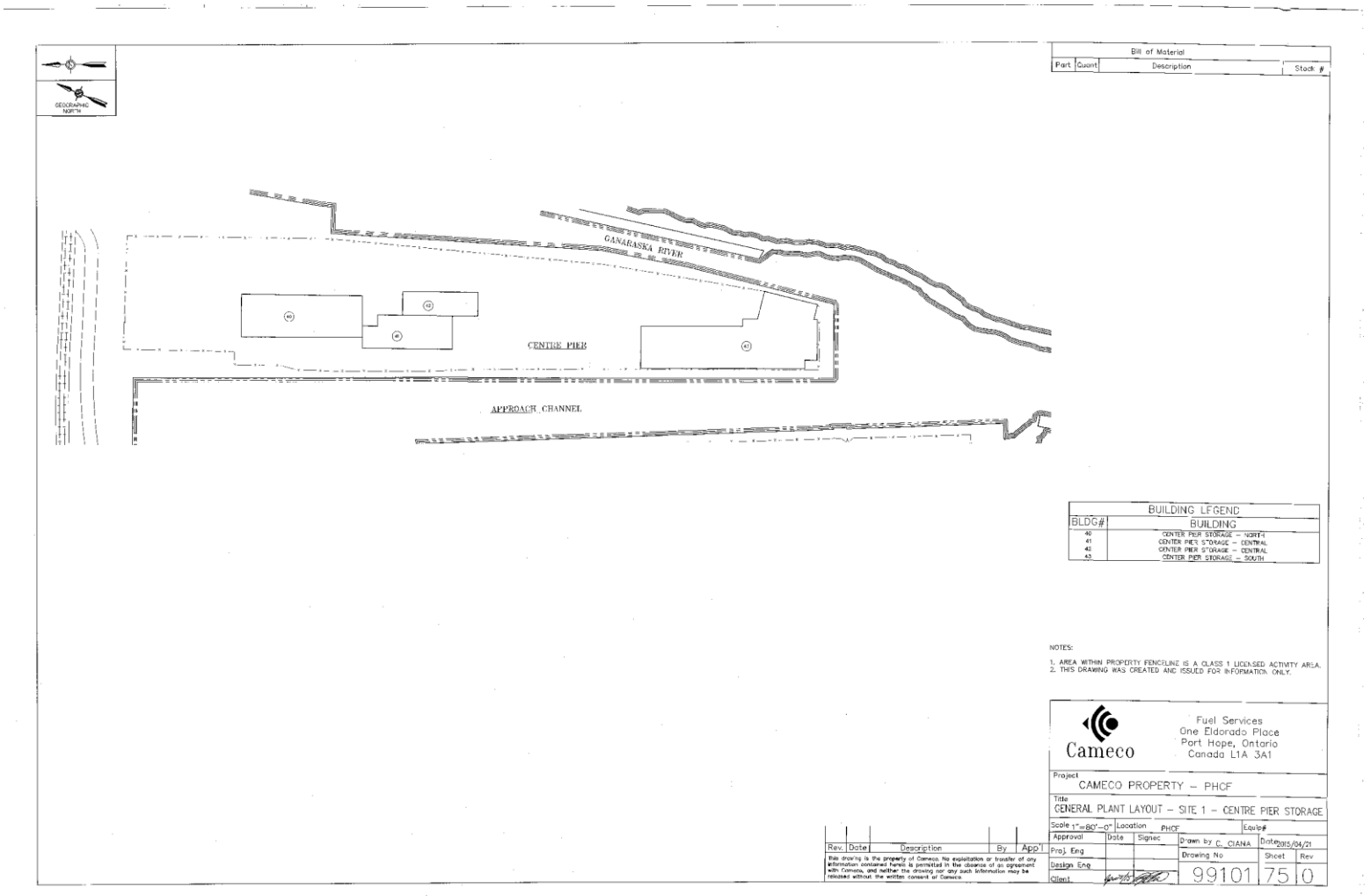


Figure 4 – General Plant Layout – Site 1 – Centre Pier Storage

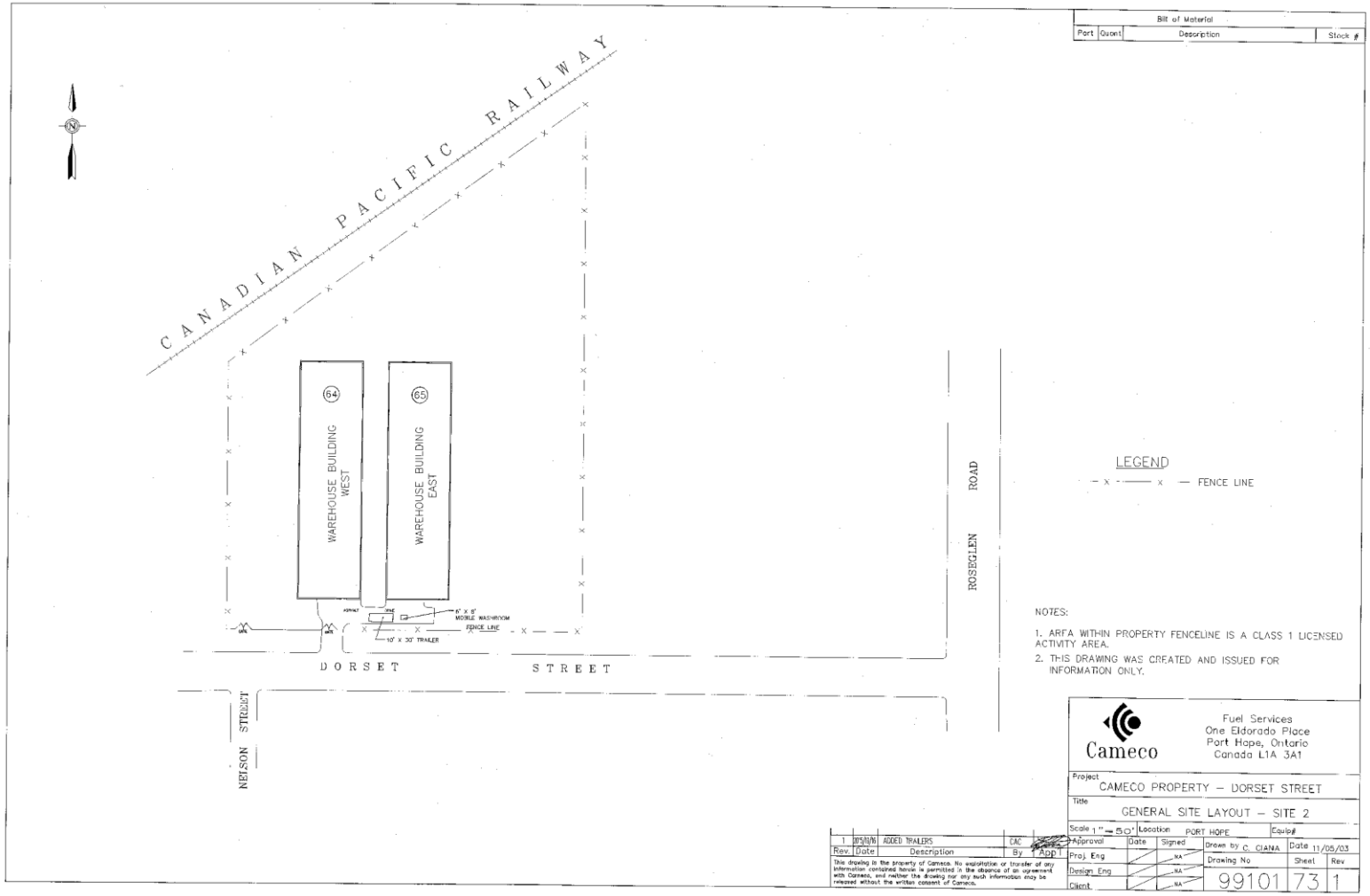


Site 2 consists of a single 2.15 hectare property for storage facilities located at 158 Dorset Street East. The Centre Pier and Dorset Street East properties are used primarily for storage of various products, equipment and waste.

An aerial photograph of Site 2 is shown in Figure 5 and a layout drawing in Figure 6.

Figure 5 – Site 2, Dorset Street Storage Facility looking south

Figure 6 – General Plant Layout – Site 2 Dorset Street Storage



2.2 Processes and Materials

The facility at Port Hope is divided into three basic processing operations: production of UF_6, UO_2 and specialty metals. Additional activities are undertaken under the operating licence in support of the three basic processing operations.

2.2.1 UF_6 Production

In the UF_6 process, UO_3 is pulverized and fed into a fluid bed reactor. Hydrogen gas enters the fluid bed reactors, reducing the UO_3 powder to UO_2. The UO_2 powder is fed into the hydrofluorination reactors where water, hydrogen fluoride (HF) and dilute aqueous hydrofluoric acid convert the UO_2 to uranium tetrafluoride (UF_4). The UF_4 slurry is then dried and calcined, which heats the UF_4 removing the final traces of water.

The calcined UF_4 is then reacted with fluorine gas in a flame reactor to produce UF_6. Cameco produces fluorine using electrolytic cells. Electric current passes through the cell and dissociates the HF into hydrogen and fluorine. These gases are diverted to separate draw off points and fluorine is used to convert UF_4 to UF_6.

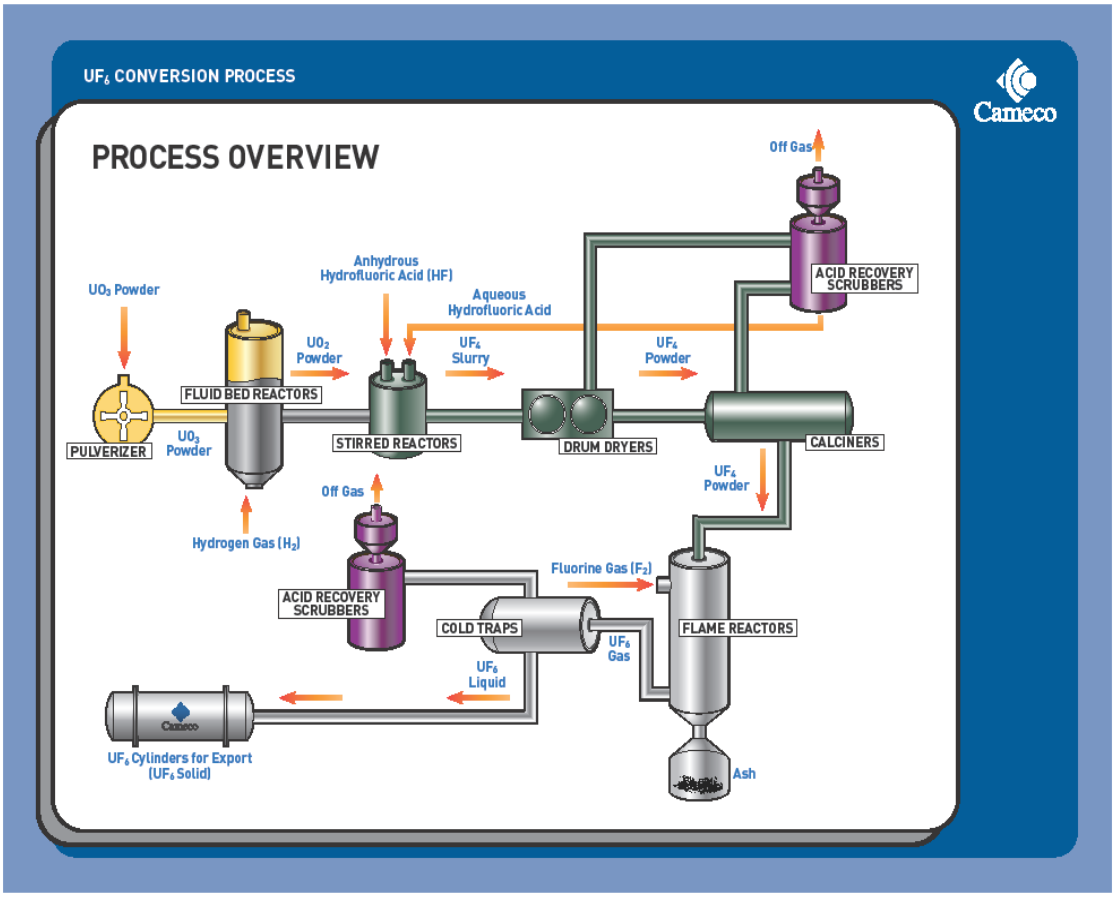
The UF_6 gas produced in the flame reactors is passed through filters to remove any solid particles before entering the cold traps. The cold traps cool and sublimate the gaseous UF_6 into a white crystalline solid.

When the cold traps are full, they are heated to liquefy the crystallized UF_6. The liquid UF_6 is drained into approved specially designed, heavy walled steel shipping cylinders. The cylinders are allowed to cool to ambient room temperature causing the UF_6 liquid to freeze to a solid. Cylinders containing solid UF_6 are then transported to enrichment plants in other countries.

Within the UF_6 plant effluent treatment circuit, spent potassium hydroxide (KOH) is dried to produce a crystalline flake. The dried flake is known as fluoride product which is primarily shipped to Cameco's Key Lake operation for uranium recovery.

A simplified block diagram of the UF_6 production process is provided in Figure 7.

Figure 7 – UF_6 Production Process



Cameco is not requesting any changes to the licence with respect to the production of UF_6.

2.2.2 UO_2 Production

In the UO_2 process, UO_3 powder is dissolved in nitric acid to produce uranyl nitrate. The uranyl nitrate solution is diluted with water and then reacted with aqueous ammonia to precipitate ammonium diurante (ADU).

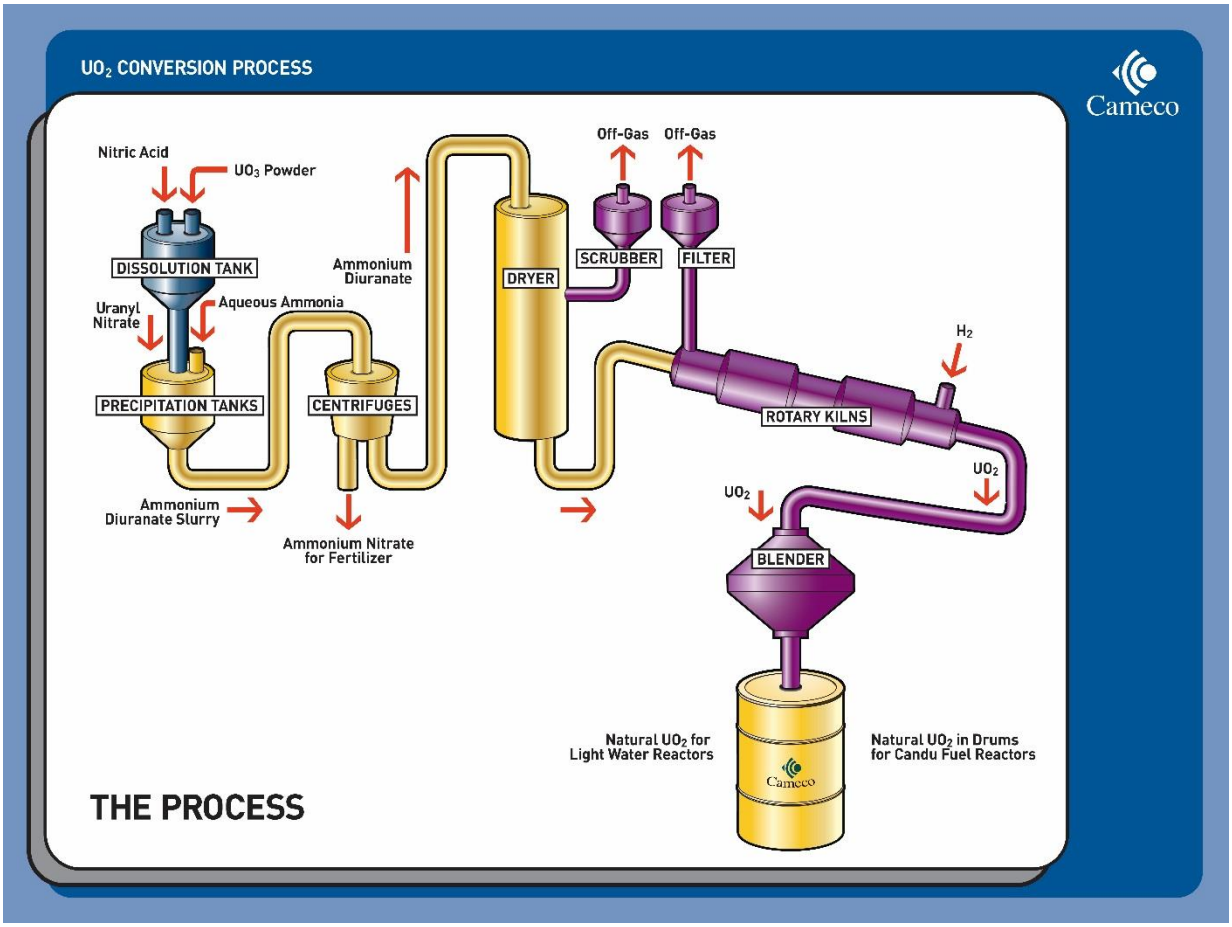
The ADU slurry undergoes solid liquid separation in centrifuges. The liquid phase is recovered and sent to the ammonium nitrate circuit for treatment prior to sale as a by-product. The wet ADU solids form a cake in the centrifuge, which is dried continuously by direct contact with hot air in a drier.

The dried ADU solids are reduced with hydrogen to form UO_2 in the heated rotary kilns. The final product of the process is a ceramic grade UO_2 powder. The powder is blended and shipped to domestic and international fuel fabricators.

The UO_2 process generates an ammonium nitrate (NH_4NO_3) solution as a by-product which is released to an agricultural supply company for use as in production of an agricultural fertilizer. The ammonium nitrate by-product is analyzed to ensure that the uranium and radium contents are less than the exemption quantities in the *Nuclear Substance and Radiation Devices Regulations, 2015* (NSRDR).

A simplified block diagram of the UO_2 production process is provided in Figure 8.

Figure 8 – UO_2 Production Process



Cameco is not requesting a change to the licence with respect to the production of natural UO_2.

2.2.3 Depleted Uranium Dioxide

The PHCF also maintains a depleted uranium process in the UO_2 plant. Depleted uranium powders are dissolved to form a uranyl nitrate solution which is pumped directly to the existing uranyl nitrate storage tank located within the UO_2 processing circuit where it is further processed to ceramic grade depleted UO_2.

Cameco is not requesting a change to the licence with respect to the production of depleted UO_2.

2.2.4 Uranium Metal Production

In the uranium metal (U metal) reduction process, measured quantities of UF_4 and magnesium metal granules (Mg) are blended together and loaded into a steel reduction vessel lined with an insulating magnesium fluoride (MgF_2) liner.

The reduction vessel is then capped and placed in a gas fired reduction furnace to initiate the exothermic reaction between UF_4 and Mg producing molten U metal and Mg F_2 slag. The vessel is then cooled to allow U metal/MgF_2 slag separation, removed from the furnace and transferred to the cooling bay to solidify. After cooling, the vessel lid is removed and the MgF_2 slag separated from the U metal derby which is cleaned and further processed. MgF_2 slag is crushed, ground to fine powder and reused as liner material in another reduction vessel.

2.2.5 Uranium Metal Casting

In uranium metal casting operations, uranium metal derbies and selected scrap materials are melted in a primary vacuum induction furnace and cast into billets or large size castings. Uranium billets and selected scrap materials are then re-melted in smaller, secondary vacuum furnaces and cast into a variety of shapes and sizes. Uranium castings can either be shipped directly or machined and plated according to customer's specifications.

Uranium metal casting operations consist of cleaning and sampling of uranium metal derbies, crucible and mould preparation, primary vacuum induction melting/casting, secondary vacuum induction melting/casting vacuum induction melting/continuous casting and machining and plating operations.

Uranium metal operations have not been undertaken in several years at the PHCF. Following discussions with CNSC staff, Cameco proposes that the following checkpoints be placed upon the return to service of the uranium metals operations:

- Commissioning plan to be submitted to CNSC staff
- Procedures to be developed and submitted to CNSC staff
- Training and qualification plan to be submitted to CNSC staff
- An updated safety report for uranium metal production to be submitted to CNSC staff
- Satisfactory prestart compliance inspection by CNSC staff

Authorization to restart uranium metal operations would be granted by an officer designated by the Commission following the satisfactory prestart compliance inspection and recommendation to authorize restart by CNSC staff.

2.3 Nuclear Substances and Radiation Devices

Cameco possesses a number of radioisotopes used for calibration of instruments, level detection and check sources. The radioisotope forms found at PHCF are:

- open sources (plated discs, solutions or powders)
- sealed sources used for measurement of density, level control or calibration purposes.
- sealed sources used in analytical equipment

The site maintains an inventory of sealed sources and radiation devices in accordance with the NSRDR as described in Appendix 6. The inventory identifies any nuclear substance contained in a radiation device, the brand name, model number and the radioactivity and quantity of the devices or sources. The licensed radioisotopes were originally covered by specific licenses, but have been incorporated into the facility operating license since 1997.

The site's programs for radiation and environmental protection, which are described in sections 4.7 and 4.9 of this document, extend to the use of nuclear substances, sealed sources and devices. This includes the monitoring of worker exposures and releases to the environment, emergency response, contamination control and the decontamination of any person, equipment or area to acceptable levels as a result of the licensed activity.

2.4 Vision in Motion (VIM)

2.4.1 Licensing Basis

The PHCF Clean-Up Program (CUP) (also referred to as Waste Management Program - 02 or WMP-02) has been in place for many years. WMP-02 clarifies how Cameco will manage CUP activities within the existing licensing basis. CUP was established to remove obsolete buildings, equipment and materials for the purpose of reducing environmental obligations, addressing health and safety hazards in underutilized buildings, creating useable space and improving the appearance of the PHCF. CUP may undertake these activities at any of the three properties that make up the PHCF.

CUP is an ongoing activity that consists of routine work and clean-up projects. Planning for CUP projects incorporates an assessment of the relevant safety and control areas from a decommissioning and waste management perspective. This assessment determines whether project-specific programs are required to supplement site programs to meet the requirements of the safety and control areas.

2.4.2 Project Overview

VIM is a specific project to carry out clean up and renewal activities at the PHCF in accordance with WMP-02. The original project description was submitted to the CNSC in 2006 under the name Vision 2010 Project.

The VIM project will facilitate remediation at the PHCF site, improve the operational efficiency and environmental performance of the PHCF and enhance site safety and security through site design. VIM also presents an opportunity for Cameco to make the PHCF more visually appealing, return the Centre Pier to the Municipality of Port Hope and improve public access to the waterfront. The project consists of removing several old or underutilized buildings; removing contaminated soils, building materials and stored wastes; transporting those soils and wastes to a long-term waste management facility (LTWMF); and constructing associated new infrastructure and building modifications.

2.4.3 Project Timeline

The VIM project is progressing with design activity based on the defined scope. The resulting plans will cover aspects such as monitoring and risk management, preliminary work plans, plans for site-project interactions and the implementation strategy and schedule.

The implementation phase of VIM is dependent on when the LTWMF is able to accept wastes from Cameco. It is anticipated that VIM implementation, which includes building demolition, soil remediation, groundwater treatment program expansion, and transfer of wastes that meet the waste acceptance criteria (WAC) to the LTWMF will occur over a four to five year period.

2.5 Request for Renewal

Cameco is seeking a 10-year renewal of its PHCF operating licence with the current UO_2, UF_6 and metals production limits of

- 2800 tonnes uranium as uranium dioxide from the UO_2 plant
- 12,500 tonnes uranium as uranium hexafluoride from the UF_6 plant, with a daily limit of 45 tonnes/day
- 2000 tonnes of uranium metal

Cameco believes that this is an appropriate licence term for the following reasons:

- PHCF has demonstrated that its performance has met CNSC staff expectations in all Safety and Control Areas (SCA) over the current licence term;
- The annual performance report on fuel cycle facilities provides the Commission with the opportunity to review PHCF's performance in a public meeting;

- Strong community support has been maintained for Cameco's continued operations in Port Hope;
- Other fuel cycle facilities that have renewed their licences within the last five years have received a 10-year licence term;
- The VIM project is being initiated within the upcoming licence period. A 10-year licence term provides sufficient flexibility to address potential delays;
- Cameco would like to offset the nuclear fuel facility operating licences within its FSD, the other licences expire in 2022; and,
- The operating licence and Licence Conditions Handbook (LCH) have requirements for 5-year reviews of studies that support the licence, including, the Environmental Risk Assessment (ERA), Derived Release Limit (DRL), Safety Report (SR), Preliminary Decommissioning Plan (PDP) and Fire Hazard Analysis (FHA), which would provide CNSC staff the opportunity to comprehensively review the performance of the facility.

2.6 Other Requests in this Licence

The following requested changes to the operating licence and LCH are also included in this application:

- The following change is requested
  - Remove the references to the North UO_2 Plant as a UO_2 production facility

- The following commitments are requested to be added to the production limit of 2000 tonnes of uranium metal in the LCH
    - Commissioning plan to be submitted to CNSC staff
    - Procedures to be developed and submitted to CNSC staff
    - Training and qualification plan to be submitted to CNSC staff
    - An updated safety report for uranium metal production to be submitted to CNSC staff
    - Satisfactory prestart compliance inspection by CNSC staff
  - Authorization to restart uranium metal operations would be granted by an officer designated by the Commission following the satisfactory prestart compliance inspection and recommendation to authorize restart by CNSC staff.

- Cameco also requests permission to treat and release groundwater, subject to the following conditions being added to the LCH
    - Only groundwater would be treated and discharged through this system. Approval to discharge other process water would not be included.
    - Proposed design of treatment system to be submitted to CNSC and MOECC staff for review

- Necessary provincial approvals secured to discharge to surface water
- Commissioning plan to be submitted to CNSC staff
- Procedures for operating and monitoring developed and submitted to CNSC staff. This would include anticipated water quality objectives.
- Regulatory action levels to be developed with appropriate risk assessment to demonstrate protection of people and the environment
- Satisfactory prestart compliance inspection by CNSC staff

- Authorization to discharge treated groundwater would be granted by an officer designated by the Commission following the satisfactory prestart compliance inspection and recommendation to authorize treated groundwater discharge by CNSC staff.

The remainder of this application will provide the information required to support renewal of the licence for a period of ten years. The information is organized as follows, with a detailed mapping of the licence application requirements set out in the *General Nuclear Safety and Control Regulations*, *Class I Nuclear Facilities Regulations*, NSRDR and the *Nuclear Security Regulations* in Appendix 4.

Section 3 will provide an overview of the site's performance in the current licence period, including achievements and improvement initiatives.

Sections 4.1 through 4.14 will describe the SCA performance, programs to ensure compliance, any improvement initiatives for each CNSC SCA, and, where applicable, any additional programs or controls that may be required for the VIM project to meet the requirements of each SCA.

Section 5 provides a discussion on facility-specific areas of interest.

The appendices provide supporting information for the application.

3.0 SITE PERFORMANCE OVERVIEW

This section describes operational highlights and improvement initiatives during the current licence period.

3.1 Performance in the Current Licence Period

Cameco is committed to the safe, clean and reliable operation of all of its facilities and continually strives to improve safety performance and processes to ensure the safety of both its employees and local residents. PHCF maintains the required programs, plans and procedures in the areas of health and safety, radiation protection, environment, emergency response, fire protection, waste management, and training. As a result of these

actions, PHCF's operations have maintained employee radiation exposures well below the regulatory dose limits. Environmental emissions and public radiation exposures are being controlled to levels that are a fraction of the regulatory limits.

In its annual performance reports to the Commission, CNSC staff has rated PHCF's performance as Satisfactory in all Safety and Control Areas each year of the current licensing period. Routine inspections by CNSC staff continue to confirm that PHCF is in overall compliance with the CNSC regulatory and licensing requirements. Action notices 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.

3.2 Conventional and Radiation Safety

Over the licence period, PHCF undertook a number of changes in the area of safety. Of particular note was the shift to an employee-led safety program modelled after Performance Solutions by Milliken. The Conversion Safety Steering Committee (CSSC), created in 2013, incorporates the previously-existing Policy Health and Safety Committee (PHSC) and Workplace Health and Safety Committee (WHSC) into one committee. The CSSC meets three days per month in an effort to improve safety performance on site and create a sustainable safety culture. The CSSC is active in promoting continuous improvement across the site and through seven active subcommittees focusing on the areas of:

- Fall Prevention
- Hazard Recognition, Risk Assessment and Control (HIRAC)
- Personal Protective Equipment (PPE)
- Radiation Protection
- Industrial Hygiene
- Hoisting and Rigging
- Confined Space

The site was presented with Cameco's Mary-Jean Mitchell Green Safety award for its 2013 safety performance which was the best safety performance in the site's operating history.

In 2015 the United Steelworkers (USW) local 13173 and local 8562 received the national USW A.Q. Evans award which is given to locals for outstanding accomplishments in occupational safety and health. This award was to recognize the involvement of the locals in the development of the PHCF employee-led safety program.

The well-established radiation protection program at PHCF has been demonstrated to be effective in the prevention of unreasonable risk to the health and safety of workers. The five year regulatory limits established in the *Radiation Protection Regulations* apply to

unique five year periods of time. The current period extends from January 1, 2011 to December 31, 2015. To date, the annual effective doses for PHCF workers are a fraction of the five-year 100 mSv regulatory limit.

3.3 Continuous Improvement

Cameco is committed to continuous improvement at all of its operations. In the current licensing period, the PHCF has made significant investment into site programs and related infrastructure and resources. Further information regarding these projects will be provided in the relevant SCA(s).

- Development and implementation of a Lab Information Management System (LIMS)
- Development and implementation of CAMRAD – a Cameco radiation protection database
- Creation of the CSSC and associated subcommittees
- Implementation of Operational Reliability initiatives in the areas of materials management, reliability engineering, work management and operations improvement. Through this program, 42 business processes have been developed, documented, and implemented. Key performance indicators have also been created and are routinely reported.
- Implementation of Emissions Management Strategy projects to reduce annual uranium loadings by 50%
- Progressed a number of projects to reduce the volume of legacy wastes

As a demonstration of the focus on continuous improvement, the site received the 2013 Cameco Innovation Award for a Cooling Water Intake Deicers project that improved operational performance while ensuring that there was no environmental impact and that safety risks were eliminated.

As a demonstration of the facility's focus on emissions reduction, PHCF received the 2014 Cameco Environmental Leadership Award (CELA) for the installation of a new scrubbing stage in the UF_6 plant that resulted in annual uranium emissions being reduced by more than 50%.

3.4 Community Support

Cameco has a mature Public Information Program (PIP) to provide relevant information to the community on how activities at PHCF affect the environment and the health and safety of employees and the community. The program is dynamic and utilizes traditional radio and print media, community forums and open houses, as well as web-based and social media to communicate with the public.

Cameco employees are proud to be active and responsible members of the communities in which they live, work and play. As a major employer in Northumberland County and a high-profile business, Cameco plays an important role in supporting organizations and community events that contribute to the high quality of life enjoyed in Northumberland County.

For over a decade, Cameco has retained outside expertise to measure public opinion in Port Hope to help determine the effectiveness of its Public Information Program (PIP). The public opinion polling has consistently demonstrated a high level (84-89% in the current licensing period) of community support for Cameco's continued operations in Port Hope.

3.5 Vision in Motion Preliminary Activities

The CUP permits Cameco to remove obsolete buildings, equipment and materials for the purpose of reducing environmental obligations, creating useable space and improve the appearance of the facility. Within the licensing period, Cameco progressed several CUP projects that influence the ongoing VIM project planning and include the following:

- SuperCUP 2014 – Additional employees were temporarily transferred to CUP, where they were trained and qualified to remove redundant equipment and clean-up in several buildings on the main site. This allowed portions of some of these buildings to be repurposed. Materials removed were processed through the outlets described in the site Waste Management Plan (WMP-01).

- VIM Trial Excavation – In 2015, Cameco carried out a trial excavation on the main site which involved the excavation of two large test pits to collect information regarding subsurface condition characteristics. The information gathered is being used to define the approach for the VIM project.

- SuperCUP 2015 – Campaign of redundant equipment removal and clean-up of underutilized buildings on the main site. Materials removed were processed through the outlets described in WMP-01.

- Centre Pier Demolition 2015 – At the time of this application, Cameco was implementing a project to demolish the above-grade portions of Buildings 42 and 43A on the Centre Pier. The work will improve the management of radiation, safety and environmental risks associated with the structures.

4.0 SAFETY AND CONTROL AREAS

4.1 Management System

PHCF, under its current operating licence, is required to have a management system for the facility that establishes the processes and programs required to ensure that the PHCF operates safely; continuously monitors its performance; and fosters a healthy safety culture. The relevant documents for this SCA are the corporate Safety, Health, Environment and Quality (SHEQ) Policy and the PHCF Quality Management Program Manual (QMPM). The QMPM has been developed to meet the CNSC Quality Assurance elements, requirements and principles outlined in the current LCH. PHCF has committed to a phased implementation of the CSA N286-12 *Management System Requirements for Nuclear Facilities* with compliance to this standard by the end of 2017.

Over the current licensing period, CNSC staff have consistently assessed the Management System SCA as meeting regulatory expectations. With the integration of the N286-12 standard into the site management system, it is expected that this level of performance will be maintained or improved over the next licence period.

4.1.1 Organizational Structure

Corporate offices are maintained in Saskatoon with some corporate functions located in Port Hope. The Science and Technology, Major Projects, Business Technology Services, logistics, supply chain, and communications groups are corporate groups that operate at the Port Hope site or divisional office. Although corporate provides direction and has accountability over these groups, the sites are responsible to ensure that the activities of these groups meet the site's management system requirements. Cameco's corporate office provides policies and guidance to all of its operating sites. The operating sites translate these into site-specific management programs. The implementation of these site programs is monitored to assure the site management that these programs are implemented, adequate and effective.

The organizational structures of the FSD and the PHCF are shown in Figures 9 and 10. The general manager, PHCF, has the responsibility of operating the facility in accordance with the corporate policies and operating budgets approved by the company's board of directors and is accountable for the programs and procedures for operating and maintaining the facility. The responsibilities for these programs and procedures have been delegated amongst the management team at PHCF and their respective personnel. Department managers are responsible for all operations within their departments. The production departments utilize the centralized service departments under the direction of the general manager, PHCF. This ensures that the programs described in this manual are applied uniformly throughout the facility

Figure 9 Organizational Structure – Fuel Services Division and Corporate that Support PHCF

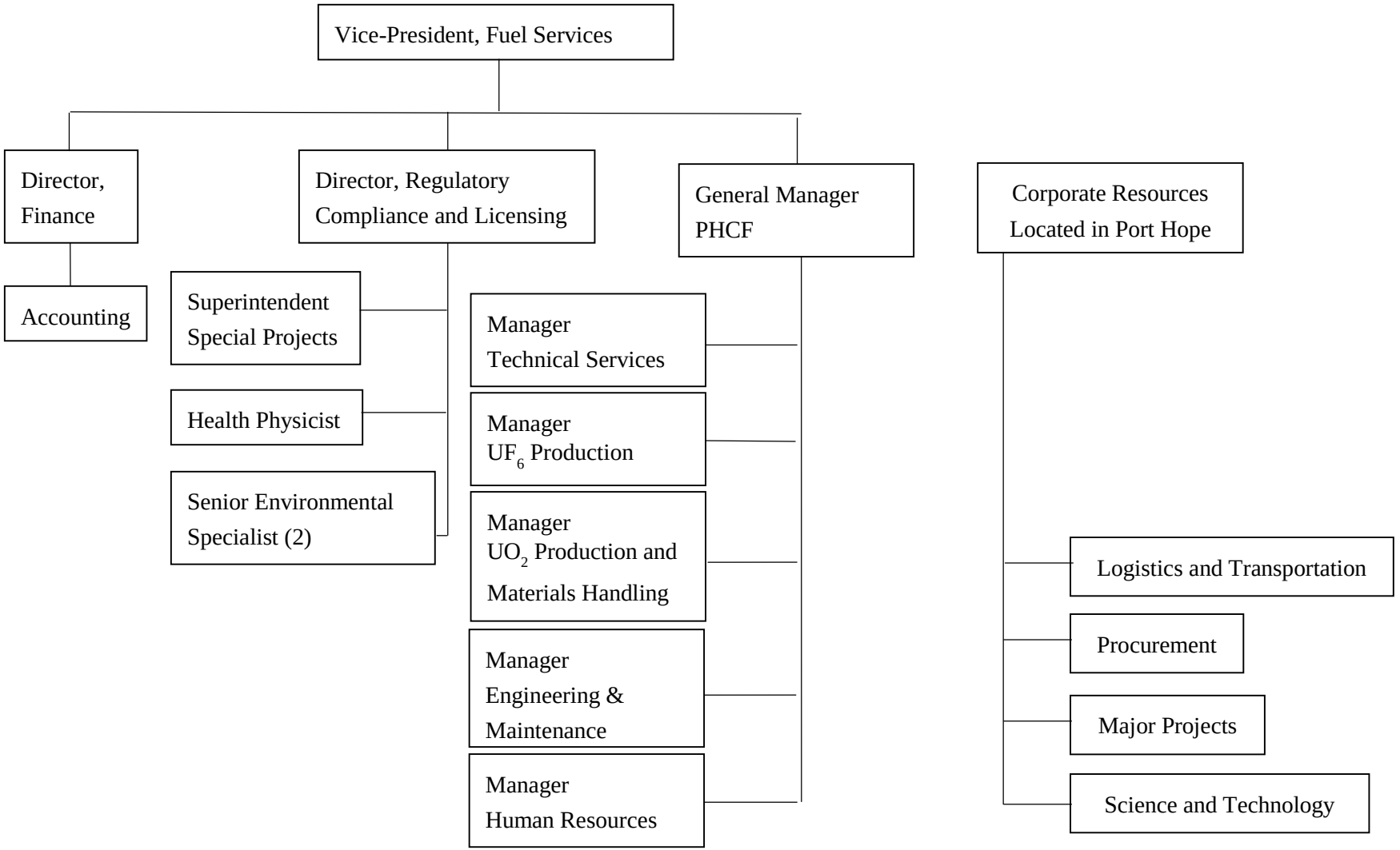
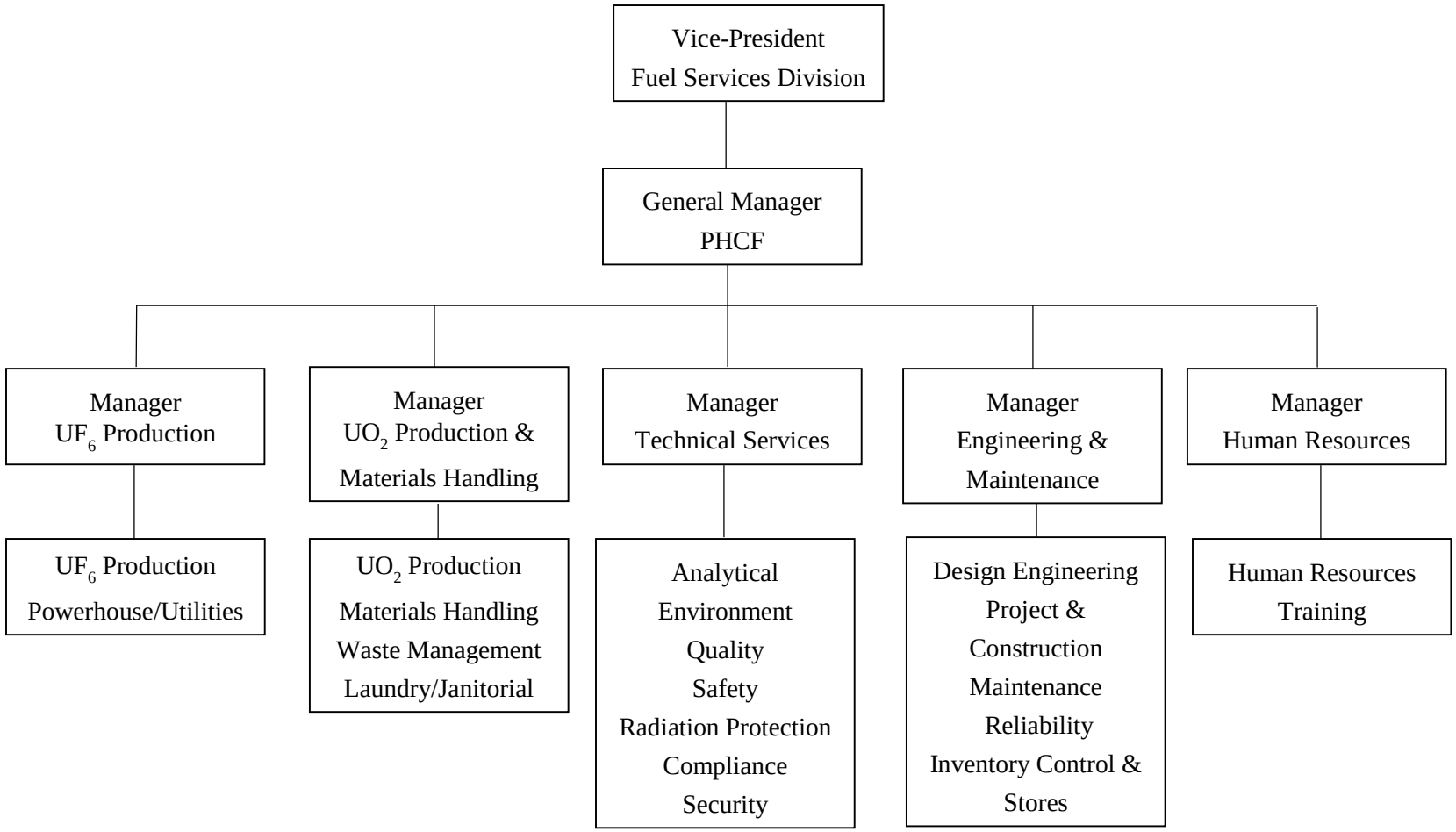


Figure 10 - PHCF Organizational Structure



4.1.2 Safety, Health, Environment and Quality (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, decommissioning and reclamation. As such, Cameco is striving to be a leading performer in all aspects of its business through a strong safety culture, environmental leadership, operational excellence and its commitment to the following principles:

- Preventing injury, ill health, and pollution;
- Complying with and moving beyond legal and other requirements;
- Keeping risks at levels as low as reasonably achievable, social and economic factors taken into account;
- Ensuring quality of processes, products and services; and
- Continually improving our overall performance.

These commitments are reflected in the safety, health, environment and quality policy which is publicly available on the Cameco website (www.cameco.com) and is approved by Cameco's board of directors.

4.1.3 Quality Management Program Manual

PHCF's QMPM provides the scope of the site management system and references the supporting program documents required to ensure safe, clean and reliable production at the facility. Updates to the QMPM are submitted to CNSC staff prior to implementation. Cameco has recently completed a gap analysis of its management system against CSA Standard N286-12 and identified that a phased implementation is required, with alignment of the PHCF's management system with the N286-12 standard by the end of 2017.

4.1.3.1 Safety Significance – Activity, System, Component and Structure

Many of the licensed activities are controlled by documenting procedures or providing qualified personnel. Additional controls are established commensurate with the safety significance of the activity or system. The QMPM contains definitions and screening criteria to evaluate systems, structures and components (SSC) to confirm their safety significance. Recognizing that there are SSCs and procedures that are essential to safe operation, a set of safety significant SSCs with the highest safety significance have been identified and require the strongest level of control. These systems are:

- liquid uranium hexafluoride;
- liquid anhydrous hydrogen fluoride;
- hydrogen;
- fluorine;
- emissions control systems;
- emergency power; and
- civil structures – floors, trenches, sumps, pits, roof and walls.

Other SSCs may also be designated safety significant at the discretion of site management, the area authorizer or the change control committee.

4.1.3.2 Program Elements

The QMPM meets the CNSC program requirements as described in the following subsections.

Program Definition
The QMPM ensures PHCF is operated and maintained using sound safety and defence-in-depth practices to ensure radiological risks to workers, the public, and the environment are as low as reasonably achievable (ALARA), social and economic factors taken into account, and in keeping with Cameco's core values of safety and the environment, people, integrity and excellence.

Policy
The corporate SHEQ policy as described in section 4.3 of this application meets this requirement.

Organization and Responsibilities
The general manager, Port Hope conversion facility has the overall responsibility and authority to ensure that the program is maintained and properly implemented, and is accountable for ensuring conformance. These responsibilities can and have been delegated amongst the management team at the PHCF and their respective personnel as described in the QMPM and section 4.2 of this application.

Personnel Capability
The PHCF uses a Systematic Approach to Training (SAT) process to ensure personnel are qualified to perform work associated with safety significant activities. This process consists of an assessment of job positions and associated competency requirements, the development of appropriate training, the assessment of qualification and competency.

The PHCF training plan is further described in the SCA Human Performance Management, section 4.2 of this application.

Use of Experience

PHCF's corrective action process, captures both corrective and preventive actions, and facilitates utilizing lessons learned from both internal and external incident and near-miss investigations, significant events, audit findings, non-conformances, or other reports. These learnings may be applied at the site, division or corporate level. All records associated with the corrective action process are maintained in the Cameco Incident Reporting System (CIRS) which is used to initiate actions to improve safety, environment, quality and the management processes.

Work Planning and Control

Work is planned and controlled to ensure that it is performed precisely and systematically where appropriate. Work activities that may be planned and/or controlled include design, procurement, commissioning, inspection, receiving, handling and storage, work control (operations), equipment control (maintenance), measuring, monitoring and testing.

Work Process Control Practices

The planned work activities resulting from work planning are assigned to appropriately qualified personnel and carried out in accordance with established practices. The requirements are specified in instructions, procedures, drawings, or other appropriate documentation. Controls will be further discussed in other SCAs in this application.

Verification

This activity is performed by personnel who have not performed the work and who are independent of those performing the work. When appropriate, these verification activities are incorporated into the work instructions or other documents that meet the requirements of work planning and control and work process control practices.

Non-conformances and corrective action

Non-conformances, accidents and incidents are assessed for cause as described in the corrective action process and documented in CIRS. The significance of an event will determine the effort taken to identify the cause and develop appropriate corrective action(s). Provisions are made for elevating the significance of an event based on potential consequences. Corrective actions are developed, agreed to and implemented in a manner appropriate to the situation for all non-conformances, accidents and incidents.

Change Control

The change control process applies to all changes within the PHCF; the concept of the change control process is to provide consistency in the review of the requested change. This will ensure that identified changes are justified and subjected to the same level of

review and approval as was originally obtained. The change control process covers several areas as described in the QMPM: process layout(s), material design, regulatory, personnel, training and document change. The current design and document change control procedures govern site changes.

Document Control and Records

All essential documentation is identified, reviewed for adequacy and approved by authorized personnel prior to use. All changes to documents are implemented in writing and processed in a manner that ensures prompt action at the specified locations. A process to identify, control and retain records provides objective evidence that documents requiring version control are effectively managed and communicated.

Audits

Internal audits of the management system are conducted to assure facility management of conformance with the program and to serve as a means of measuring performance, assessing the effectiveness of the program and promoting improvements. Audits are performed on all program elements identified in the QMPM on a frequency from one to three years, depending on the significance of the program element. CIRS is used to retain records associated with audits.

Management Self-Assessments

Facility management regularly assesses the management processes for which they are responsible. Site objectives and targets provide an indication of how well different programs within the management system are working. Managers or other appropriate personnel will be required to obtain and assess the supporting information at least quarterly and report to the site leadership team. Status of actions from audits, management review, enterprise risk, and the safety culture assessment are reported monthly to the site leadership team. These reports are summarized and reviewed as part of the annual management review.

Management Review

Management review of site programs that support the management system to ensure continuing suitability and review opportunities for improvement and need for revisions is completed on an annual basis by senior management. The management review minutes and resulting actions are documented and managed through the corrective action process.

4.1.4 Safety Culture

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

Cameco conducts safety culture surveys (also called safety culture assessments) on a five year cycle at all sites within the FSD. These surveys gauge the perception of employees in relation to safety culture in a scientifically meaningful way. From these surveys/assessments action plans are developed in areas where opportunities for continual improvement are identified. Action plans will be entered into CIRS for tracking and follow-up and incorporated into the monthly audit, management review and enterprise risk action status report reviewed with site leadership.

The following are some examples of some of tools that are in place at the PHCF to support a strong safety culture:

- In order to enhance and continue support of a questioning attitude in employees and to ensure that an appropriate level of investigation and/or corrective action, the corrective action process and CIRS are used to drive continual improvement. CIRS is available to all employees for initiating records for events, concerns and conditions.

- PHCF's leadership team has a field presence program to increase their presence in different areas of the facility and to improve communications between operators and the leadership team.

- Cameco has joined the CANDU owners group (COG), and is working through other nuclear industry affiliations to share experiences and learn from other organizations in addition to ongoing sharing of best practices across sites within Cameco.

- Cameco utilizes the corrective action process to share notifications of incidents and lessons learned through internal use of experience.

- Cameco has enhanced its safety analysis process to ensure that a cross-functional team is involved in all PHAs allowing safety to be assessed with various perspectives.

The PHCF and FSD leadership teams are committed to enhancing a sustainable safety culture and will continue to work diligently to ensure that all employees remain engaged in a strong safety culture.

4.2 Human Performance Management

Under its current operating licence, the PHCF is required to have a training program that is a SAT-based system. This SCA covers activities that enable effective human performance through the development and implementation of processes that ensure that licensee staff members are sufficient in numbers in all relevant job areas, and have the necessary knowledge, skills and tools in place, in order to safely carry out their duties.

4.2.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Human Performance SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.2.2 General Training

PHCF provides training to meet legislative and internal company requirements to ensure that employees have adequate knowledge and skills to fulfill their roles and responsibilities including the following:

- Conventional Safety (including chemical safety)
- Industrial Hygiene (including heat stress and respiratory protection)
- Radiation Protection
- Environmental Awareness
- Fire Safety
- Emergency Response
- Workplace Violence
- Security Awareness

All PHCF employees are required to complete this general training at the time of hire, return to work after an extended absence or as necessary upon transfer to a new area or job. The need for retraining is reviewed periodically, with retraining and/or refresher awareness on a frequency identified in the appropriate program manuals.

4.2.3 Systematic Approach to Training

The granting of initial qualifications for new operators and operators new to areas, ongoing maintenance of operator qualifications, and requalification of operators in accordance with SAT principles continued in both the UF_6 and UO_2 production operations. On-the-job training (OJT) periods were tracked and formal evaluations of OJT and classroom based training were carried out and documented to confirm that each trained person is qualified and competent to perform their duties.

Using SAT, the PHCF training plan follows the ADDIE process - a logical progression from the assessment (A) of each task of a position to determine criteria for the training to the design (D) of training objectives and methods to deliver training to the development (D) of training packages followed by the implementation (I) phase which includes delivery, assessment and documentation of training. Following these phases, the evaluation (E) stage measures the effectiveness of the training program through internal/external evaluations and identify areas where improvement may be required.

In accordance with the SAT, PHCF made improvements to the training program over the current licensing period. These improvements include the following enhancements:

- Development of additional qualifications onto the Computer Based Training (CBT) platform. This supports consistency and flexibility with 24/7 access to training;
- Development of a training procedure to capture the processes used in developing training;
- Job Task Analyses (JTA) for all operating areas within the UF_6 plant were updated and revised to include critical task identification;
- JTAs reviewed and updated where appropriate for other in-scope positions in technical services and materials handling; and,
- General revisions to the qualification procedures for UF_6 operators, UF_6 supervisors and UO_2 operators following formal evaluations of the existing training programs

4.2.4 Worker Training and Qualification

All of Cameco's operations employ the SAT model to develop internal required training. The PHCF has an on-site training department whose mandate is to plan, organize, direct and monitor the infrastructure to support training, organizational development and learning at the PHCF.

The worker training and qualification program at PHCF is defined by the Training Plan (TP-01) which describes the outline of the training approach employed at PHCF where the SAT is utilized and integrated with the computerized learning management system. TP-01 provides roles and responsibilities associated with the SAT. The training plan currently meets the requirements of HPD-TPE-01 Objectives and Criteria for Regulatory Evaluation of Nuclear Facility Training Programs where SAT is utilized and integrated with the management system described in section 4.1. The PHCF has reviewed TP-01 against Regulatory Document (REGDOC)-2.2.2 Personnel Training and has committed to compliance with this new requirement by the end of 2016.

The training plan:

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

PHCF's training plan ensures that personnel are qualified to perform work related to the protection of workers, the public and the environment.

4.2.5 Contractor Training

The Cameco procurement and project management processes ensure that contractors are qualified to carry out the work they are contracted to do and would typically not require contractors to complete a SAT-compliant qualification process. However, all contractors and some other non-site personnel who will be performing work in designated areas of the facility are required to complete a half-day Contractor Safety Orientation and/or nuclear energy worker (NEW) training under the Contractor Safety Management Plan (OHSPLAN001).

This safety orientation is delivered by the training department and is a structured review of the site hazards, risks and safety procedures that must be followed while on site. Additional work-area specific awareness may be provided through the job hazard analysis and pre-work briefings facilitated by the contractor sponsor. Contractor safety orientation and NEW qualification are valid for a period of one year.

4.2.6 Supervisor and Management Training

In addition to the CNSC's regulatory requirements, the requirements of the *Canada Labour Code* apply to the PHCF. Under Part II of the *Canada Labour Cod*e, management and supervisors must take every reasonable precaution for the protection of

workers, including ensuring workers use prescribed protective equipment and are advised of potential and actual hazards. It is a requirement that supervisors and management are trained to fully execute these responsibilities and this training is part of the required health and safety related training for supervisors. The PHCF's Occupational Health and Safety Management System and referenced procedures provide additional information.

In addition, to ensure nuclear security, supervisors and management are trained to anticipate and respond to changes in employee behavior in accordance with both the violence prevention requirements under Part II of the *Canada Labour Code*, and the *Nuclear Security Regulations.*

4.2.7 Minimum Shift Complement

The minimum shift complement is defined in order to ensure that the minimum number of qualified workers are always present to support the safe operation of PHCF, respond to all credible events and to ensure adequate emergency response capability.

In accordance with the guidance of G-323, Ensuring the Presence of Sufficient Qualified Staff at Class I Nuclear Facilities – Minimum Staff Complement, PHCF has determined the minimum complement of sufficient personnel to safely operate the facility and operates the facility in accordance with the minimum complement.

4.3 Operating Performance

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

4.3.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Operating Performance SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.3.2 Regulated Activities

The PHCF is primarily federally regulated by the CNSC as a Class 1B nuclear facility. In addition to the CNSC, Cameco is also regulated by a number of other government agencies. Table 1 provides a list of key regulatory authorities along with an overview of the key activities and certain regulations.

Table 1: Key Regulatory Agencies Governing PHCF's Operations

Area of Regulation	Regulatory Agency	Key Activities Regulated
Environment	Environment Canada	*Canadian Environmental Protection Act, 1999* and its associated regulations and other requirements such as the National Pollutant Release Inventory; *Federal Halocarbon Regulations, 2003*; *Environmental Emergencies Regulations*; and the *Fisheries Act* as it relates to effluent discharge
	Department of Fisheries and Oceans	*Fisheries Act* and regulations primarily as it relates to cooling water intakes
	Ontario Ministry of the Environment and Climate Change (MOECC)	*Environmental Protection Act* and Ontario Regulations. (O.Reg) 255/11, 419/05 and 127/01 as it relates to air discharges and approvals, O. Regs. 255/11 and 560/94 as it relates to discharges to surface water and approvals, O. Reg. 675/98 as it relates to spills reporting, and noise
	Municipality of Port Hope	Sanitary sewer and noise bylaws
Health and Safety	Department of Employment and Social Development Canada (ESDC)	Conventional health and safety issues through the *Canada Labour Code* and *Canada Occupational Health and Safety Regulations*
	Ontario Ministry of Labour (MOL)	Some contractors working at the facility are regulated by the *Occupational Health and Safety Act*
Quality Control	Ontario Technical Standards and Safety Authority (TSSA)	*Technical Standards and Safety Act, 2000* as it relates to the regulation of boiler and pressure vessels at the facility
Transportation	Transport Canada	*Transportation of Dangerous Goods Act, 1992* and *Transportation of Dangerous Goods Regulations*, emergency response assistance plan
Safeguards	International Atomic Energy Agency	Activities associated with non-proliferation

4.3.3 Operating Conditions under FFOL-3631.00/2017

The PHCF produces a variety of uranium-based products for both domestic and foreign customers. The FLM supports the licensing basis for the site and documents the various programs that the PHCF maintains to ensure that the facility is operated in a manner that supports safe, clean and reliable production while complying with applicable federal and provincial acts and regulations. Many of these programs will be discussed in greater detail in other SCAs.

The FLM and associated programs establish safe, uniform, and efficient operating practices and processes within the facility to ensure safety of the public, the environment, as well as the safety of the plant personnel and plant equipment.

4.3.4 Operating Procedures

As required by the licence, PHCF maintains essential documentation that includes program manuals and associated work instructions, engineering design and control, operating procedures and work instructions, and other documents that provide guidance, instructions, documentation and/or other controls for safety significant activities. This includes the written work instructions for handling of radioactive materials by workers to ensure that these activities are done in a manner that is protective of workers, the public and the environment.

4.3.5 Safety Analysis

The protection of the environment and health and safety of persons is a fundamental principle of the NSCA, its associated regulations and the regulatory approval process. The hazards, preventative measures and mitigating controls associated with the licensed activities at the PHCF have been systematically reviewed and documented from several perspectives as described in section 4.4. Safety analyses are periodically reviewed to ensure that changes within the facility, scientific literature and regulatory requirements are incorporated and used to drive improved efficiency, emissions reduction, and safer operations for workers and the public.

4.3.6 Change Control and Procedures

The change control process defined in the QMPM ensures that significant changes are reviewed to ensure that proposed changes are justified and subjected to the same level of review and approval as was originally obtained for the design. Where the original intent and associated requirements are not available, the change control process requires an analysis to show that the level of safety imparted by the current design, procedure or

process is not compromised and that the change will provide an equivalent or greater level of safety.

Essential documentation to support operating performance includes program manuals and associated work instructions, engineering design and control, operating procedures and work instructions, process hazard assessments (PHAs) and other documents that provide guidance, instructions, documentation and/or other controls for safety significant activities.

4.3.7 Operational Reliability

The Operational Reliability program focuses on improvements to ensure maximum reliability of production facilities by developing key business processes, education, and tools that would affect almost every employee on site to one extent or another. Achieving operational reliability was deemed to require focus in four pillar areas: work management; materials management; reliability engineering; and operations improvement. This program will be described in more detail in section 4.6.

4.3.8 Staffing Levels

As described in section 4.2.7, PHCF has determined and maintains onsite, the minimum complement of sufficient personnel necessary to operate the facility in a manner that meets the requirements of the safety analyses and programs in place to control potential hazards identified in the safety analyses.

4.3.9 Corporate Oversight

The corporate office in Saskatoon provides policies, programs and guidance to all of the operating sites, which may be translated into site-specific management programs. There may also be procedure-level documents that are owned by corporate and do not require translation into site documents. The implementation of the site programs is regularly monitored, audited and reported on to assure the site management that these programs are implemented, adequate and effective. This information is shared with corporate and it may be use it for the assessments and development of programs. On a minimum five year basis, corporate performs an audit of the site management programs to verify that site performance is as reported.

4.3.10 Radioactive Material Inventory and Control

As required by the NSCA and its regulations as well as pursuant to a licence condition, Cameco maintains and reports on inventories of uranium materials in accordance with RD-336, Accounting and Reporting of Nuclear Material.

As described in section 4.7 of this application under the Radiation Protection Program, the facility uses a number of radioisotopes that are regulated under the CNSC's NSRDR. Cameco 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 the Radiation Protection Program Manual (RPPM) and the associated procedures. These sources range in type from nuclear gauges and static eliminators to laboratory calibration sources and tracer solutions. This information is available to CNSC inspectors when they are onsite.

As described in section 4.11 of this application under the Waste Management Plan, PHCF maintains an inventory of all stored radioactive wastes. These wastes are included in the site's safeguard inventory, and are verified through ongoing CNSC/IAEA safeguards activities.

4.3.11 Pressure Boundary

PHCF maintains a pressure boundary program for the facility that includes Certificates of Authorization with the Technical Standards and Safety Authority (TSSA) to confirm that the quality program for pressure systems is in accordance with the *Ontario Technical Standards and Safety Act, 2000* and the *Boilers and Pressure Vessels Regulation*. Included in the scope of authorization is CSA B51 Boiler Pressure Vessel and Pressure Piping Code. In addition, PHCF maintains an Authorized Inspection Agency Agreement with the TSSA as required by the LCH. The current agreement expires in the first quarter of 2016 and will be renewed prior to its expiry.

4.3.12 Monitoring Programs

Programs such as the Radiation Protection Program, Dosimetry Program and Environmental Monitoring Plan have parameters that are monitored, measured and tracked to ensure the facility is operated as intended and are further described in sections 4.7 and 4.9 of this application. These parameters have a foundation in a regulatory requirement imposed by statute, regulation, permit, approval and/or licence or are from a parameter of potential concern identified in one of the safety analysis assessments described in section 4.4. Data from these programs is reviewed routinely against internal administrative levels and regulatory action levels. Data outside of acceptable operating parameters, identified via internal administrative levels is investigated for cause through the corrective action process.

4.3.13 Corrective Action Program

PHCF's corrective action process, captures both corrective and preventive actions, ensures deficiencies, non-conformances or other conditions that adversely impact, or may adversely impact operations, personnel, nuclear safety, the environment, equipment and component reliability, production or other business deliverables, are promptly identified, investigated and actions developed.

4.3.14 Operational Reviews

PHCF supervisory and management employees conduct regular, planned reviews of plant performance and operational issues to facilitate a prompt correction of any safety or performance concerns. Routine production meetings are held that include review of safety, operational and other incidents with broad representation from across departments. Site performance indicators are reviewed at management and extended site leadership meetings.

Annual management review meetings focus on overall performance in all areas of the operation, including health, safety, radiation protection, quality assurance and environment, in the previous calendar year. Senior management personnel from the divisional office as well as from the corporate office attend these meetings.

4.3.15 Reporting and Trending

Routine Reporting

The management system and other program level documents have parameters that are monitored, measured and tracked to ensure the facility is operated as intended. Quarterly and annual compliance reports, an annual groundwater report and annual fire program reviews are submitted to the CNSC as required by the LCH.

Additional routine reports are required on a quarterly and/or annual frequency to meet the legislated, licensed and/or permitted requirements of the other regulators identified in Table 1. CNSC staff are provided copies of these reports as a courtesy.

Non-routine/Incident Reporting

Unusual events and/or process upsets are reported internally in accordance with the corrective action process. These events are reviewed by the management team, emergency on-call staff and/or technical services staff to determine whether the event must be reported to external agencies. The decision is based upon the nature of the event, significance of the consequences, the CIRS matrix found in CQP-117, the guidance

provided in the Internal and External Reporting Requirements procedure, the requirements of the LCH and NSCA and additional applicable reporting requirements in licences, permits and legislation.

4.3.16 Public Information Program

The PHCF has an extensive PIP, further described in section 5.1.1 to provide information to the community regarding the general nature and characteristics of the anticipated effects on the environment, the health and safety of employees and the community that may result from activities conducted at PHCF.

The compliance and licensing function reports performance on key safety and compliance metrics through its quarterly and annual compliance reports submitted to the CNSC as required by the CNSC licence. Environmental events that meet the criteria set out on the FSD website or other events that may be of interest to a member of the public will be posted on the FSD website. Copies of all quarterly and annual reports are also posted on the FSD website.

4.4 Safety Analysis

PHCF, under its current operating licence, is required to maintain a safety analysis for the facility. Safety analysis refers to a systematic evaluation of the potential hazards associated with the conduct of the activities within the facility and considers the effectiveness of preventative measures and strategies in reducing the effects of these hazards.

4.4.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Safety Analysis SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.4.2 Safety Analysis Overview

The protection of the environment and health and safety of persons is a fundamental principle of the NSCA, its associated regulations and the regulatory approval process. The hazards, preventative measures and mitigating controls associated with the licensed activities at the PHCF have been systematically reviewed and documented from several perspectives. The design, construction and operation of the Port Hope facility is intended to eliminate or minimize the potential of radiological, chemical or other physical hazards to facility personnel, the environment and the general public. This is accomplished not by a single approach, but rather by a defence-in-depth approach. This approach is documented in the risk and hazard assessments described in the following sections. The site has a formal design control process to ensure that any proposed plant changes involving new equipment or processes or other changes that may otherwise differ from current design parameters is thoroughly assessed with respect to safety considerations.

Cameco will create summaries of significant supporting studies and documents that will be made publically available as part of these licence renewal activities.

4.4.3 Safety Report for the Port Hope Conversion Facility

Hazard risk assessments and safety analyses are now the cornerstone of process safety management throughout the world. This is a widely accepted method and practice used by industry and regulators to assess the risk and potential impact from plant operations.

The PHCF utilizes a PHA methodology to systematically identify and analyze hazards associated with the licensed activities. A PHA is a set of organized and systematic assessments of the potential hazards associated with an industrial process; provides information intended to assist managers and employees in making decisions for

enhancing safety and reducing the consequences of unwanted or unplanned releases of hazardous chemicals; and, is directed toward analyzing potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals and major spills of hazardous chemicals, focusing on equipment, instrumentation, utilities, human actions, and external factors that might impact the process.

The Safety Report for the PHCF (Safety Report) takes the detailed analyses found in the PHAs and summarizes by area the hazards, potential accident scenarios and controls in place to prevent and/or mitigate the consequences of these scenarios. PHCF completed a comprehensive revalidation of the PHAs that are the basis for the Safety Report in 2014 and 2015. This process included:

- incorporating design changes made to the facility since the last update
- incorporating information from project PHAs where appropriate
- reviewing incidents that occurred between November 2010 and April 2015 and including the relevant information in the Safety Report and/or Environmental Aspects Registry
- reviewing, and updating where required, the hazards, potential consequences and adequacy of the control measures with a cross-functional team including operations, technical support and maintenance personnel
- systematic air modelling assessment for potential airborne releases from PHCF operations to support emergency response planning and prioritizing efforts to further reduce the impact of a potential release

Issue 6 of the Safety Report will reflect changes made in the operating plants, safety systems, operational procedures and abatement equipment identified in the 2014-2015 PHA revalidation. Issue 6 of the Safety Report will be submitted to CNSC staff for review and acceptance by the end of 2015.

4.4.4 Chemical Hazard Assessment

The PHCF has developed a site-specific Spill Prevention and Contingency Plan (SPCP) in accordance with the requirements of Ontario Regulation (O. Reg.) 224/07. The primary objective of the SPCP is to help prevent or reduce the risk of spills of hazardous chemicals, pollutants or dangerous goods to the environment and to prevent, eliminate or improve any adverse effects that may result from such spills. The SPCP provides detailed information and guidance on actions related to the prevention of spills and procedures to detect and respond to them in a timely and effective manner if they occur and supports the site Emergency Response Plan (ERP).

As part of the SPCP, a PCHF spill risk assessment (SRA) was completed using the following steps:

- Identification of the potential spill hazard scenarios;
- Likelihood assessment of the spills occurring and reaching the environment;
- Assessment of the consequence of the identified potential spills;
- Ranking the potential spill hazard scenarios and identification of the significant spill hazards; and,
- Identification of the preventive measures to address the identified significant spill risks.

A summary of the hazardous chemicals onsite that are regulated under the E2 Regulations is provided in Appendix 7.

An annual review and signoff of the SPCP is completed as required by O. Reg. 224/07.

4.4.5 Environmental Aspects Registry

In accordance with the requirements of ISO14001 – Environmental Management Systems, the PHCF has documented and analysed its activities, products and services to determine the interactions of the facility with the environment. These interactions may result in environmental impacts of varying significance. Interactions are categorized into actual and potential environmental impacts. Actual environmental aspects (i.e. interaction) are those that result from the plant operation, such as emissions to the air, water and land. Potential environmental aspects are those that may result from the plant operation and for which controls are in place to prevent an event from happening or mitigating the impact if the event occurs. This information is documented in the Environmental Aspects Registry which is updated at least every three years. Significant aspects identified through this process are reviewed to ensure the monitoring program is appropriate for the facility. In addition, where opportunities to improve the aspects exist,

this information is considered in the development of annual environmental objectives and targets.

4.4.6 Fire Hazard Analysis

Cameco maintains a site Fire Hazards Analysis (FHA) that meets the requirements of NFPA 801 (2008) 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.
There is an FHA for every building at the PHCF which is updated as necessary to reflect current plant conditions. The FHA contains safety and security sensitive information as well as information that is considered to be commercially proprietary.

4.4.7 Environmental Risk Assessment and Public Assessments

Cameco completed an environmental risk assessment and environmental effects monitoring study in June 2004. The purpose of this study was to determine if the current Environmental Monitoring Plan was adequate to identify the potential impacts that the facility could have on the environment. Cameco completed additional studies to close the gaps identified in the original assessment.

In 2008, Cameco completed a site-wide environmental investigation to characterize soil and groundwater contamination onsite. A site-wide risk assessment was completed in 2008, and updated in 2009 and 2010 following the implementation of a site-wide environmental management plan. These documents demonstrate that with existing groundwater control measures in place, there is no unreasonable risk to employees, the public or the environment from subsurface contamination onsite.

In 2015, Cameco undertook an update to its environmental risk assessment in accordance with the new requirements of the N288.6 Environmental Risk Assessments standard at Class I nuclear facilities and uranium mines and mills. This assessment will be submitted to CNSC staff for review and acceptance by the end of the first quarter of 2016.

4.4.8 Derived Release Limit and Operating Release Levels

CNSC regulations require that no member of the public receive an effective radiation dose in excess of 1 mSv/year. In order to demonstrate that this requirement has been met, the site maintains a derived release limit (DRL) report in accordance with CSA N288.1 (Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities). The DRL and associated Operating Release Levels (ORL) are reviewed every five years to ensure that considering

the most relevant scientific literature, the facility operations are maintained well below the public dose limit.

Following the update to the models for the environmental risk assessment in 2015, Cameco initiated an update to the DRL Report and the ORL for the PHCF. These documents will be submitted to CNSC staff for review and acceptance by the end of the first quarter of 2016.

4.4.9 Hazard Identification, Risk Assessment and Controls (HIRAC)

A Hazard Identification, Risk Assessment and Control procedure that meets the requirements under Part II of the *Canada Labour Code* was developed by a subcommittee in 2015. This tool is a process through which steps of a job will be broken down to identify hazards which will then be evaluated in order to implement control and preventive measures.

4.4.10 Practical Application of Safety Analysis

As part of the SAT, a job task analysis is conducted for all positions in production operations and a risk assessment completed to identify the specific tasks that require a higher degree of attention and a detailed work instruction or procedure.

In addition to job-specific tasks, there are other more generic high-risk tasks such as confined space entry, use of hoists and cranes and working at heights. Formal programs or procedures are in place for these activities.

For new or non-routine work, a job-hazard analysis (JHA) and/or task analysis safety card (TASC) is completed prior to the start of the job in order to identify high risk activities associated with the job, so that these risks can be mitigated and/or controlled.

4.5 Physical Design

PHCF, under its current operating licence, is required to have a program for physical design of the facility. In addition, the licence prohibits the PHCF from making any change to the design of, or equipment at the facility that would introduce hazards different in nature or greater in probability than those considered by the safety analysis without the prior written approval of the Commission or a person authorized by the Commission.

4.5.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Physical Design SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.5.2 Facility Design

A general facility description and description of processes and materials are provided in sections 2.1 and 2.2. The licensed area is secured by a metal fence that encloses the entire perimeter other than the front of the main building and shipping receiving.

As required by the licence and LCH, modifications to the facility are made in accordance with the *National Building Code of Canada*, 2010, the *National Fire Code of Canada*, 2010 and *National Fire Protection Association*, NFPA-801, 2008 Standard for Fire Protection for Facilities Handling Radioactive Materials.

4.5.3 Current Plant Equipment

PHCF contains numerous types of conventional industrial equipment including storage tanks, conveyors and associated piping, as well as specialized equipment for the uranium conversion processes described in section 2. Due to the nature of the raw materials such as aqueous hydrogen fluoride and ammonia, materials of construction in the facility are specific to the service in which they are in. Pipe specifications are maintained by the engineering department to document the materials of construction and other associated requirements for each type of chemical service.

4.5.4 Facility and Process Changes

All changes to the physical design of equipment, processes and the facility are evaluated from project planning through to the completion of the project through the Process and Design Change Control procedure and the change control process described in the

QMPM. Changes may be physical changes completed through capital projects or maintenance work or may be administrative through training, procedures or other controls. The change control process identifies impacts and potential impacts to the environment and health and safety. It also triggers review by appropriate subject matter experts, the change control committee and the area authorizer to ensure all applicable codes and legal requirements are observed. For some changes, third party review and/or CNSC notification is also required.

4.5.5 Design Governance for Safety Significant Systems

All changes to the facility's design and equipment are reviewed and documented throughout the change control process. However, the systems that are designated to have the highest safety significance with respect to protection of people and the environment, as outlined in section 4.1.3.2, are controlled not only by the use of documented procedures and qualified personnel but also other controls, commensurate with the degree of risk. The Change Control Committee has been designated by management to review changes of potential significant risk, changes affecting safety significant structures, systems or components or any other change deemed to require independent review by the area authorizer, a subject matter expert or site leadership. The role of this committee is described in the Process and Design Change Control procedure.

4.5.6 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. All third party reviews are conducted by qualified persons from organizations whose management and financial operations are independent of the design organization. All third party fire reviews are submitted to CNSC staff as required by the licence and LCH.

4.5.7 Pressure Boundary Program

As required by the its operating licence, the PHCF maintains an agreement with an Authorized Inspection Agency (AIA) for the registration, inspection and other activities related to pressure systems. The AIA for the PHCF is the TSSA, with the current agreement expiring in the first quarter of 2016. The preparations for the new agreement have been initiated.

The TSSA approves the quality control program which governs the shop fabrication, field installation, assembly, repairs and erection of piping systems in accordance with CSA-B51 *Boiler, pressure vessel, and pressure piping code,* CSA-B52 *Mechanical Refrigeration Code,* American Society of Mechanical Engineers (ASME) B31.1 *Power Piping,* ASME B31.5 *Refrigeration Piping Codes* and repairs and alterations of boilers

and pressure vessels, piping and fittings in accordance with CSA B51 *Boiler, pressure vessel, and pressure piping code*, the National Board Inspection Code and Original Codes of Construction.The pressure boundary program establishes the infrastructure and defines the activities necessary to maintain a sustainable process that allows PHCF to perform activities associated with repairs, replacements, modifications and alterations to pressure retaining items, components, and systems including installation of new systems. Within this program Cameco maintains Certificates of Authorization with the TSSA to confirm that the quality program for pressure systems is in accordance with the *Ontario Technical Standards and Safety Act, 2000* and the *Boilers and Pressure Vessels Regulation*.

4.6 Fitness for Service

PHCF, under its current operating licence, is required to have a program for maintenance of the facility and a program for periodic inspection and testing for the facility. In addition, the licence prohibits the PHCF from making any change to the design of, or equipment at the facility that would introduce hazards different in nature or greater in probability than those considered by the safety analysis without the prior written approval of the Commission or a person authorized by the Commission.

4.6.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Fitness for Service SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.6.2 Maintenance Program

The site maintenance program ensures that equipment functions as designed over its lifetime so that safety systems remain 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.

Maintenance is managed by the engineering and maintenance department and performed by qualified personnel. A series of Cameco Quality Procedures (CQPs) provide guidance on maintenance work orders, preventative maintenance, equipment registration and records, pressure and safety related piping and vessel control, registration and inspection. Maintenance work instructions exist for repairs and/or preventative maintenance activities on selected equipment. All preventative maintenance activities are tracked in a computer database, with preventive maintenance tasks deemed critical for safety and/or regulatory reasons flagged to facilitate tracking and review. This includes equipment for which a failure could potentially result in a reportable event under section 29 of the *General Nuclear Safety and Control Regulations*.

In the event of an equipment failure, the preventive maintenance program for that piece of equipment may be reviewed to determine if it needs to be modified to reduce the likelihood of future equipment failure. The list of critical preventive maintenance tasks is reviewed and updated regularly by the engineering and maintenance department.

4.6.3 Operational Reliability Program

In late 2010, PHCF embarked on a journey towards operational excellence by initiating the Operational Reliability program. The program sought to ensure maximum reliability of production facilities by developing key business processes, education, and tools that would affect almost every employee on site to one extent or another. Achieving operational reliability was deemed to require focus in four pillar areas:

- *Work Management*, which looks to ensure maintenance-related work activities are properly identified, prioritised, planned, scheduled and executed, so that labour resources are effectively utilised and work results reach the desired outcome.
- *Materials Management*, which looks to ensure the right parts and materials required to support maintenance work activities are of the right quality and condition and available when required.
- *Reliability Engineering*, which looks to ensure integrity of master data and applies a systematic approach to failure prevention and management.
- *Operations Improvement*, which looks to ensure plant issues are clearly and consistently documented and categorised, and that operator personnel play an active role in equipment reliability through basic care, housekeeping, and monitoring activities.

4.6.4 In-service Inspection Program

Cameco has in-service inspection and non-destructive examination programs which applies to the piping and vessels in the safety significant systems. Quality Control Procedures (QCPs) are in place for the methods used to conduct this work. The methods have been selected on the basis of the historical record of operating and inspecting the UF_6 plant. They are considered the most appropriate for detecting potential problems and for revealing the type of deterioration most likely to occur as a result of the service conditions to which the equipment is subjected.

The technicians performing radiographic, ultrasonic, magnetic particle and liquid penetrant inspections are certified in accordance with the Canadian General Standards Board (CGSB).

4.6.5 Periodic Inspection and Testing for Fire Protection Systems

Fire protection systems are tested according to an established schedule developed using the *National Building Code*, 2010, and the *National Fire Code*, 2010 as described in the Fire Protection Program (also see section 4.10.8). Annual third-party reviews are

conducted to confirm that required tests and inspections with respect to fire safety are completed and these annual review reports are submitted to CNSC staff.

Critical requirements for maintaining a safe facility are effective maintenance and quality assurance programs. This is to ensure maintenance and/or any changes to plant equipment are adequately controlled and authorized, and do not adversely affect the safety of the facility.

4.7 Radiation Protection

PHCF, under its current operating licence, is required to have a radiation protection program and report to the Commission or a person authorized by the Commission upon becoming aware of an action level exceedence and file a report within 45 days.

4.7.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Radiation Protection SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.7.2 Radiation Protection Program

In accordance with the *Radiation Protection Regulations*, PHCF maintains a detailed radiation protection program for the facility as outlined in the RPPM. Radiation protection measures are in place to minimize and control the potential for radiation exposure to both employees and members of the general public arising from the PHCF operations.

The RPPM describes written procedures used to ensure that radiation exposures and doses are kept ALARA, social and economic factors taken into account, through the implementation of:

- Management control over work practices
- Personnel qualification and training
- Control of occupational and public exposure to radiation
- Planning for unusual situations

Radiation exposure for employees is monitored through a comprehensive dosimetry program that includes internal and external dosimetry monitoring. Radiation exposure for the public is calculated based upon the derived release limit (DRL) as described in section 4.9. The dominant contributor to the public dose is gamma radiation which is measured continuously at the facility fence line.

4.7.3 Potential Radiological Hazards

Radiation hazards at PHCF are primarily associated with natural, depleted and enriched uranium and the associated daughter products and impurities. The hazards associated with natural uranium are of greater concern due to the quantities received, processed and

produced 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. While both external and internal radiation hazards are found at the facility, the potential risk associated with internal hazards are of more significance. Working in the presence of uranium, exposure can result from inhalation, ingestion or contamination of an open wound. The primary hazards are chemical damage to the kidney, radiation dose to the bone, and radiation dose to the lung.

In a study previously reported to the Commission, Cameco determined that while neutron radiation is detectable from UF_6 cylinders, the neutron dose rates are very low and do not represent an undue risk to workers or members of the public. It was concluded that routine neutron measurements are not required at the PHCF.

Uranium levels in the air, water and soil in the vicinity of the facility are monitored as described in section 4.9 to ensure that they are minimized and maintained below levels that affect the environment or the public.

4.7.4 Nuclear Energy Worker (NEW) Designation

Employees or contractors that have a reasonable probability of receiving a radiation dose greater than 1 mSv are designated as 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 of the applicable effective and equivalent dose limits. Female NEWs are also notified in writing of their rights and obligations related to pregnancy, including the requirement for female NEWs to inform Cameco, in writing, if they are pregnant.

All NEWs receive training in radiation safety when first hired or returning to work after an extended absence. Regular refresher training is also conducted annually. On hiring, employees will receive a medical examination. Medical surveillance examinations are then conducted on a periodic basis. Contractors designated as NEWs may be given a medical appraisal by the occupational health nurse depending on the nature and duration of their work.

4.7.5 Radiation Protection Control Measures

Radiation protection controls and measures to ensure radiation exposures and doses are kept at ALARA levels are described in the RPPM and associated site documents and procedures. These procedures for radiation protection control cover areas including, but not limited to, individual exposure monitoring, zone control, contamination control,

radioisotope control, use of radiation meters and calibration of radiation monitoring and sampling equipment.

Permanent air sampling stations are located throughout the facility. Stations are located in process areas where there is a higher likelihood of airborne uranium dust being present and are operated on a continuous basis. The air sampling stations serve to assist in identifying process upsets, equipment breakdowns or other instances of loss of containment. Real-time uranium in air monitoring is used to alert workers when respiratory protection is required.

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

Maintenance work requires a safety clearance which will trigger the completion of a radiation work permit where additional controls to minimize dose may be required, based upon factors such as the equipment, nearby nuclear devices, high gamma areas or the duration of the work.

A radiation protection subcommittee has been formed as part of the employee-led safety initiative. This subcommittee leads projects to improve contamination control such as the implementation of zone control improvements and improved monitoring capabilities.

Supervisors are responsible for ensuring their employees follow all radiation safety procedures including zone control procedures, proper use of protective clothing and devices, contamination control and proper waste disposal.

In terms of protecting the public, the radiation protection program prevents the uncontrolled release of contamination or radioactive materials from the site by controls and monitoring of people and materials.

4.7.6 Nuclear Criticality Control

The Nuclear Criticality Safety Program Manual (NCSPM) has been developed to guide the generation and implementation of PHCF's criticality prevention practices as they pertain to licensing and criticality prevention issues. This document is structured to meet the requirements of CNSC Regulatory Document RD-327 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 quantity of enriched nuclear materials permitted on site at any one time. The NCSPM applies to all PHCF facilities, equipment and operations that are licensed by the CNSC with respect to the handling of fissile materials.

The NCSPM applies to operations including research, storage and special projects involving small quantities of fissionable material (less than 80% of the Smallest Critical Mass (SCM)) and operations including research, storage and special projects involving large quantities of fissionable material (greater than 80% of the SCM). Any activities involving large quantities of enriched material requires special handling as outlined in the NCSPM as well as review and acceptance of project-specific safety and operating procedures by CNSC staff.

4.7.7 Personal Dosimetry

The annual dose assignment of NEW's working at the PHCF consists of both external and internal dosimetry inputs. The annual dose assignment is the sum of their whole body dose as measured by dosimeter badges plus dose from uranium in urine plus dose from lung burden which is reported to the NEW on an annual basis. Each of the three components of the personal dosimetry program is described below.

External exposures are monitored using a CNSC-approved licensed dosimetry service provider. The Fuel Services Division maintains an internal dosimetry services provider licence issued by the CNSC for the urine analysis and lung counting programs. Action levels used to ensure that radiation exposure is controlled are shown in Table 2.

Table 2 Summary of Action Levels for the Radiation Protection Program

Dosimetry Program	Dosimetry Parameter	Frequency	Regulatory Action Level
External	Whole Body Exposure	Monthly - NEW	3.0 mSv
		Monthly - Pregnant Worker	1.0 mSv
		Monthly - Pregnant Worker (cumulative dose during pregnancy)	2.0 mSv
		Quarterly	3.0 mSv
	Skin Exposure	Monthly	15.0 mSv
		Quarterly	15.0 mSv
Internal	Urine Analysis	Weekly Pre shift (Cameco Employees)	65 µg U/L
		Daily Pre shift (Contractors)	80 µg U/L
		Any post shift (chemical toxicity - uranium)	500 µg U/L
		Fluoride toxicity	7 mg F/L
	Lung Count	Annual	5 mSv

4.7.8 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 Cameco is provided through a CNSC approved external dosimetry service provider. PHCF has set action levels that are approved by CNSC staff and referenced in the RPPM and in the appropriate radiation protection procedures to trigger investigation of unusual radiation exposure. Extremity dose measurements may also be performed using ring-type personal dosimeters that are processed by the external dosimetry service provider. Due to the nature of the work at PHCF there is low probability of high extremity dose and routine use of ring dosimeters is not required.

4.7.9 Internal Dosimetry

Cameco's FSD holds a licence from the CNSC (11010-16.0) that authorizes Cameco to provide internal dosimetry services to the PHCF, Blind River Refinery and Cameco Fuel Manufacturing. The internal dosimetry program meets the requirements of CNSC document S-106: Technical and Quality Assurance Standards for Dosimetry Services in Canada. Additional information regarding this program may be found in FSD's Internal Dosimetry Program Technical Basis Document (TBD).

Internal dose is assessed and assigned through two programs – urine analysis and lung counting. As described in the TBD, when assigning dose through the urine analysis program, it is assumed that the exposure was to a fast (soluble) uranium material. When a dose is assigned due to a lung burden, it is assumed that a combination of medium (slightly soluble) and slow (insoluble) uranium material is present. When the source of the exposure to a NEW is known (e.g. due to a process upset), the dose calculations are specific to that material.

4.7.10 Urine Analysis

All employees and contractor NEWs are required to submit routine urine samples for the analysis of uranium and (depending on their work area), fluorides. Routine urine samples that meet the criteria specified in the TBD are used to calculate and assign dose to the employee. A computer-based system is used to generate labels for urine samples and to track the submission of urine samples for the purposes of assessing compliance with the program. Any urine result exceeding 13 μg U/L is screened by the radiation protection personnel to validate the sample and initiate investigation into an abnormal intake as defined in the RPPM. Urine analysis action levels are accepted by CNSC staff, documented in the RPPM and are appropriate to the worker group and submission frequency.

4.7.11 Lung Counting

The dose assessment of uranium in lungs is performed using a germanium detector based lung counting system. A group-counting technique is used for dose assignment where all employees in a similar work group who are below the minimum detectable activity (MDA) are assigned the average dose that is calculated for the group. The frequency of lung counting of NEWs is based on the work group to which the employee belongs and is described in the RPPM.

Individuals with lung count results above the MDA are assigned their own dose and this dose is not included in the group average. The dose from lung counting is assigned to NEWs annually as part of their annual dose report. Individuals with lung burden above the MDA are informed of their dose as soon as possible after completing their lung count.

4.7.12 Radiation Protection Dose Limits and Action Levels

Maximum permissible doses and action levels are documented in the RPPM. Employee exposures are tracked on a monthly basis by the radiation protection team.

4.7.13 Zone Control – Contamination Control

The PHCF maintains zone control and monitoring programs as described in the RPPM to identify areas of potential contamination and prevent the spread of contamination from these areas. There are three aspects to maintaining contamination control:

- Controlling contamination at the source;
- Containing and controlling radioactive and contaminated materials; and,
- Monitoring to verify the effectiveness of contamination control.

The site has been delineated into three control zones, and the zones are simply referred to as Zone 1, Zone 2 and Zone 3. The possibility of contamination increases with increasing zone numbers.

4.7.14 Radioisotope Control

The facility uses a number of radioisotopes that are regulated under the CNSC *Nuclear Substances and Radiation Devices Regulations*. Cameco 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 the RPPM and the associated procedures. These sources range in type from nuclear gauges and static eliminators to laboratory calibration sources and tracer solutions.

The controls associated with sealed sources, unsealed sources and radiation devices (including x-ray equipment) are described in the RPPM and associated procedures and include training, certification where required, leak testing, radiation warning signs and limited access to areas where sources are stored.

4.7.15 Planning for Non-Routine Incidents

The RPPM outlines the triggers for an investigation related to a non-routine radiation protection incident. Examples would be:

- Contamination identified outside of the production areas
- Routine monitoring of product or equipment leaving site above release levels as described in the RPPM
- Personal dosimetry results above the administrative or regulatory action levels set out in the RPPM
- Injury with potential for uranium contamination of the wound
- Airborne release of uranium within a production area as identified by routine monitoring

The level of investigation is determined by the significance of the event, as defined by the corrective action process.

Screening, administrative and action levels have been established to verify all samples and trigger investigations for potentially significant intakes, both from a radiological and chemical toxicity point of view. Formal dosimetry investigations involve verification of the sample, reviewing the workplace conditions, tasks performed and PPE used by the worker. A temporary removal from a production area may be required to collect additional urine samples, a lung count and/or other follow-up as determined by radiation protection personnel or medical personnel. Dose is assigned as per the dosimetry program licensed by the CNSC.

Corrective actions from dosimetry and/or contamination incidents are used to strengthen the radiation protection program at the facility. Planning for and responding to specific non-routine situations that may occur at the facility is also addressed in various radiation protection, fire safety and emergency response documentation.

4.8 Conventional Health and Safety

PHCF, under its current operating licence, is required to maintain an occupational health and safety program for the facility to protect the health and safety of its workers.

4.8.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Conventional Health and Safety SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.8.2 Conventional Safety Program

A key element of a safe, clean and reliable operation is a comprehensive and well-established worker protection program, which is in place at PHCF. The regulations made pursuant to the NSCA and Part II of the *Canada Labour Code* prescribe specific health and safety requirements that are met by the PHCF. In addition, Cameco's SHEQ policy and corporate Health and Safety Program provide direction for site programs and procedures. The Occupational Health and Safety Management Program Manual describes the health and safety program at the site.

The health and safety management program fosters and promotes a strong sustainable safety culture. Under the Operational Excellence initiative we strive for a safe, healthy and rewarding workplace. Cameco has five key principles in the area of safety that form the framework of how safety is managed. These are:

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

The health and safety of workers at PHCF is assured through site-specific safety and health management programs. 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.

4.8.3 Conversion Safety Steering Committee

The requirements for a Policy Health and Safety Committee (PHSC) and a Workplace Health and Safety Committee (WHSC) under Part II of the *Canada Labour Code* are met by the Conversion Safety Steering Committee (CSSC). This committee is an employee driven safety committee with subcommittees to focus on specific safety topics. The CSSC reviews and discusses matters involving occupational health and safety (OH&S) policies, procedures and programs, safety performance, safety program performance, work refusals, safety related projects, and joint union/management OH&S issues that may arise from time to time. It was established in 2013 and meets three days per month to address safety performance and safety culture. One meeting per month is specifically dedicated to the health and safety committee requirements set out in the *Canada Labour Code*. Time is allotted, actions are reviewed, issues discussed and minutes are maintained separately to address the code requirements of both a WHSC and PHSC. The CSSC is active in promoting continuous improvement that supports the site moving towards and injury-free workplace.

4.8.4 CSSC Subcommittees

The CSSC has established subcommittees consisting of cross-department groups of employees with an interest in continual improvement in the focus area of the subcommittee. The purpose of subcommittees is to actively engage a larger number of employees in safety improvements. Each subcommittee consists of approximately eight hourly and staff personnel, with a subcommittee sponsor whose role is to guide the subcommittee through logistical activities such as budgeting, project planning, and other aspects of the business. There are currently seven active subcommittees focusing on the areas of:

- Fall Prevention;
- HIRAC;
- PPE;
- Radiation Protection;
- Industrial Hygiene;
- Hoisting and Rigging; and
- Confined Space.

4.8.5 Hazards

The PHCF is a Class IB nuclear facility and a chemical processing plant. There are radiological hazards associated with the various forms of uranium found at the facility as well as chemical hazards from process chemicals including: bulk quantities of anhydrous hydrogen fluoride, aqueous hydrofluoric acid, fluorine, hydrogen, aqua ammonia, nitric acid, phosphoric acid, and smaller quantities of laboratory chemicals, 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.

These hazards are identified in various site documentation and procedures including the Occupational Health and Safety Management Program Manual, the Safety Report and the Environmental Aspects Registry.

4.8.6 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 employees are encouraged to discuss safety issues or concerns. Safety awareness, training and re-training are done through in-class sessions, safety meetings, and computer based training depending on the topic as described in section 4.2.

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. Purchasing procedures are in place for the procurement of chemicals. Safety Data Sheets (SDS) are requested from vendors for each type of chemical purchased. SDS information has also been developed for all of the uranic materials on site. The SDS information is available in the areas where the chemicals are used.

Work instructions, procedures, JHA, TASC, HIRAC, safety clearances and hazard specific clearances (i.e. hazardous energy, radiation, anhydrous HF) are some of the tools used to identify and control hazards in the workplace.

PPE is provided as necessary and is specified in the work instruction, JHA or clearance for the job. All PPE is approved by the technical services department to ensure that the correct PPE is available for each job. Chemical resistant gloves, chemical goggles and/or face shields, chemical suits and disposable coveralls are available for safe chemical handling. Half mask, full-face mask and supplied air respiratory protection with

appropriate respirator cartridges are available for tasks where inhalation of uranium, chemicals and/or dust is possible. In addition to air-purifying respirators, process and emergency response personnel are trained in the use of self-contained breathing air apparatus.

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

4.8.7 Program Effectiveness

All OH&S incidents and near misses are investigated and documented in CIRS for tracking of actions and trending. Incidents captured by the *Canada Labour Code* (Part II) definition of hazardous occurrences fall under Categories III-V of CIRS. Incidents and near misses are reviewed by the site leadership team on weekday morning conference calls to share initial lessons learned across departments. Site awareness of hazardous occurrences is also maintained by review at CSSC meetings, at weekly manager's meetings, and through weekly highlight reports. Site wide incident notifications are issued for all medical treatment and lost time injuries.

The effectiveness of the conventional OH&S system 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. Audits and inspections are conducted at PHCF to ensure regulatory compliance and compliance to Cameco's policies and procedures. Audit and inspection results are discussed with the managers responsible for the areas inspected and entered CIRS for resolution or management. This information also feeds into the annual management review of the management system and associated programs.

The PHCF 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 facility.

4.8.8 Employee Programs Regarding Health and Safety

The site also has a Live Better committee, consisting of a cross-section of employees. The purpose of this committee is to promote healthy living both on and off the job.

The company's benefits program includes an employee family assistance program which provides a broad range of support services to employees and their families.

In addition to personnel monitoring completed as part of the dosimetry programs described in section 4.7, PHCF has an established medical surveillance program which requires each employee to have a complete medical examination prior to employment and at least every two years during employment. The medical examinations are conducted by the facility nurse and the company doctor.

4.9 Environmental Protection

PHCF, under its current operating licence, is required to have in place a program that identifies, controls and monitors all releases of radioactive and hazardous substances from the facility. These requirements are met by the Environmental Management Program Manual (EMPM), Environmental Monitoring Plan (EMoP) and the Environmental Inspection and Test Plan (E-ITP).

4.9.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Environmental Protection SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.9.2 Environmental Management Program

The Environmental Management Program Manual (EMPM) describes how the PHCF meets the requirements of the ISO 14001 standard and links the various site documents that support the EMoP. The key characteristics of the operation and activities that can have a significant environmental impact, as defined through the Environmental Aspects Registry and Environmental Risk Assessment (ERA) are monitored and measured and are described in the EMoP, PHCF E-ITP and associated procedures. The E-ITP identifies all of the emissions to the air, water and land, the programs that are in place to monitor them, what is measured, the legal requirements and the reporting requirements.

Cameco is also committed to complying with the applicable CSA N288 series standards which provides guidance on the framework and methodology for establishing an environmental management program. This includes the assessment of risk and the development of monitoring programs to address these risks and demonstrate regulatory compliance.

PHCF has committed to revise its ERA to incorporate the requirements of CSA standard N288.6-12, Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills by the end of 2015. At the time of this application, the draft ERA was under review and the final version will be submitted to CNSC staff for review and acceptance in the first quarter of 2016.

Following CNSC staff acceptance of the ERA, PHCF will use the recommendations from the ERA, as well as the guidance outlined in CSA standard N288.4-10, Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills and

CSA standard N288.5-11, Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills to update the EMoP and associated E-ITP. These documents and any required changes to other lower tier documents in the EMPM will be fully aligned with these requirements by the end of 2017.

4.9.3 Role of Other Regulatory Agencies

Environmental Protection is an SCA where regulatory agencies in addition to the CNSC have jurisdiction over the operation of the PHCF. As described in section 4.3.2, Environment Canada, Fisheries and Oceans Canada, and Ontario Ministry of Environment and Climate Change have regulatory requirements that PHCF must comply with in addition to those set out in the operating licence and LCH.

4.9.4 Environment and Public Assessments

As described in section 4.4, the PHCF has developed multiple risk assessments which are periodically revised to reflect changes to the facility, corporate or divisional policies and/or external standards and guidance as well as verify that PHCF operations do not pose an unreasonable risk to employees, the public or the environment.

The most relevant risk assessments for the Environmental Protection SCA are the:

- Safety Report
- Environmental Aspects Registry
- Spill Prevention and Contingency Plan
- Environmental Risk Assessment
- Derived Release Limit
- Operating Release Level

All of these assessments will have been reviewed and/or updated between 2014 and 2016. The updated ERA to meet the requirements of CSA standard N288.6-12, Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills will be the most comprehensive ERA completed for the site and includes a screening for contaminants of potential concern, a Human Health Risk Assessment (HHRA), Ecological Risk Assessment and additional studies regarding physical stressors such as temperature and entrainment. This work will be included in the significant supporting studies and documents summary that will be made publically available to support the transparency of the licensing process.

4.9.5 Environmental Regulation

Airborne and liquid effluent discharge quality is defined and regulated by federal and provincial regulators. For Cameco, the primary federal regulators are the CNSC and

Environment Canada. Provincial regulation is performed through the Ontario Ministry of the Environment and Climate Change (MOECC). The rules and regulations enforced by these groups include the *Nuclear Safety Control Act; Canadian Environmental Protection Act, 1999; Fisheries Act; Ontario Water Resources Act; Environmental Protection Act*; Municipal and Industrial Strategy for Abatement (MISA) programs and the municipal bylaws related to storm and sanitary sewers.

The PHCF's Environmental Monitoring Plan (EMoP) has been developed to monitor direct discharges to the air and water, as well as assessing the operation's impact on the ambient air, water and vegetation. This monitoring data is then compared to applicable action levels and limits to ensure operations remain in compliance with applicable regulations and licence limits. As indicated in section 4.9.2, the PHCF will be updating the EMoP and associated plans and work instructions by the end of 2017.

4.9.6 Airborne Emission Program

The primary air emissions associated with the PHCF operations are uranium, fluorides ammonia and nitrogen oxides. 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

The main process stacks in the UF_6 plant and UO_2 plant are continuously sampled during operations. In the UF_6 main stack, fluoride and uranium emissions are monitored and in the UO_2 main stack, ammonia and uranium emissions are monitored. All other stacks and discharge points are sampled on an occasional or as requested basis. The details of this program are provided in the EMoP.

PHCF is requesting no change for the air emissions action levels and limits for the main production stacks which are shown in Table 3.

Table 3: Summary of Air Discharge Limits and Environmental Action Levels

Source	Parameter	Limit	Action Level	Averaging Period
UF_6 Plant Main Stack	Uranium	290 g/hr	40 g/hr	Daily
	HF	650 g/hr	230 g/hr	Daily
UO_2 Plant Main Stack	Uranium	150 g/hr	7 g/hr	Daily
	NH_3	58 kg/hr	13 kg/hr	Daily
UO_2 Plant Depleted Operations Stack	NOx	78 kg/hr	n/a	Daily

Validation of Cameco's emissions and samplers on the UO_2 main stack and UF_6 main stack is completed by compliance testing conducted by an independent third party, targeted for every 2 years. These sources are tested using approved sampling protocols outlined by the United States Environmental Protection Agency (US EPA), Environment Canada (EC) and Ontario Source Testing Code (OSTC) for licensed parameters. Other parameters may be added to the testing campaigns. A pre-testing plan is prepared and approved prior to each testing campaign.

Total site emissions are documented and compared against point of impingement standards in the site Emission Summary and Dispersion Model (ESDM) report which is reviewed by the MOECC. 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 and the amended Environmental Compliance Approval (ECA) ECA 2229-9FFK9G.

Ambient Monitoring

In support of the source sampling program, an ambient air program has been established to measure the quality of ambient air near the facility. The facility's emissions that have the greatest potential impact are fluorides and uranium; therefore, the program's focus is on these two constituents.

The ambient air program is comprised of three sampling programs: lime candles, dustfalls and high volume air samplers. All permanent sampling stations have been assigned a unique station number and may have one or more components of each of the sampling programs. Details with respect to the individual sampling stations and sampling programs are provided in the EMoP.

Fluorination rate is an indirect measurement of the gaseous fluoride concentration in the ambient air. An established method for measuring the fluoride concentration in ambient air is to expose lime (calcium oxide) coated filter papers, commonly called lime candles, for a fixed period of time. The fluoride reacts with the lime and the analysis of the lime candles provides a time-averaged fluoride concentration. The lime candles are prepared, deployed and collected on a specified frequency and are analyzed. The period of time is normally 30 days; however, weekly periods are also used.

Dustfall monitoring is a measurement of deposition rate and is obtained by collecting particulate matter in a container, termed a dustfall jar. The particulate matter is collected over a one-month period, and analyzed to determine the uranium deposition rate. In addition to the uranium analysis, the fluoride content of the collected dust provides information of fluoride in air near the facility. There is no regulated standard for uranium or fluoride content in dustfall.

The high volume (hi-vol) air-sampling program monitors the concentration of uranium suspended in the air near the facility. Approximately 40 cubic feet per minute of air is passed through and collects on a filter over a 24 hour period. There is no regulated standard for uranium content in hi-vol monitoring.

4.9.7 Liquid Emission Program

The PHCF liquid management and discharges are summarized as follows:

- Filter backwash stream (FBW) consisting of backwash water from the cooling water pumphouse and filter room which is discharged to the harbour;
- South cooling water return (UO2S) consisting of UO_2 plant non-contact cooling water return which is discharged to the harbour;
- North cooling water return (UO2N) consisting of UF_6 plant non-contact cooling water return and a minor contribution of non-contact cooling water by-pass from Building 2 which is discharged to the harbour;
- Sanitary sewer discharge consisting of contributions from steam boiler operation in the powerhouse, air compressor operation in the powerhouse, instrument cooling water from laboratories, personnel showers, and general facility operations (lunchroom, toilets, etc)
- Process waste water stream consisting of all process waste water effluents, all of which are discharged to an evaporator for treatment or re-used within the process.

- Groundwater recovered from the Pump & Treat system, which is discharged to an evaporator for treatment or re-used within the process.

Source Monitoring

Most of the PHCF cooling water requirements are met by the facility's cooling water intake located at the entrance to the Port Hope harbour. The remaining cooling water requirements are met by municipal potable water. A once-through non-contact cooling water system is used, and wherever possible, the cooling water pressure is higher than the process streams.

Cooling water effluent sampling locations (FBW, UO2S, UO2N), sample types, sample frequencies, effluent objectives and effluent limits are defined through the *Ontario Regulation 560 Effluent Monitoring and Effluent Limits – Metal Mining Sector* (O.Reg.560-94) and amended Environmental Compliance Approval (ECA) 4998-9CKL7F. The PHCF cooling water intake operations are further regulated by Permit to Take Water (PTTW) 1610-7QFKCK. This monitoring program is described in the EMoP and associated procedures.

The municipal sewage treatment plant processes the sanitary sewer discharges from the PHCF and sewage quality is defined by the municipal sewer-use by-law. Several sources contribute to the combined PHCF sanitary sewer discharge. The principal sources are standard domestic contributions from throughout the facility, effluent discharges from the powerhouse (i.e. boiler blowdown) and contributions from facility showering facilities. All sanitary sewer sources merge into a common sanitary sewer line within the PHCF prior to discharging to the municipal sanitary sewer system. It should also be noted that a portion of the sanitary sewer discharge from PHCF originates upstream of the facility, primarily from the municipal water treatment facility.

Ambient Monitoring

The ambient water quality program, like the ambient air program, is concerned with monitoring the impact of the aqueous discharges into the receiving waters. Discharges to the harbor are cooling water outfalls, storm water discharges and groundwater flow through the facility site.

The south cooling water intake (SCI) is sampled at the intake of the harbour water pumps immediately downstream of the travelling screens. The Port Hope harbour is also sampled at 13 locations around the perimeter of the harbour turning basin and approach channel as described in the EMoP and associated procedure. At each location, samples are obtained just below the surface and just above the harbour sediment layer.

The PHCF storm sewer works consists of 10 active storm water outlet discharges to the Port Hope harbour turning basin and approach channel with associated subsurface and above grade infrastructure. Storm water from the facility is collected in catch basins/manholes and directly discharged to active outlets at the Port Hope harbour turning basin and approach channel. The PHCF implemented initiated a revised storm water monitoring program in 2012. Storm water sampling is completed at select outlets on a semi-annual frequency as described in the EMoP and associated procedure.

Groundwater sampling and groundwater level monitoring is completed at numerous monitoring wells and pumping wells throughout the facility, and in some cases at monitoring wells beyond the facility fence line, in accordance with the EMoP and associated environmental procedure. Groundwater is sampled under three separate schedules: monthly sampling of the operating treatment wells, quarterly sampling of overburden monitoring wells covering five key areas of the site, and annual sampling of bedrock monitoring wells. The five keys areas of the site include: the refinery wells, the east plume associated the UF_6 plant, the south plume associated with the UF_6 plant, the former UF_6 plant area, and the UO_2 plant area. Groundwater collection and treatment is also regulated under Permit to Take Water (PTTW) PTTW 2762-7T9RFX. A comprehensive review of the groundwater monitoring is completed and submitted to the CNSC, MOECC and Environment Canada annually.

4.9.8 Terrestrial Monitoring Program

Annual vegetation and soil surveys at selected locations around the facility and local area are also performed.

Vegetation Sampling

The focus of the vegetation monitoring program is foliar fluoride concentrations within the Municipality of Port Hope. The effect of fluorides on local vegetation is determined each autumn when samples of fluoride-sensitive vegetation are collected for analysis and assessed for visible foliar damage. The monitoring program is completed in conjunction with the MOECC and samples are obtained from locations adjacent to PHCF and throughout the surrounding community.

Soil Monitoring

The terrestrial sampling program, including soil and vegetation components, is carried out at frequencies specified in the individual procedures to supplement results from the PHCF air emissions monitoring programs and to monitor the long-term effects of facility air emissions in the areas surrounding the PHCF. The soil monitoring program currently consists of five monitoring locations beyond the facility fence line.

4.9.9 Estimated Dose to the Public

As discussed in section 4.4, an operating release level (ORL) for the PHCF has been developed to account for all public dose exposure pathways – air, water and gamma. The ORL is derived from the Derived Release Limit (DRL) report. The ORL equation is based on a total dose of 0.3 mSv/year to the critical receptor with the air and water components each being less than 0.05 mSv/year and gamma component being less than 0.3 mSv/year. The ORL was adopted as the licence limit. The annual regulatory dose limit for a member of the public is 1.0 mSv.

A significant portion of the contribution to public dose is due to gamma emissions from the facility. Therefore, it is essential to monitor gamma emissions at the fencelines of sites 1 and 2 to ensure that levels are maintained ALARA. The gamma emissions for both site 1 and site 2 are measured at key locations along the fenceline of each site using environmental dosimeters supplied by a licensed dosimeter service. The ORL for site 1 sets a licensed limit for fenceline gamma emissions of 14 μR/h at the critical receptor currently located at station 14 (opposite 125 Mill Street).

During the current licence period, CSA standard N288.1, Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities which provides guidelines and a methodology for calculating DRLs for routine releases of radionuclides to air and surface water was updated. In preparation for 2016 relicensing activities, Cameco reviewed its 2008 DRL report and identified that there were several opportunities for improvement to the existing DRL that needed to be addressed in advance of the licence renewal. These opportunities included:

- Aligning the conceptual site models between studies completed to support operations, VIM, environmental risk assessment and public dose assessment, in particular with respect to receptors and receptor locations
- Alignment of the risk assessment models with ongoing environmental monitoring programs to reflect current conditions by including groundwater, storm water and contributions to the sanitary sewer and removing process effluent
- Updating the DRL to align with the guidance in N288.1-14

Subsequent to the completion of the draft ERA to align with N288.6-12 in the fourth quarter of 2015, PHCF initiated an update to the DRL to align with N288.1-14. This report will be submitted to CNSC staff by the end of the first quarter of 2016. As there is potential for significant change to the DRL which may impact the monitoring program, in particular for fenceline gamma, PHCF will ensure that any changes are communicated to the public in advance of implementing these changes.

4.9.10 Reporting of Environmental Information

PHCF 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 camecoporthope.com website, and a record of spills and other events that may be of interest to the public is also maintained on the website. Quarterly updates are provided to the Municipality of Port Hope council, through the community newsletter Energize, as well as community forums and social media.

4.9.11 Vision in Motion Environmental Assessment Follow-up Monitoring and Reporting

The majority of controls to be used during the VIM project to ensure safety for workers, the public and the environment are already captured under the site programs described in the respective safety and control areas of this application and the FLM. However, in the SCA of Environmental Protection, Cameco has recognized that additional monitoring, specific to particular phases and activities within the project, will be required to augment the existing program and/or to address follow-up requirements of the environmental assessment that was completed in support of the project. Cameco has drafted a VIM-specific Environmental Monitoring Plan (VIM EMP) that will provide the framework for monitoring the impact of the VIM project activities on the environment in the vicinity of Sites 1 and 2.

The VIM EMP will continue to develop as the site project planning is advanced and as implementation details are established for areas where coordinating environmental monitoring activities with the Port Hope Area Initiative (PHAI) cleanup project may be possible.

4.10 Emergency Management and Fire Protection

PHCF, under its current operating licence, is required to maintain an emergency preparedness plan in accordance with the requirements of the NSCA and the *Class 1 Nuclear Facilities Regulations* and a fire protection program to meet with the requirements of NFPA-801(2008) Standard for Fire Protection for Facilities Handling Radioactive Materials.

The PHCF has completed a gap analysis between its Emergency Response Plan and the CNSC REGDOC-2.10.1 Nuclear Emergency Preparedness and Response and has committed to compliance with this new requirement by the end of 2017. A gap analysis has also been completed between the Fire Protection Program and the CSA Standard N393-13 Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances and PHCF has committed to compliance with this new standard by the end of 2017.

4.10.1 Current Operations

Since the last licence renewal, CNSC staff have assessed the Emergency Management and Fire Protection SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting all regulatory requirements and expectations. It is expected that this SCA will continue to meet or exceed regulatory requirements and expectations over the next licence period.

4.10.2 Emergency Planning

Emergency planning for nuclear facilities is a requirement of the NSCA, the *Class 1 Nuclear Facilities Regulations* and the operating licence. In addition to the CNSC licensing requirements, Environment Canada and the Ministry of Environment and Climate Change have requirements related to emergency planning and spill prevention. The federal *Environmental Emergency Regulations* identify specific chemicals and quantity levels that require the facility to develop release scenarios and conduct drills at prescribed frequencies as part of an Environmental Emergencies Plan (E2 Plan). Ontario Regulation 224/07 *Spill Prevention and Contingency Plans* requires the site to maintain a site-specific Spill Prevention and Contingency Plan (SPCP) as a resource for preventing, detecting and responding to spills.

The site has well-established measures to prevent or mitigate the effects of accidental releases of nuclear and other hazardous substances. The measures and response actions are documented in the current versions of the site Emergency Response Plan and Fire Safety Plan (FSP) and referenced procedures. The E2 Plan and SPCP support the site Emergency Response Plan (ERP). These plans outline the actions to be taken in order to minimize the worker and public health hazards and environmental hazards, which may

result from fires, explosions, or the release of hazardous materials. Interaction with off-site authorities is also addressed in the plans.

4.10.3 Emergency Response Plan

Effective emergency response is carried out through the PHCF's Emergency Response Plan (ERP). The plan assigns specific accountabilities and sets out processes and procedures to protect the health and safety of employees, contractors, the public and the environment in the case of an emergency. It outlines the actions to be taken to respond to emergencies including response team assembly, personnel accounting, event classification, emergency hazard monitoring, and the treatment of casualties as well as the return of the facility to normal operations.

In addition to the ERP, Standard Operating Guidelines (SOGs) and Pre-incident Plans (PPs) provide additional emergency response information. These documents outline the requirements for training, drills and exercises as well as emergency response facilities and equipment and interface with offsite organizations and community notification in event of an emergency.

The following requirements for ensuring a continuing effective emergency response capability are documented in the ERP:

- Testing the implementation of the measures to prevent or mitigate the effects of an accidental release through regular exercises and drills;
- Training and qualifying of emergency response personnel;
- Maintaining emergency equipment and facilities, including survey equipment, procedures and decontamination capability;
- Evaluation and assessing of programs;
- Assisting off-site authorities in planning and preparing to limit the effects of an accidental release;
- Notifying off-site authorities of an accidental release or the imminent threat of an accidental release; and
- Reporting information to off-site authorities during and after an accidental release and assisting off-site authorities in dealing with the effects of an accidental release.

4.10.4 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: Emergency Response Team (ERT), Emergency Medical Team (EMT), Emergency Response Organization (ERO), Local Crisis Management Team (LCMT),

Corporate Crisis Management Team (CCMT) and Transportation Emergency Response Organization (TERO). 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.

4.10.5 Emergency Response Team

As the primary response provider for the facility, the PHCF Emergency Response Team (ERT) consists of designated members that are in place to respond to emergencies at the facility. ERT members are trained to NFPA 600 – Advanced interior/exterior firefighting level and NFPA 472 Hazardous Materials Technician Level. Training is specific to products, feed materials, processes and response equipment found in the Port Hope Conversion Facility. ERT members have annual training requirements to maintain their qualifications through the SAT.

The facility maintains personnel onsite to allow for an entry team, and a rapid intervention team to respond to incidents at the facility 24-hours a day when the facility is operating. The facility maintains a Rapid-Notify system to recall members of the various response organizations to the facility or local crisis management centre at the divisional office to respond to any emergency scenario.

An emergency response and training assistance agreement between Cameco and the Municipality of Port Hope provides an additional layer to the PHCF's emergency response capability. This ensures that the two response organizations have the opportunity to train together to prepare for emergencies that could require a joint response. Also, as part of the agreement, Cameco provides the Port Hope Fire and Emergency Services (PHFES) with the necessary equipment and training to effectively respond to emergencies at the PHCF.

4.10.6 Exercises and Drills

The PHCF completes a minimum number of drills and training exercises (table top and full simulations) each year to test the ERP and provides the members of the various EROs to improve and sustain their emergency response capability. Drills and exercises are an opportunity for continual improvement through the development and implementation of recommendations from previous drills and exercises, audits and inspections, lessons learned from external incidents such as the Fukushima-Daiichi nuclear accident and other sources of corrective actions or opportunity for improvement. Table top exercises, drills and full simulations are used for the following purposes:

- Table Top Exercises - round table discussions of a potential emergency situation. They are developed to practice elements of the ERP and structured to meet the specific objectives identified. Table top exercises will be conducted a minimum of one per year.
- Drills - are hands-on activities that test a certain element of the emergency response system, such as facility evacuation and census. The drills are based on realistic scenarios that could impact the PHCF. They involve activating personnel to handle the described emergency. Personnel will be required to respond to an evolving emergency event run on real time. Stimuli for the events of the exercise will be scripted and simulators will provide the inputs to the organization via telephone and radio. Frequency of drills will increase proficiency. A drill for personnel will be conducted once per year. Drills may be utilized in training/qualification of ERT members, involve a subset of the facility or ERO and/or be coordinated with a full simulation exercise.
- Full Simulations – to test the complete emergency response organization. An actual incident is staged and the complete organization is mobilized to deal with it. A simulation centre is used to generate the outside world. Community resources are invited to participate in the exercise simulation. The PHCF will conduct a full simulation exercise to test specific elements of the ERP at least once every four years.

4.10.7 Emergency Response Assistance Plan

Cameco also has an Emergency Response Assistance Plan 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 PHCF are included in the plan. Cameco reviews and updates the Emergency Response Assistance Plan as required.

4.10.8 Fire Protection Program

The PHCF Fire Protection Program (FPP) establishes provisions to prevent, mitigate and respond to fires such that fire risk to workers, the public, the environment and Cameco property is acceptably low and controlled. It not only meets internal Cameco requirements, but also meets the requirements of the National Fire Code of Canada, 2005, the National Building Code of Canada, 2005 and NFPA 801 Standard for Fire Protection for Facilities Handling Radioactive Materials, 2008. It will be aligned with CSA N393-13 by the end of 2017.

The purpose of the FPP is to define management responsibilities, program objectives, program elements and program controls required to achieve the fire safety objectives. The

FPP applies to all buildings at the facility and shall apply to the design and construction of new buildings and facilities; to the modification of existing facilities and through their different operational stages, including shutdown and decommissioning.

The Fire Protection Program consists of two main elements: the Fire Hazards Analysis and the Fire Safety Plan.

4.10.9 Fire Hazards Analysis

A Fire Hazard Analysis (FHA) meeting the requirements of NFPA 801 and supporting reference materials has been completed for every building at the Port Hope Conversion Facility. It is updated as necessary to reflect current plant conditions. The objectives of the Fire Hazard Analysis are to:

- Identify fire hazards and their potential impact related to life safety, nuclear safety, environmental protection and asset protection.
- Identify the ignition sources and combustible materials in areas containing radioactive or hazardous materials.
- Establish the fire protection features required to meet regulatory requirements and program objectives.

4.10.10 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 fire safety features required by the FHA.

The following aspects of fire prevention are documented in the FSP:

- Fire safety information;
- Housekeeping and control of transient combustibles;
- Control of dangerous goods;
- Control of ignition sources;
- Facility inspections;
- Fire prevention surveillance;
- Fire reports; and,
- Construction, demolition and renovations.

The following aspects of fire protection 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.

4.10.11 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. Any recovery plan may be reviewed and approved by the regulatory bodies and would be developed to minimize the impact to personnel involved in the clean-up, the environment and the general public. Therefore no specific instructions on clean-up have been provided in the ERP.

4.11 Waste Management

PHCF, under its current operating licence, 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 Current Operations

Within the current licensing period, CNSC staff have consistently assessed the Waste Management SCA in the Annual Performance of Uranium Fuel Cycle and Processing Facilities Report as meeting regulatory requirements and expectations. Given the robust processes in place at the PHCF, the divisional focus on waste management for the next five years and the implementation of the VIM project in the upcoming licence period, it is expected that this SCA will continue to meet or exceed regulatory requirements and expectations during the next licensing period.

4.11.2 Waste Management Plan

The Waste Management Plan (WMP-01) describes how waste is managed throughout its lifecycle to the point of disposal at the PHCF. It includes waste generation, storage, processing, recycling and removal/transfer to an appropriate waste management or other facility. WMP-01 was developed to meet the following objectives:

- To implement waste segregation, volume reduction and waste recycle/utilization programs which are environmentally sound and economically viable to minimize the amount of radioactive waste, hazardous waste and mixed waste which must be managed at the PHCF.

- To implement disposal outlets for material that must be managed as radioactive, mixed and/or hazardous waste.

- To provide storage facilities for radioactive waste generated from past, present and future facility operations where no recycle, utilization or others outlets exist.

- To manage non-contaminated waste streams through established and provincially approved waste receivers. The principles of reduce, reuse and recycle will be applied wherever possible.

- To provide sufficient information to the regulatory agencies and to the public to demonstrate conformance to these objectives.

This plan is applicable to all wastes and by-products generated at the Port Hope conversion facility, but does not include airborne and water-borne effluents. The implementation of the routine waste management programs described in the plan is through segregation at source by the various departments at the site, followed by processing, storage and/or disposal by the PHCF waste management group.

For non-routine, project or special waste management programs FSD staff will provide guidance on sampling, assess waste acceptance criteria in order develop pathways analysis, seek out appropriate waste disposal facilities and secure program approvals (where required) for waste generated at PHCF. FSD compliance and licensing personnel provide oversight of these projects and also act as a liaison with the various regulatory agencies that have jurisdiction.

Liaison with the regulatory agencies on waste management matters is carried out by the divisional compliance and licensing group. The CNSC have established cooperative arrangements with the environmental regulatory agencies. Accordingly, Cameco also maintains liaison with Environment Canada and the MOECC. Non-radiological waste, which is classified as hazardous waste by provincial or federal regulations, is disposed of in compliance with the applicable regulations.

Records on the status of various waste management programs are maintained on site. This information is available to the CNSC staff or designated staff from the environmental regulatory agencies.

4.11.3 Current PHCF Waste Inventory

There is a large inventory of accumulated wastes located at the PHCF and ancillary properties. The majority of these wastes are eligible for disposal in the LTWMF to be constructed within in the Municipality of Port Hope by the PHAI. The VIM project is responsible for the preparation and transport of the wastes destined for the LTWMF. Wastes at the PHCF that do not meet the WAC are not currently eligible for disposal in the LTWMF and must either be processed so that they meet the criteria or be disposed of at an alternate facility. Cameco has a target to divest these materials to an appropriate recycle or licensed hazardous waste management facility by the end of 2018.

Disposal or recycling pathways have been identified for all wastes currently being generated and Cameco does not anticipate any ongoing accumulation of wastes beyond 2018.

4.11.4 Centre Pier Soil Mound

Cameco stores approximately 20,000 m^3 of marginally contaminated soil on the Centre Pier from an excavation at the Municipality of Port Hope's current waterworks site property. The proposal to store this soil was approved by the CNSC on April 7, 2003. The project was deemed to be complete on August 28, 2003.

The Low-Level Radioactive Waste Management Office (LLRWMO) under the Construction Monitoring Program removed the soil from the current waterworks site. The soil is in interim storage pending the construction of the LTWMF in the Municipality of Port Hope.

During the interim storage period on the Centre Pier, the soil pile is inspected monthly by staff from the LLRWMO. Gamma surveys at the mound and perimeter fence are taken quarterly. Monthly radon in air measurements are also taken at the east and west perimeter fence line. This data is reported to Cameco on a quarterly basis.

4.11.5 Clean-Up Program

The CUP has been established to remove obsolete buildings, equipment and materials for the purpose of reducing environmental obligations, creating useable space and improving the appearance of the PHCF. CUP may undertake these activities at any of the three properties that make up the PHCF:

Site 1 – main site operations and storage (1 Eldorado Place)
Site 1 – Centre Pier storage (1 Hayward Street)
Site 2 – Dorset Street storage (158 Dorset Street East)

The activities of the CUP group are carried out in accordance with work plan WMP02 – Cleanup Program. CUP activities can be generally broken down into routine operations and projects.

4.11.6 Routine CUP Work

Routine work performed by CUP operators includes the following activities:

- Decontamination – CUP operators use a variety of techniques including grinding, scarifying, hot water washing, pressure washing and grit blasting to remove fixed and/or surface contamination from equipment, scrap metal or other objects and in areas where contamination is identified outside of zone 3 areas. This will include planned work and responding to incidents or yard contamination.

- Scrap Metal Processing – CUP operators carry out scrap metal collection, size reduction, decontamination and monitoring of material for release from the facility to a scrap metal recycler.

- Waste Management – CUP operators conduct the day-to-day activities of waste management including waste segregation, handling, volume reduction, packaging and storage for the various waste management programs described in the Waste Management Plan (WMP-01).

- Dismantling/Demolition – CUP operators remove redundant equipment and piping and other demolition activities to address health and safety issues (i.e. access ladders that do not meet code), prepare areas for new equipment installation/repurposing

- Rehabilitation/Repurposing – CUP operators conduct other activities, including residual hazardous substance decontamination, cleaning, material movement to support rehabilitation/repurposing work in active areas of the facility.

- Spill response – CUP operators support site operations in small scale clean-up activities such as uranium releases or small spills that do not require a hazardous material (hazmat) response

4.11.7 CUP Projects

CUP projects, such as SuperCUP or VIM, are defined with a general scope of work that defines the project, the end-state for the project and the expected timeframe during which the work will be completed. A CUP project may consist of a single or multiple parts, with associated plans that describe the project from initiation to the desired project end-state.

CUP projects are those that fit within the following conditions:

- Large scale equipment removal which may:
  - require multiple days to remove
  - occupy a substantial footprint of the building/area
  - require coordination with more than one department
  - include multiple pieces of equipment removed in a single area
- Isolated area of repurposing/rehabilitation
- Wastes that require specialized handling and/or are produced in large volumes
- Activities that are in preparation for future decommissioning work

CUP projects are designated as either a small or large CUP project, with planning requirements for each type of project set out in WMP-02, including the project scope

and/or the CUP Project Work Plan Assessment (WPA). The WPA is intended to ensure that the project considers the relevant safety and control areas and how the activities, supervision/oversite responsibilities and potential hazards will be managed. Hazards may be managed through existing site monitoring and control processes for health, safety, radiation protection, fire protection, environment, and quality, or may require additional project-specific monitoring and controls. For large CUP projects, CNSC staff will be notified of the upcoming project via submission of the WPA. Completed WPA will feed into the preliminary decommissioning plan five-year review process.

4.11.8 Vision in Motion - Background

As described in section 2.4.2, the VIM project provides Cameco with an opportunity to deliver an allowance of qualifying waste materials to the LTMWF and to remediate and redevelop the PHCF. The VIM project meets the criteria of a large CUP project and is expected to be implemented during the next 10 years in conjunction with the PHAI Port Hope project being implemented by Canadian Nuclear Laboratories (CNL).

The federal/municipal agreement establishing the PHAI specifies that approximately 150,000 m^3 of Cameco decommissioning waste materials arising at the PHCF and other specified locations are to be accommodated in the LTWMF which is to be located in the Municipality of Port Hope. This agreement provides Cameco with a limited window of opportunity, during the time that the LTWMF is receiving wastes, in which to transport waste for storage at the LTWMF. Soil remediation for the VIM project is being targeted to specific areas. The scope is based on modelled improvements to groundwater, including a risk based approach. The VIM project will be undertaken within the general framework of environmental and health and safety programs currently in place at the PHCF. In addition, specific plans have been developed to guide VIM specific activities. The following works and activities will be completed as part of the VIM project:

- Demolition activities: These activities include removal of hazardous materials and drummed wastes from interiors; removal of equipment, material and building services; cleaning of building interiors; building dismantlement; and management of removed demolition waste.
- Excavation activities: The excavation method to be used will depend on the subsurface soil and groundwater conditions, the depth of excavation, and the proximity to facilities. Excavation will include shallow excavations above the groundwater table and excavations that extend to or below the groundwater table.
- Construction activities: These activities include modifications to existing buildings, potential construction of a new building or building addition and upgrades to site infrastructure, such as pipe racks, underground utilities as well as on-site roads, parking lots, fencing and lighting and finished grading.

- Transportation and disposal of contaminated and non-contaminated materials: Contaminated wastes will be transported to the LTWMF. Non-contaminated waste materials may be transported to other waste outlets. Materials to be disposed of at the LTWMF will include drummed wastes, contaminated soils, demolition debris, and asbestos-containing material.

Upon completion of the project scope, the following will be accomplished:

- Waste materials at the PHCF within the defined remediation scope will have been transferred to the LTWMF (or other waste outlets as appropriate).
- New or modified infrastructure will have been commissioned as needed to support the project objectives such as roadways, berms and retaining walls; and subsurface piping.
- The environmental objectives of the project will have been achieved.
- Improvements to the PHCF which are consistent with the community planning objectives for development of the waterfront will have been completed, as defined within the details of the project scope.

4.11.9 Vision in Motion – Progress in Current Licence Period

Following acceptance of the environmental assessment in 2012, Cameco refined the scope for the project. The planned remediation scope was presented to the CNSC, Environment Canada, and MOECC. In February 2014, all three regulatory agencies provided letters of support, in principal, for the selected option, subject to formal approval processes. Subsequent to receiving regulatory support for the remediation scope, the project was advanced to the next phase of design and planning for the selected scope and project licensing submissions.

As described in section 3.5, Cameco advanced CUP projects in 2014 and 2015 that began physical preparation for VIM. SuperCUP 2014, the VIM Trial Excavation, SuperCUP 2015 and Centre Pier Demolition resulted in removal of redundant equipment, clean-up of several on-site buildings, gathering of physical information regarding subsurface conditions onsite, and demolition of above-grade portions of buildings to improve the physical safety of portions of the facility. This work is being used to inform the ongoing VIM project planning.

Similar projects are anticipated to be executed in 2016 as the VIM project planning progresses. Cameco will also begin to develop WPAs for various phases of the project and work with the CNSC and other regulators such as EC, MOECC and Fisheries and Oceans Canada (DFO) to ensure that project planning meets regulatory requirements.

Additionally, Cameco will progress/finalize agreements with CNL/PHAI regarding project implementation for areas of interaction, and opportunities for cooperation in monitoring, public information and other mutual areas of interest.

4.11.10 Environmental Assessment

A comprehensive study-type environmental assessment (EA) was completed under the *Canadian Environmental Assessment Act* (CEAA) 1995 with the CNSC as the responsible authority. The Environmental Impact Statement (EIS) and supporting documentation was submitted by Cameco in December 2010, with the CNSC Comprehensive Study Report (CSR) issued in May 2012. The CSR concluded that the Vision 2010 project was not likely to result in significant adverse environmental effects taking into account the implementation of mitigation measures identified during the EA.

The CSR was the subject of a CNSC hearing in May 2012, and the EA for Vision 2010 was accepted by the Federal Minister of the Environment in December 2012. The project was subsequently rebranded Vision in Motion (VIM). Work was then undertaken to refine the scope of the project.

4.11.11 Vision in Motion –Next Licence Period

VIM is a unique opportunity that has been made possible because of the PHAI and the LTWMF that will be constructed by the PHAI on the site of the licensed Welcome Waste Management Facility. Due to the close relationship of the two projects, effective coordination of VIM with the PHAI activities is required, in particular for the transfer of materials to the LTMWF, building demolition, soil remediation and other activities on the Centre Pier that are required to be completed while the site is licensed by the CNSC, remediation along Cameco's fenceline, and remediation of the Port Hope harbour. Public information, environmental and radiation monitoring and regulatory oversight are other aspects of the projects that require clear coordination.

Cameco anticipates that the LTWMF will be open to receive Cameco materials in approximately 2018. As the VIM project is predicated on the availability of the LTWMF to receive wastes, the schedule for the implementation of the project will need to adjust to any changes in the schedule for receipt of wastes at the LTWMF.

Until the LTWMF is open to receipt of materials, Cameco will progress detailed project design for the multiple aspects of the project, seek regulatory concurrence from CNSC and other regulators on the design and implementation plans for the project and coordinate with PHAI where appropriate.

4.11.12 Preliminary Decommissioning Plan

Cameco maintains a Preliminary Decommissioning Plan (PDP) and financial guarantee for the PHCF. These documents meet the requirements of the CSA Standard N294-09 Decommissioning of Facilities Containing Nuclear Substances, G-219: Decommissioning Planning Guide for Licensed Activities (June 2000) and G-206: Financial Guarantees Guide for the Decommissioning of Licensed Activities (June 2000).

The PDP is reviewed and revised as appropriate every five years. The PDP is currently under revision and will be submitted to CNSC staff within the first quarter of 2016. Once the PDP is accepted by CNSC staff, the financial guarantee will be amended to reflect the 2015 review of the PDP and submitted to the Commission for approval. This is further described in section 4.15.

4.12 Security

PHCF, under its current operating licence, is required to have a nuclear specific security program covering facility security and security systems. Cameco maintains a security program to comply with the requirements of the *General Nuclear Safety and Control Regulations*, the *Nuclear Security Regulations* and any additional requirements such as designated officer orders.

4.12.1 Current Operations

Since the last licence renewal, CNSC staff have consistently assessed the Security SCA as meeting regulatory requirements and expectations. Given the robust security processes in place at PHCF, it is expected that this SCA will continue to meet or exceed regulatory requirements and expectations during the next licensing period.

4.12.2 Security Plan

Cameco's Security Plan presents an overview of the security operations at the PHCF 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*. 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 PHCF Security Plan has continued to evolve in order to meet all regulatory requirements and commitments over the period of the current operating licence.

The PHCF has reviewed REGDOC-2.12.3, Security of Nuclear Substances: Sealed Sources and completed a gap analysis against the existing security plan. PHCF has committed to compliance with this new requirement by the end of the second quarter of 2016.

4.13 Safeguards

PHCF, under its current operating licence, 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.

4.13.1 Current Operations

Over the current licensing period, CNSC staff have consistently assessed the Safeguards SCA as meeting regulatory requirements and expectations. Cameco anticipates making further enhancements to this area and expects that this SCA will continue to meet regulatory requirements and expectations during the next licensing period.

4.13.2 International Obligations

The PHCF complies with the IAEA Document SG-SGOB-3105, Integrated Safeguards Procedure for conversion and fuel fabrication and continues to meet its licence conditions as described in the LCH concerning Canada's international obligations under the Treaty on the Non-Proliferation of Nuclear Weapons.

4.13.3 Inventory and Reporting

The facility maintains a natural uranium inventory system in which receipts and shipments are recorded. Monthly reporting to the CNSC is completed as per the requirements of RD-336 Accounting and Reporting of Nuclear Material. Periodic audits of the inventory system are conducted by the IAEA, the CNSC and by Cameco internal auditors. Uranium accountability controls and practices are in place through the accountability system in order to comply with the applicable requirement for nuclear materials safeguards of the CNSC. Cameco completes an annual Physical Inventory Taking (PIT) as part of licence conditions pursuant to the implementation of safeguards by the IAEA. Canadian facilities are selected at random by the IAEA for a Physical Inventory Verification (PIV) that follows the PIT. If a facility is not chosen for PIV, then CNSC Safeguards Staff performs limited confirmation activities following the annual PIT.

In the upcoming licensing period, PHCF anticipates improvements to this SCA as wastes that will be transferred to the LTWMF will be characterized and transferred from retained waste to the LTWMF. Cameco is working with CNSC staff, PHAI and IAEA on the requirements to complete this work under safeguards obligations.

4.14 Handling, Storing, Packaging and Transport

PHCF, under its current operating licence, is required to have program for the receipt, packaging and transport of nuclear and dangerous goods.

4.14.1 Current Operations

In the current licensing period, CNSC staff have consistently assessed the Packaging and Transport SCA as meeting regulatory requirements and expectations. Given the controls in place at the PHCF, it is expected that this SCA will continue to meet or exceed regulatory requirements and expectations during the next licensing period.

4.14.2 Packaging and Transport Program

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

Nuclear substances are packaged and transported on public roadways, railways and marine transport in accordance with the *Transportation of Dangerous Goods Regulations* (TDG) and the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR, 2015). Employees are trained in the safe handling, packaging, shipping and receipt of dangerous goods commensurate with their responsibilities. Detailed work instructions are documented and employees are trained in the safe handling of nuclear substances and dangerous goods, as required by the TDG Regulations, PTNSR, 2015 and the *Canada Labour Code*, Part II.

The TDG Regulations regulate the shipping, emergency response and associated documentation for uranium and other dangerous goods. The PTNSR, 2015 apply to the safe packaging, marking, labelling, placard and documentation associated with the transport of nuclear substances in Canada. All packages shipped from the facility are monitored prior to leaving the facility as described in the RPPM and Section 4.7 of this application.

UO_2 is packaged in drums and transported by road from the PHCF to the Cameco Fuel Manufacturing Ltd. (CFM) facility in Port Hope and/or other domestic fuel manufacturing facilities. UO_2 is also packaged in drums and transported by road and marine overseas to Japan and Korea. There is also a small amount of material transported by air for customer evaluation purposes. The drums used for air transport meet the Type IP-3 packaging requirements; all other drums meet the Type IP-1 packaging requirements.

UF_6 is packaged and transported in Type H(U) and H(M) cylinders as per the PTNSR, 2015 by road or marine from the PHCF to the USA or overseas, including but not limited to, the United Kingdom, Germany, Holland and Japan.

Shipments of radioactive materials are made exclusively to:

- Persons or facilities holding a valid licence to possess such prescribed substances; or
- Persons or facilities not requiring such a licence by virtue of national regulations.

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 the Department of Foreign Affairs, Trade and Development.

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

5.0 NUCLEAR FACILITY SPECIFIC AREAS OF INTEREST

5.1.1 Public Information Program

The objective of Cameco Corporation's (Cameco) PIP is to foster open dialogue between the company and persons living in the vicinity of the PHCF.

The PIP has been designed to meet the requirements of the Canadian Nuclear Safety Commission's (CNSC) RD/GD 99.3, Public Information and Disclosure (March 2012). The PIP was updated by Cameco, submitted to and accepted by CNSC staff in 2015.

The PIP outlines the general nature and characteristics of the anticipated effects on the environment and the health, safety and security of the community as a consequence of the continued operation of the PHCF. Due to the fact that Cameco also operates CFM in the same community, the PIPs for both facilities are closely aligned.

As part of the PIP, Cameco commits to:

- Describing an overview of the production process;
- Providing quarterly and annual updates on the results of the environmental monitoring program;
- Addressing concerns related to the environment, including long-term effects of uranium emissions;
- Addressing issues related to public health, safety and security, while bearing in mind that information about security may be of a prescribed nature;
- Addressing issues specifically related to fire safety and emergency response, flooding potential and decommissioning financial guarantees;
- Providing information related to significant projects at the PHCF (i.e. new construction, process changes, risk assessments);
- Providing information on the socio-economic impact of Cameco in the community;
- Establishing a community liaison forum process to provide an ongoing vehicle to discuss issues related to the operation of the facility with interested parties;
- Establishing a community web site to provide local residents with specific information related to Cameco's operations in Port Hope;
- Using social media to provide ongoing information about local operations;
- Providing an analysis of media coverage, public opinion research and feedback gained through community forums; and
- Providing information written in plain language that addresses the effects of the conversion facility's activities on the environment and the health and safety of employees and the community.

5.1.2 Aboriginal Consultation

Cameco is committed to provide opportunities to engage with First Nation and Métis communities, regarding the PHCF's ongoing operations and Cameco's VIM project.

Cameco includes the chiefs of the five nearest First Nations bands and the Metis Nation of Ontario on our mailing list to ensure that the First Nations are aware of all community forums and other community events. Cameco will continue outreach to the local First Nations and Métis communities throughout the licensing process and subsequent licence period.

5.1.3 Financial Guarantee

The PHCF has a Preliminary Decommissioning Plan (PDP), which was prepared based on guidance provided in the CNSC Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*. The current financial guarantee, maintained in the form of irrevocable letter of credit for $101.7 million reflects the PDP accepted by the Commission during the previous licensing proceedings.

The PDP has recently been updated and will be provided to CNSC staff for review and acceptance in early 2016. 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 plan is revised and re-submitted to the CNSC as required by the LCH. As part of this process the financial guarantee is also updated in accordance with the criteria set out in CSA standard N294-09 and CNSC regulatory documents G-219 and G-206. Once the value of the financial guarantee has been approved by the Commission, Cameco will secure an irrevocable letter of credit to cover the full amount required by the updated PDP.

5.1.4 Nuclear Liability Insurance

As required by the operating licence and associated LCH, the PHCF maintains valid nuclear installation liability insurance and annually provides proof of this insurance to CNSC staff.

5.1.5 Other Regulatory Approvals

During the current licensing period, the PHCF received amendments to the following approvals from the MOECC:

- an environmental compliance approval (ECA) for air and noise emissions

- an environmental compliance approval (ECA) for cooling water and storm sewer works

During the current licensing period, the PHCF received maintained the following approvals from the MOECC:

- a permit to take water (PTTW) for its cooling water intake
- a permit to take water (PTTW) for its groundwater collection system

A list of other regulatory approvals that PHCF maintains are found in Appendix 1.