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Cameco Corporation

Port Hope Conversion Facility

One-Day Public Hearing

Scheduled for:
November 9 and 10, 2016

Request for a Licensing Decision:

Regarding:

Renewal of Operating Licence FFOL-3631.0/2017 for the Port Hope Conversion Facility

Submitted by:
Cameco Corporation

TABLE OF CONTENTS

EXECUTIVE SUMMARY

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

Cameco operates the Port Hope Conversion Facility (PHCF) under Canadian Nuclear Safety Commission (CNSC) operating Licence FFOL-3631.0/2017 (the Licence) 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.

PHCF is operated under Fuel Facility Operating Licence FFOL-3631.0/2017 issued to Cameco Corporation by the CNSC, which expires on February 28, 2017. Cameco has submitted an application and supporting documentation to request the renewal of this operating licence for a period of 10 years.

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

- No change to current annual production limits of:
  - 2,800 tonnes uranium as uranium dioxide (natural or depleted) 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;
- Continued authorization to process and store various natural, enriched and depleted uranium compounds;
- Removal of references to:
  - the north UO_2 plant as a UO_2 production facility, including existing production limits
  - the metals plant and metals production as an activity authorized under the licence, including existing production limits;
- That the operating licence specifically describe the authorization for PHCF to engage in clean-up, decontamination, demolition and remediation activities, (including Vision In Motion (VIM)), that are within the current licensing basis; and,
- Approval of the proposed financial guarantee of $128.6 million, based on the 2016 update to the Preliminary Decommissioning Plan (PDP).

The application for licence renewal submitted on November 20, 2015 and the supplemental information submitted on August 4, 2016, as well as referenced material in these documents, serve as the licensing basis for consideration in the renewal of FFOL-3631.00/2017 for a period of 10 years.

This CMD describes PHCF's performance over the current licence period for each of the 14 Safety and Control Areas (SCAs) that comprise the CNSC regulatory framework. Included in the discussion of each SCA are PHCF's commitments to improved

performance, including alignment with Canadian Standards Association (CSA) standards and CNSC Regulatory Documents (REGDOCs). PHCF will continue to work closely with CNSC staff throughout the proposed licence period to implement additional standardized requirements under the regulatory framework in a manner that ensures operations remain safe, clean and reliable during any applicable implementation phase.

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

1.0 INTRODUCTION

1.1 Background

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

Cameco operates PHCF under Canadian Nuclear Safety Commission (CNSC) operating licence FFOL-3631.0/2017 (the Licence) 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.

PHCF is situated in Ward 1 of the Municipality of Port Hope (the Municipality) on the north shore of Lake Ontario. 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"). Site 1 is bounded by Hayward Street to the north, the Port Hope harbour to the east, Lake Ontario to the south, and Choate Street, Marsh Street and municipal land associated with the Port Hope Water Treatment Plant to the west. An aerial photograph of Site 1 is shown in Figure 1.

Figure 1 – Site 1, Port Hope Conversion Facility

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 2.

Figure 2 – Site 2, Storage Facility

PHCF currently processes and stores various natural, depleted and enriched uranium compounds. The facility receives nuclear grade uranium trioxide for conversion to either UF_6 or UO_2. The current licence allows for the annual production of up to 2,800 tonnes of uranium as UO_2 and up to 12,500 tonnes of uranium as UF_6. 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 each safety and control area (SCA) detailed below.

1.2 Summary of Application

PHCF's current operating licence was granted by the CNSC on February 28, 2012 for a five-year period and the Licence is set to expire on February 28, 2017. On November 20, 2015 an application was submitted to the CNSC for the renewal of the Licence for a period of 10 years. Additional information was provided in subsequent months to fulfil CNSC staff requests for information regarding the application, the supporting studies and programs that comprise the licensing basis. Supplemental information regarding Cameco's application commitments was submitted to the Commission on August 4, 2016.

In the renewal of FFOL-3631.0/2017, Cameco makes the following licensing requests of the Commission:

- A 10-year renewal of its PHCF operating licence maintaining the current UO_2 and UF_6 production limits of:
    - 2,800 tonnes uranium as uranium dioxide (natural or depleted) from the UO_2 plant
    - 12,500 tonnes uranium as uranium hexafluoride from the UF_6 plant, with a daily limit of 45 tonnes;
- Continued authorization to process and store various natural, enriched and depleted uranium compounds;
- Removal of the following:
    - the north UO_2 plant as a UO_2 production facility, including existing production limits
    - the metals plant and metals production as an activity authorized under the licence, including existing production limits;
- That the operating licence for PHCF specifically describe the authorization for PHCF to engage in clean-up, decontamination, demolition and remediation activities, (including Vision In Motion (VIM)), that are within the current licensing basis; and,
- Approval of the proposed financial guarantee of $128.6 million, based on the 2016 update to the Preliminary Decommissioning Plan (PDP).

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

- Derived Release Limits (DRLs) have been updated to meet the requirements of CSA N288.1-14 *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* (CSA N288.1-14 (Derived Release Limit)) as well as reflect current information regarding discharges from the facility, in particular for releases to groundwater, surface water and the municipal sanitary sewer. This study was accepted by CNSC staff in 2016;
- Additional programs and/or detail in site programs related to waste management, the Clean-Up Program (CUP) and VIM; and
- An increase of $26.9 million to a total of $128.6 million for the financial guarantee for decommissioning based on the cost estimate developed as part of the Preliminary Decommissioning Plan (PDP) that was updated in 2015 in accordance with CSA N294-09 *Decommissioning of facilities containing nuclear substances* (N294-09 Decommissioning Planning), G-219: *Decommissioning planning guide for licensed activities* (G-219 (Decommissioning Planning) and G-206: *Financial guarantees guide for the decommissioning of licensed activities* (G-206 Financial Guarantees). The PDP was accepted by CNSC staff in 2016.

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

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

Within the requested licence period of 10 years, PHCF expects to continue with current licensed operations and to carry out VIM. This project will make significant improvements to the site under the waste management and environmental protection programs at the facility.

The application for licence renewal submitted on November 20, 2015 and the supplemental information submitted on August 4, 2016, as well as their referenced material, serve as the licensing basis for consideration in the renewal of FFOL-3631.00/2017 for a period of 10 years.

2.0 Business Plan

Cameco is committed to the safe, clean and reliable operation of PHCF. Objectives and targets for the facility are set and reviewed regularly. Cameco anticipates UF_6 and UO_2 production operations will continue to operate at similar production levels and within the existing capacity limits during the next licence period. PHCF's UF_6 and UO_2 operations will continue to provide vital services for the nuclear industry and ultimately the energy-consuming public.

During the next licence period, PHCF will also carry out VIM as part of the Clean-Up Program. VIM will facilitate remediation at the PHCF site and is an opportunity to make PHCF more visually appealing, improve environmental performance and operational efficiency, return the Centre Pier to the Municipality and improve public access to the waterfront. VIM activities include 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) being constructed

by Canadian Nuclear Laboratories as part of the Port Hope Area Initiative (PHAI); and constructing associated infrastructure and building modifications.

3.0 Safety and Control Areas (SCAs)

3.1 Management System

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

3.1.1 Relevance and Management

PHCF, under its Licence, is required to have a management system that establishes the processes and programs required to ensure PHCF operates safely; continuously monitors its performance; and, fosters a healthy safety culture. PHCF's management system has been developed to meet the CNSC quality assurance elements, the requirements and principles outlined in the current Licence Conditions Handbook (LCH) and to incorporate aspects of CSA N286-12 *Management system requirements for nuclear facilities* (CSA N286-12 (Management System)). The management system describes how licensed activities are controlled and references the supporting program documents required to ensure safe, clean and reliable production at the facility. Updates to the management system are submitted to CNSC staff prior to implementation. PHCF has committed to a phased implementation of CSA N286-12 (Management System) with full alignment by the end of 2017.

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

The organizational structures of PHCF and FSD are shown in Figures 3 and 4. The general manager, PHCF has the overall responsibility and authority to ensure that management system and related program documents are maintained and properly implemented, and is accountable for ensuring conformance. The responsibilities for these programs and procedures have been delegated amongst the management team at PHCF and their respective personnel. Support for aspects of the management system is provided by divisional and corporate personnel.

Figure 3 – PHCF Organizational Structure

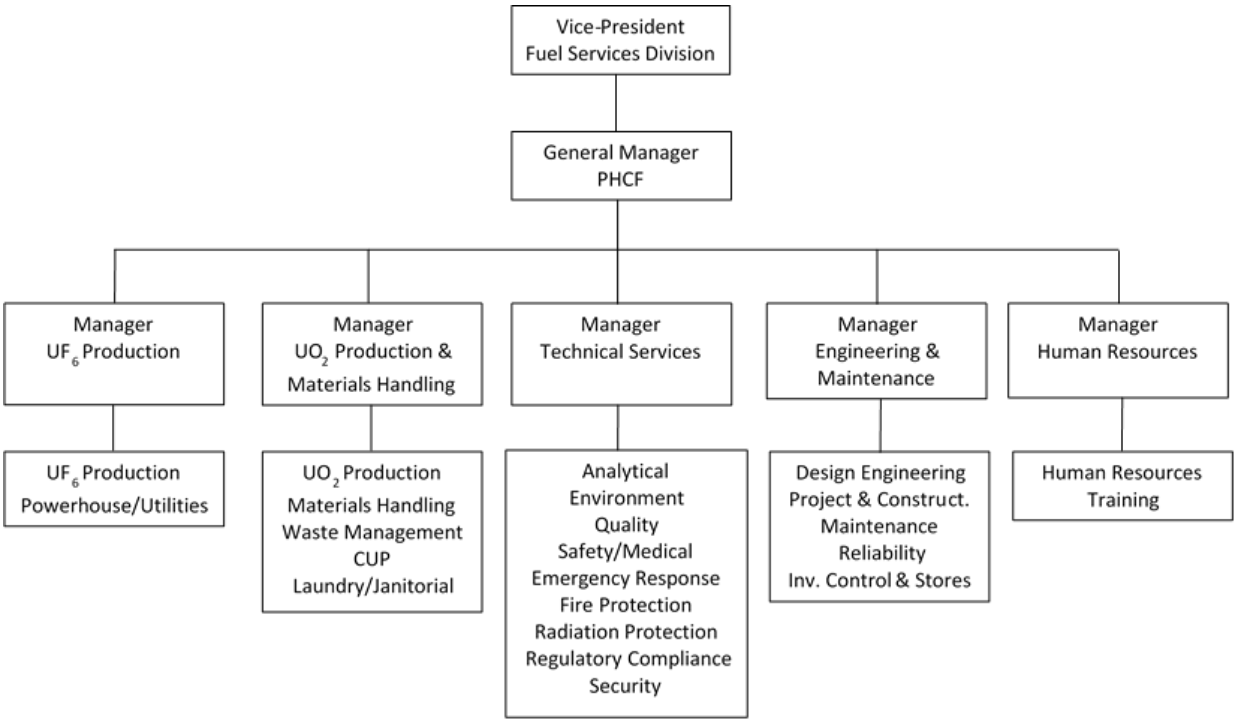
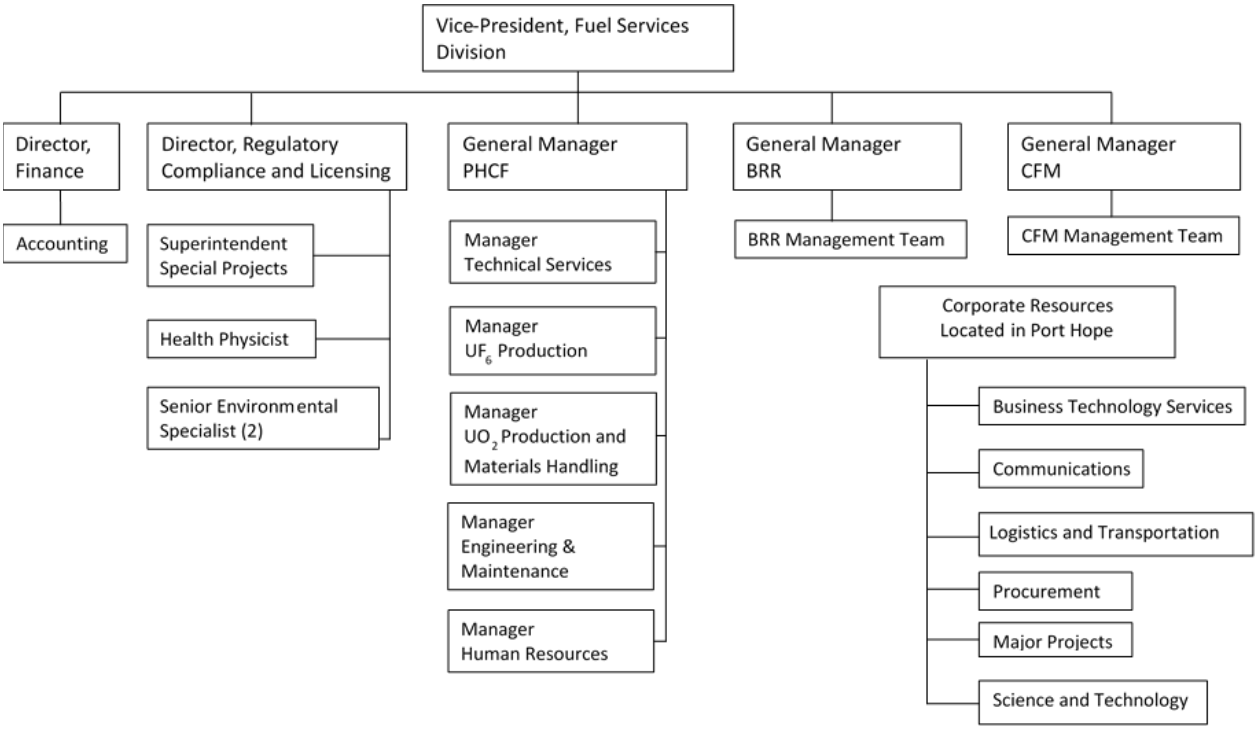


Figure 4 – Fuel Services Division and Corporate Support for PHCF



3.1.2 Past Performance

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 neighbouring communities. The management system is the framework that guides the processes and programs required to ensure safety objectives are achieved, performance is monitored and a healthy safety culture is maintained during production, maintenance, materials handling, waste management and other onsite activities. This includes, but is not limited to, requirements for work planning, change control, corrective action processes, document control, audits, and management review. The application of requirements under the management system is scaled according to the complexity and hazard potential of a particular activity. Routine inspections by CNSC staff continue to confirm that PHCF is in overall compliance with these requirements. Findings made by CNSC inspectors and specialists are reviewed by PHCF and are used to strengthen existing programs and controls to ensure safety, security and the environment are not compromised. PHCF continued to strengthen its management system during the current licence period.

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

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

- Development and implementation of a Cameco laboratory information management system;
- Development and implementation of a Cameco radiation protection database;
- Creation of the employee-led Conversion Safety Steering Committee (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%; and,
- Progressed a number of projects to reduce the volume of legacy wastes.

Further information regarding these projects will be provided in the relevant SCA(s).

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

Cameco conducts safety culture assessments approximately every five years at all sites within the FSD. These assessments gauge the perception of employees in relation to safety culture in a scientifically meaningful way. The most recent assessment identified a definite sense among employees that improvements have occurred over the longer term and that this is a continuous process. The assessment also identified the following strengths:

- Safety is a priority for management and employees;
- Strong questioning attitude and reporting culture regarding safety concerns;
- Availability of training;
- Supervisors are available;
- Employees can be involved in implementing solutions; and,
- In-the-field tools such as PPE and equipment labelling supports safety culture.

From these assessments, action plans are developed in areas where opportunities for continual improvement are identified. The foundations of a good safety culture are apparent at PHCF and a number of these strengths set the stage for taking the safety culture to the next level. From the most recent assessment, PHCF is focusing on improving accountability for safety and implementing additional human performance management tools.

3.1.3 Future Plans

While the existing management system meets current regulatory requirements, to continue to improve its management system Cameco has committed to complete the implementation of CSA N286-12 (Management System) by the end of 2017 across FSD. At PHCF, the requirements of the standard will be phased-in through a series of updates to the management system and supporting documentation throughout 2016 and 2017.

3.1.4 Challenges

Though significant improvements have been made in the area of safety culture over the previous licence periods, there remain opportunities to further strengthen site, divisional and corporate safety culture. The publication of the REGDOC regarding safety culture in the next licence period will provide standardized expectations for safety culture programs and improvements. It is anticipated that this will require significant

coordinated effort to assess, develop and implement a plan to address the requirements of the REGDOC.

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

3.1.5 Requests

PHCF has no requests at this time. It is recognized that CSA N286-12 (Management System) will be implemented by the end of 2017.

3.2 Human Performance Management

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

3.2.1 Relevance and Management

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

PHCF has a number of programs, procedures and processes that support human performance management. Aspects of human factors have been considered in the development and continual improvement of site management system programs, work instructions, engineering and operations activities, change control and the corrective action process as described in the management system, the Facility Licensing Manual (FLM) and other supporting documents. Minimum staff complement, safety performance, operating work instruction/procedure development, change control, operating practices and continual improvement are some of the other human performance management activities embedded in site programs.

3.2.2 Past Performance

Over the current licence period, PHCF has formalized and/or strengthened a variety of tools to develop and reinforce behaviours that support human performance. These tools are associated with the various programs and systems that support the quality

management program. Additionally, at the corporate level, Cameco continues to develop and implement human performance tools in accordance with Cameco's continual improvement processes and in accordance with all proposed changes in CSA standards and/or REGDOCs developed for this SCA. Cameco actively participates in CSA standard development and responds to requests for comments during the development of the REGDOCS.

PHCF uses several tools to support strong human performance. The overarching principles intended to describe expectations for performance, behaviours, communication and decision making are defined in:

- Cameco Competency Model
- PHCF Operating Fundamentals
- Ladder of Self-Responsibility and Accountability
- Employee Performance Programs

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

- Change Control Processes
- Risk Analysis Tools
- Work Instructions and Operating Documents
- Routine Operating Practices
    - Operator care rounds, daily crew meetings, mini-inspections, job task observations

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

The worker training and qualification program is well established using a systematic approach to training and a computerized learning management system, which is described in the site training plan and supporting documents. In the first quarter of 2016, the training plan was updated to meet all the requirements of REGDOC-2.2.2 *Personnel Training*. This was well in advance of PHCF's commitment made to CNSC staff to comply with this new requirement by the end of 2016. PHCF continues to enhance the training program by addressing opportunities identified through routine audits and inspections.

PHCF operates on a 24-hour basis, 365 days a year. In accordance with the requirements of Part II of the *Canada Labour Code*, PHCF has defined maximum hours of work in a shift cycle for all employees onsite. In addition, to ensure qualified personnel are available to carry out licensed activities in a safe manner, minimum crew complements for UF_6 operations, UO_2 operations and emergency response have been defined.

Cameco has a range of programs and procedures in place to address human resource matters and to ensure employees are fit for duty. These include programs or procedures

addressing alcohol and substance abuse, violence in the workplace, respectful workplace, medical surveillance and radiation protection monitoring.

3.2.3 Future Plans

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

3.2.4 Challenges

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

3.2.5 Requests

PHCF has no requests at this time.

3.3 Operating Performance

Under its current operating licence, 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 ongoing performance is maintained and continuous improvement is achieved. This provides an overview of how licensed activities are performed and how supporting activities enable effective performance.

3.3.1 Relevance and Management

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

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

3.3.2 Past Performance

Throughout the current licence period, annual production targets were achieved for both UO_2 and UF_6 operations. PHCF continues to operate in a manner that supports safe, clean and reliable production in compliance with applicable legislation.

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

Cameco reports unplanned events as required by the *Nuclear Safety and Control Act* (NSCA), its regulations and the licence conditions. During the licence period, 42 incidents related to plant operations, health and safety, radiation protection and environmental performance were promptly reported. PHCF investigated each incident to determine its cause and took the necessary corrective actions to prevent a reoccurrence as per PHCF's corrective action process. Over the licence period, PHCF improved its public communication regarding these events so that all events reported to the CNSC, Ministry of the Environment and Climate Change (MOECC) and Environment and Climate Change Canada (ECCC), with the exception of prescribed security events, are posted on the Cameco website and/or described in the quarterly and annual compliance reports which are also posted on the website.

There were three events reported to the Commission during the current licence period.

The first event occurred in January 2014 and was presented to the Commission as an Event Initial Report (EIR). This event occurred when a hydrogen recirculation valve for the cell room did not respond as expected and resulted in the recombination of hydrogen and fluorine gas and ambient air being drawn into the system. The control/isolation valves were closed manually to place the system in a safe state. There were no injuries and no releases within or outside of the plant as a result. Due to this event, PHCF instituted additional change management controls for process control systems. These corrective actions were reviewed and accepted by CNSC staff.

The second event presented to the Commission as an EIR occurred in November 2014. In this event, a small quantity of anhydrous hydrogen fluoride (AHF) was released within the cell room following work being done on an AHF feed line. The sensors in the area detected the AHF and automatically activated the local area alarms, the cell room emergency ventilation and shut down the cell room. Three employees working nearby were treated for possible exposure and transferred to hospital for precautionary follow-up. All employees were released from hospital the same day. No AHF was released to the environment. The event was due to issues with equipment lockout over more than one shift. The corrective actions for this event included updates to the control of hazardous energy standard and procedures as well as improvements to shift cross-over communication. These were reviewed and accepted by CNSC staff.

The third event was presented to the Commission twice as a status update. In April 2016, a flange failure on a tank in the UO_2 plant led to the release of an estimated 1,850L of dilute nitric acid (25% to 30% solution) into secondary containment within the plant. At the time of the incident, the tank was undergoing routine, regularly scheduled cleaning. Minor nitric acid fuming was detected within the plant. It was identified that incorrect material of construction for a spool piece caused the failure. The corrective actions are in progress and include improving the identification process for material placed back into stock following work as well as pre-use inspection for in-house fabrication of parts. The implementation will be tracked by CNSC staff.

Noteworthy accomplishments during the current licence period include:

- Implementation of the systematic approach to training;
- Achieving full compliance with REGDOC 2.2.2;
- An Environmental Risk Assessment (ERA) completed in accordance with the requirements of CSA N288.6-12 *Environmental risk assessment at class I nuclear facilities and uranium mines and mills* (N288.6-12 (Environmental Risk Assessment));
- A DRL assessment completed in accordance with the requirements of CSA N288.1-14 (Derived Release Limit);
- Completion of large Clean-Up Program projects to advance VIM planning;
- Significant reduction in uranium emissions from the UF_6 main stack through installation of an improved Venturi scrubbing system for which the site received the Cameco Environmental Leadership Award;
- Safely relocating the depleted uranium dissolution circuit from Building 2 to Building 24;
- The operational reliability program was recognized for its success with the Plant Engineering and Maintenance (PEM) Magazine – PEM Maintenance Award 2012 award and recognition in two independent industry magazines; and
- Received the corporate Mary-Jean Mitchell Green Safety Award for its 2013 safety performance.

3.3.3 Future Plans

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

In addition, PHCF will be commencing the implementation phase of VIM during the upcoming licence period. This multi-year project involves significant planning to ensure operations are safely maintained during the project, as well as coordination with the

PHAI on project interfaces such as transfer of materials to the LTWMF, remediation of the Centre Pier and the Port Hope harbour.

3.3.4 Challenges

Cameco does not have any specific challenges associated with this SCA

3.3.5 Requests

Cameco has requested, through the licence application and supplemental submissions, that the production limits for the metals plant and the north UO_2 plant be removed to reflect the current operational status.

The implementation of VIM in the next licence period will provide improved performance of supporting departments through the clean-up and repurposing of many underutilized areas of the facility. Cameco has requested, through the licence application and supplemental submission, that the operating licence for PHCF specifically provide the authorization for PHCF to engage in clean-up, decontamination, demolition and remediation activities (including VIM) that are currently part of the licensing basis.

3.4 Safety Analysis

Safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards.

3.4.1 Relevance and Management

PHCF has systematically assessed its operations using different risk analysis tools to ensure it continues to operate in a safe, clean and reliable manner. The site safety report (Safety Report) is the primary risk analysis for the facility and it summarizes the systematic review of the site operations to identify and assess hazards and potential risks to the public and environment from PHCF operations. A hazards and operability (HAZOP) approach is used to assess new processes or equipment. This focuses on equipment, instrumentation, human actions and other factors that affect the process. HAZOPs are conducted prior to making any plant modifications that may affect the safety case for the facility, with the Safety Report updated at least every five years to include the findings from any HAZOPs completed since the last revision to the Safety Report.

The equipment and systems with the highest safety significance at PHCF, with respect to protection of people and the environment, are:

a) liquid UF_6;
b) liquid AHF;
c) hydrogen;
d) fluorine;

e) emissions control equipment;
f) emergency power; and
g) civil structures – floors, trenches, sumps, pits, roof and walls.

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

- A site-specific spill prevention and contingency plan under Ontario Regulation 224/07;
- An environmental aspects registry to meet the requirements of ISO 14001:2004 Environmental Management System Standard;
- A fire hazards analysis (FHA) that meets the requirements of the National Fire Protection Association 801 *Standard for fire protection for facilities handling radioactive materials* (NFPA 801);
- An ERA completed in accordance with the requirements of CSA N288.6-12 (Environmental Risk Assessment). The ERA is used to ensure the adequacy of the monitoring program; and
- A DRL assessment completed in accordance with the requirements of CSA N288.1-14 (Derived Release Limit).

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

3.4.2 Past Performance

Safety analyses for the facility are reviewed at least every five years to ensure changes to the facility, recommendations from CNSC staff, industry best practices, new scientific literature, recent operating experience and/or new or updated regulatory documents and standards are incorporated to enhance the robustness of the analysis. During the current licence period, the following activities were carried out and reviewed by CNSC staff to support the safety analysis for the facility:

- An updated Safety Report was submitted in December 2015 and accepted by CNSC staff in 2016. This update included revalidation of the HAZOPs that form the basis for the Safety Report and an update of the worst-case process upset and accident scenario modelling exercise. The Safety Report concludes that the risk to the public and the environment arising from the unplanned release of hazardous materials stored, processed and transported to and from PHCF has been mitigated. The current safety systems, procedural controls and abatement equipment effectively mitigate risk.
- The ERA was updated during the licence period following the requirements of CSA N288.6-12 (Environmental Risk Assessment). It was accepted by CNSC

staff in 2016. This was the first ERA for the facility completed in accordance with the standard. The ERA is further discussed in section 3.9.

- The DRL assessment updated during the licence period followed the requirements of CSA N288.1-14 (Derived Release Limit). It was submitted in 2016 and accepted by CNSC staff. The conceptual model for water releases has been improved in the 2016 study for discharges to water from the facility and to ensure all potential exposure pathways for the public have been assessed. The DRL is further discussed in section 3.9.

3.4.3 Future Plans

PHCF is required to update its Safety Report, ERA and DRL assessments at a minimum of every five years. In the proposed licence period, this would result in at least two updates of each document. Where applicable, each update will incorporate recommendations from CNSC staff, industry practice as well as applicable REGDOCs and standards to enhance the robustness of the analysis.

PHCF currently has an FHA that meets the requirements of NFPA 801. This is currently being updated as part PHCF's commitment to fully implement CSA N393-13*, Fire protection for facilities that process, handle, or store nuclear substances* (CSA N393-13 (Fire Protection)) by December 2017.

3.4.4 Challenges

During the next licence period, the facility will undergo significant changes throughout VIM. PHCF will engage with CNSC staff when determining the appropriate study periods for re-evaluating the various safety analyses.

3.4.5 Requests

PHCF is not requesting any changes at this time.

3.5 Physical Design

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

3.5.1 Relevance and Management

PHCF maintains a program for physical design as described in the FLM. 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. The plant equipment is designed, installed, operated and modified with materials suitable for the service and hazards of each area. The aspects of the physical design program are as follows:

- Facility and process changes – All changes to the physical design of equipment, processes and the facility are evaluated from project planning to the completion of the project through the process and design change control procedure and the change control process described in the management system. 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.
- Third party review for fire protection – Modifications for which the initial assessment indicates a potential impact on fire protection design basis, goals, or criteria are subject to a qualified third party review independent of the design organization. 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 NFPA 801.
- Pressure boundary program – This establishes the infrastructure and defines the activities necessary to maintain a sustainable process for PHCF to follow when repairing, replacing, modifying and altering pressure retaining items, components, and systems including installation of new systems. As required by the Licence, PHCF maintains an agreement with an authorized inspection agency for the registration, inspection and other activities related to pressure systems.

As part of Cameco's budgeting process, plant improvements related to physical design are identified and prioritized so that capital expenditures for these improvements can be budgeted. A stage gate process is used at PHCF to review capital projects at up to four points in the design process, which includes sign-off by site management, site radiation, environment and fire protection personnel to ensure these requirements are addressed in every capital project.

3.5.2 Past Performance

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

The quality control manual for the Technical Standards and Safety Authority (TSSA) certificate of authorization governs the shop fabrication, field installation, assembly, repairs, and erection of piping systems in accordance with the applicable boiler, pressure vessel, pressure piping and mechanical refrigeration codes as well as repairs

and alterations of boilers and pressure vessels, piping and fittings in accordance with the applicable codes. The quality control manual was updated in April 2016.

PHCF maintained its authorized inspection agency agreement with TSSA during the current licence period. The agreement was renewed in 2015 and expires in March 2019. This agreement ensures oversight of pressure retaining components and systems continues to be carried out by a third-party expert. As part of this process, PHCF uses non-destructive examination techniques to assess the integrity of pressure vessels and related systems. These examinations are primarily done in-house by qualified staff, though qualified third-party experts are used when necessary.

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

3.5.3 Future Plans

During the current licence period, PHCF committed to further improvement in its physical design program through the implementation of several CSA standards and REGDOCs. Though PHCF's existing programs meet regulatory requirements for physical design, the full implementation of CSA N286-12 (Management Systems) will further enhance the existing design program by incorporating industry standards. PHCF has also committed to the implementation of CSA N393-13 (Fire Protection), which has requirements for facility modifications. PHCF has committed to full implementation of both of these standards by the end of 2017.

PHCF has reviewed the changes between CSA B51-09 and CSA B51-14, *Boiler, pressure vessel, and pressure piping code* (B51-09 Boiler and pressure vessels). PHCF will implement the additional requirements of the 2014 version of the standard by the end of 2018.

3.5.4 Challenges

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

3.5.5 Requests

PHCF has no requests at this time.

3.6 Fitness for Service

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

3.6.1 Relevance and Management

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

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

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

The operational reliability program accounts for ageing through a number of processes designed to detect early warning signs and to prescribe rehabilitation programs or proactive replacement strategies. The program is evaluated by the same means as the overall maintenance program and is considered to be effective. Cameco has invested a considerable amount of time benchmarking and developing this program at PHCF in the current licence period.

Fire protection systems are tested according to an established schedule as outlined in the fire protection program. Third-party reviews are conducted to confirm required tests and inspections with respect to fire protection are completed and these review reports are submitted to the CNSC.

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

- Process monitoring through product and intermediate quality control testing (such as chemical analysis);

- Monitoring of environmental systems (i.e. conductivity probes in cooling water to detect leaks, in-plant alpha-in-air monitoring and real-time stack monitoring for oxides of nitrogen; and,
- Operator and specialist (i.e. safety officer and radiation safety officer) inspections.

3.6.2 Past Performance

Throughout the licence period, the operational reliability program has driven improvements in the area of fitness for service. These improvements have included the following:

- Development of operator care rounds which involve the operators in the daily assessment and maintenance of plant equipment;
- Introduction and enhancement of a production loss tracking system to improve data entry and analysis;
- The use of failure mode effects analysis (predictive) and causal analysis (investigative) tools to improve maintenance plans and strategies for key equipment;
- The piloting and implementation of hand-held technology in various applications to improve efficiency and accuracy of data collection/logging;
- Improvements to work instructions, maintenance job-planning, scheduling, kiting and other work aids; and
- Development of asset management tools

KPIs are in place for the PM program and key aspects of the operational reliability program. A monthly PM report is generated and reviewed by senior site management to ensure all regulatory PM tasks are completed. The in-service inspection program was maintained throughout the current licence period.

During the licence period, PHCF's operational reliability program was recognized for its success with the PEM – Maintenance Award 2012 and recognition by two independent industry magazines, first by Plant Engineering & Maintenance in its 2013 March/April edition for the program's production loss tracking system and secondly by Plant Services in its August 2014 edition for all aspects of the program.

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

3.6.3 Future Plans

The implementation of CSA N286-12 (Management Systems), N393-13 (Fire Protection) and B51-14 (Boiler and Pressure Vessels) in 2017 and 2018 as discussed in section 3.5.3 will improve PHCF's performance under the Fitness for Service SCA.

3.6.4 Challenges

No additional challenges for this SCA.

3.6.5 Requests

PHCF has no requests at this time.

3.7 Radiation Protection

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

3.7.1 Relevance and Management

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

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

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

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

3.7.2 Past Performance

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

- The automated dose assignment system that assigns dose to all routine dosimetry urine analysis samples above the minimum detection level was implemented for contractors and provides a more accurate assessment of worker dose;
- A methodology was developed to assign prorated internal lung doses for long-term contractors;
- A radiation protection sub-committee focused on contamination control improvements was established;
- An enterprise-wide database to house all health physics data was implemented across Cameco sites;
- Derived Release Limit (DRL) and Operating Release Level (ORL) assessments were updated and accepted by CNSC staff; and
- Improvements to the RPP and associated procedures were made throughout the licensing term to address changes at the facility, audit and inspection findings or other opportunities for improvement.

Four radiation protection action levels were exceeded during the current licence period.

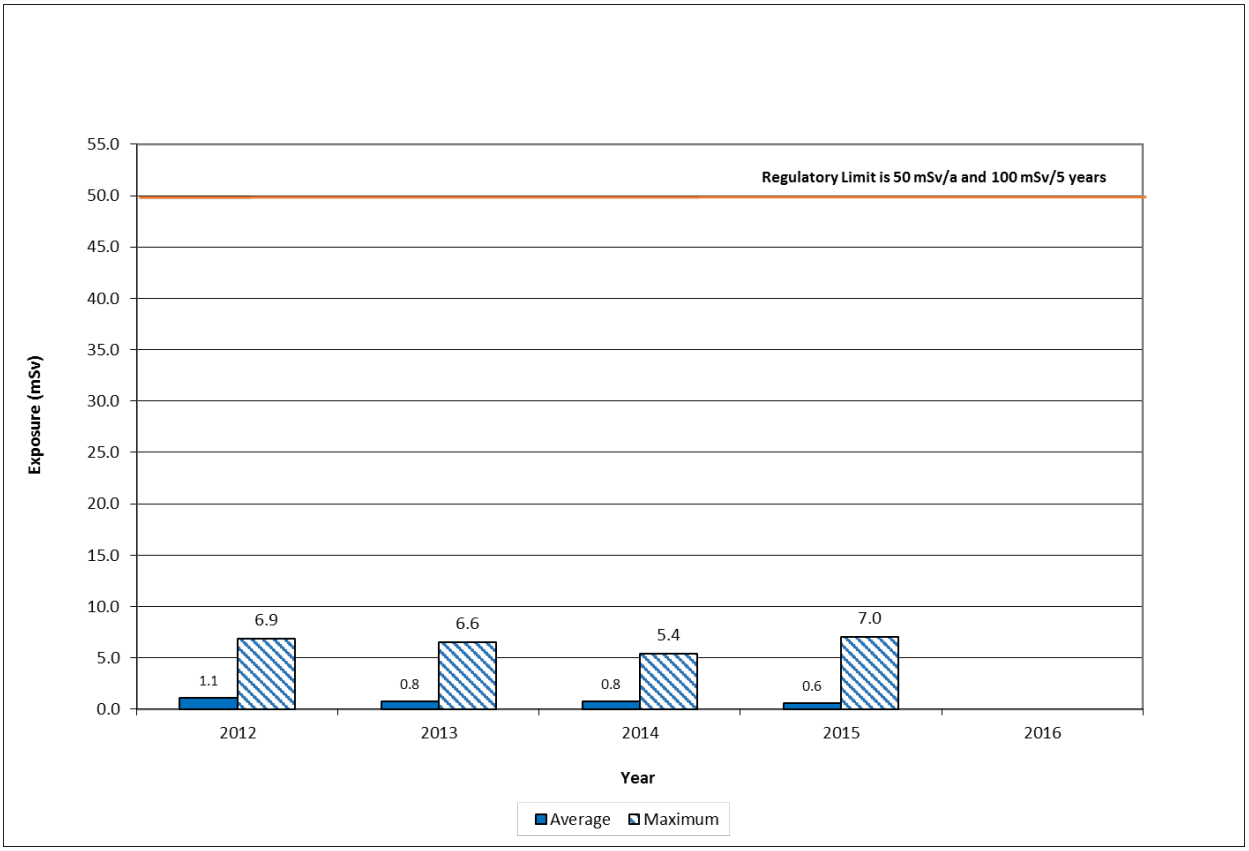
Two were fenceline gamma action levels in May and June 2013. These were investigated and determined to be due to a change in heeled UF_6 cylinder storage. Cameco reviewed outdoor storage practices and change control documentation to ensure a radiation work permit is completed for future changes of a similar nature.

In November 2015, an employee's pre-shift urine sample had a uranium concentration above the regulatory action level. During the investigation it was determined early removal of the respirator (i.e. before contaminated PPE was removed) during a routine task (ash can change) contributed to the elevated result. The employee was given work outside the production areas until their results returned to normal levels and a dose from the event of 0.12 mSv was assigned. The employee was coached on the proper use of PPE and there are active projects to improve worker protection in the ash can area.

In November 2015, an employee had an elevated skin dose above the action level. During the investigation it was determined that it was due to where the employee was standing while acting as a firewatch in the flame reactor area. During the investigation it was identified that the radiation work permit was not adequately used during the task. Follow-up activities included ensuring direct read dosimeters that could measure beta and gamma radiation were available and how the radiation work permit is to be used for any work in the flame reactor area.

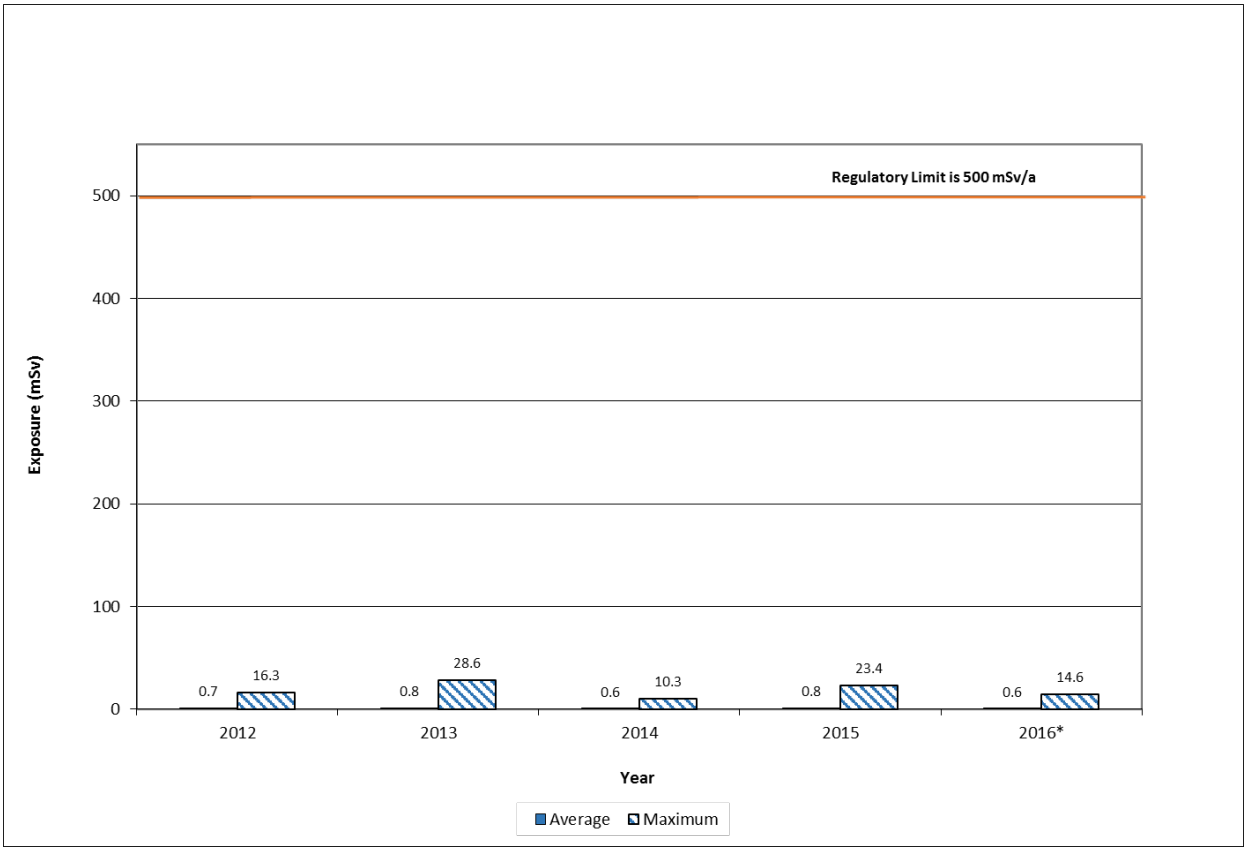
Figures 5 through 10 summarize employee and public exposure results over the current licence period. These results show PHCF's RPP and associated procedures are effective at controlling the dose to employees and the public.

Figure 5 – Effective dose to workers for the licence period



The total effective dose consists of three components: external whole body dose, internal dose to the lung and internal dose to the kidney. Based on how the internal dosimetry program for lung counting is set up, the total effective dose for workers for 2016 cannot be calculated until after the first campaign of lung counting in 2017. The annual effective dose to Nuclear Energy Workers (NEWs) remains well below the regulatory limit. The highest individual effective dose to an employee over the licence period from 2012 – 2015 was 20.03 mSv, which is 20% of the regulatory limit.

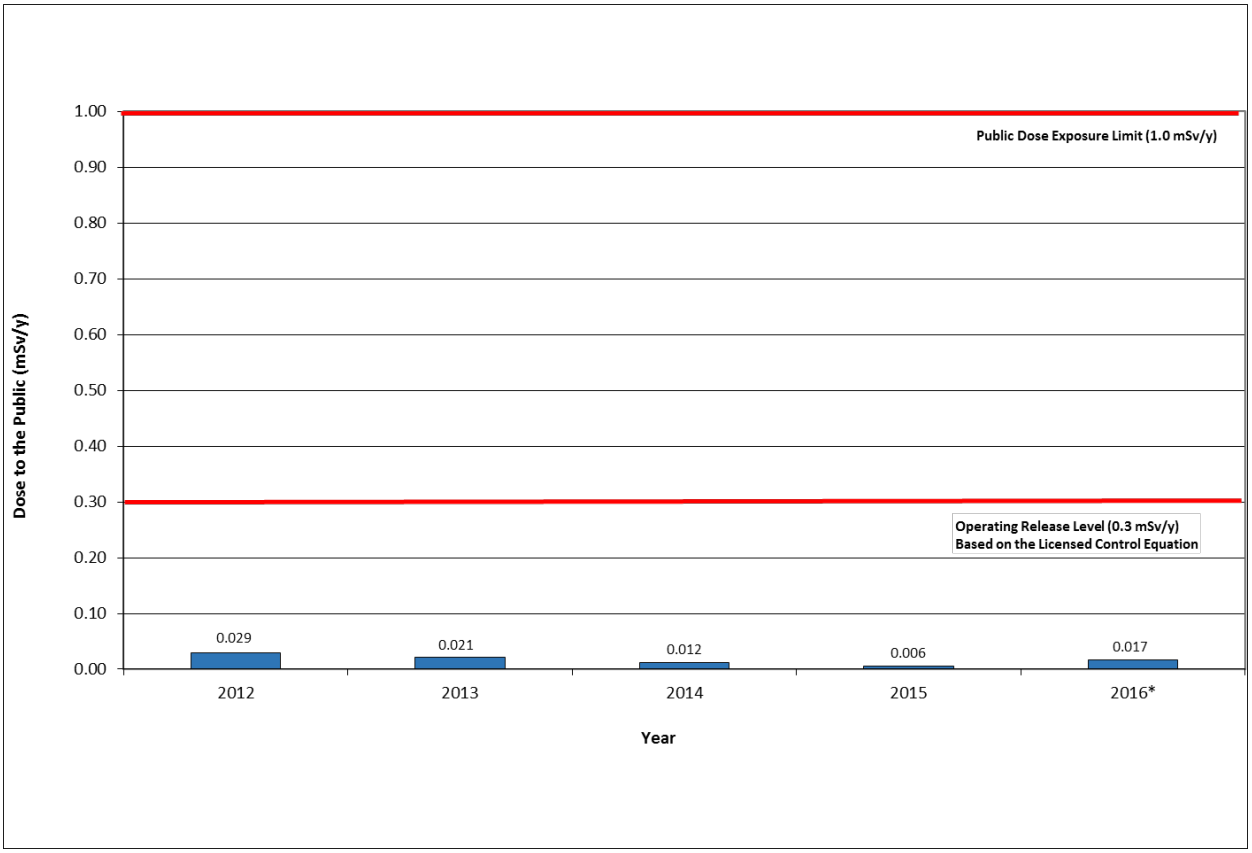
Figure 6 – External skin dose to workers for licence period



* Note: 2016 results as of June 30, 2016

The highest skin dose recorded in the current licence period was 28.6 mSv, which is approximately 6% of the regulatory dose limit. The data show that the RPP is maintaining doses to workers ALARA.

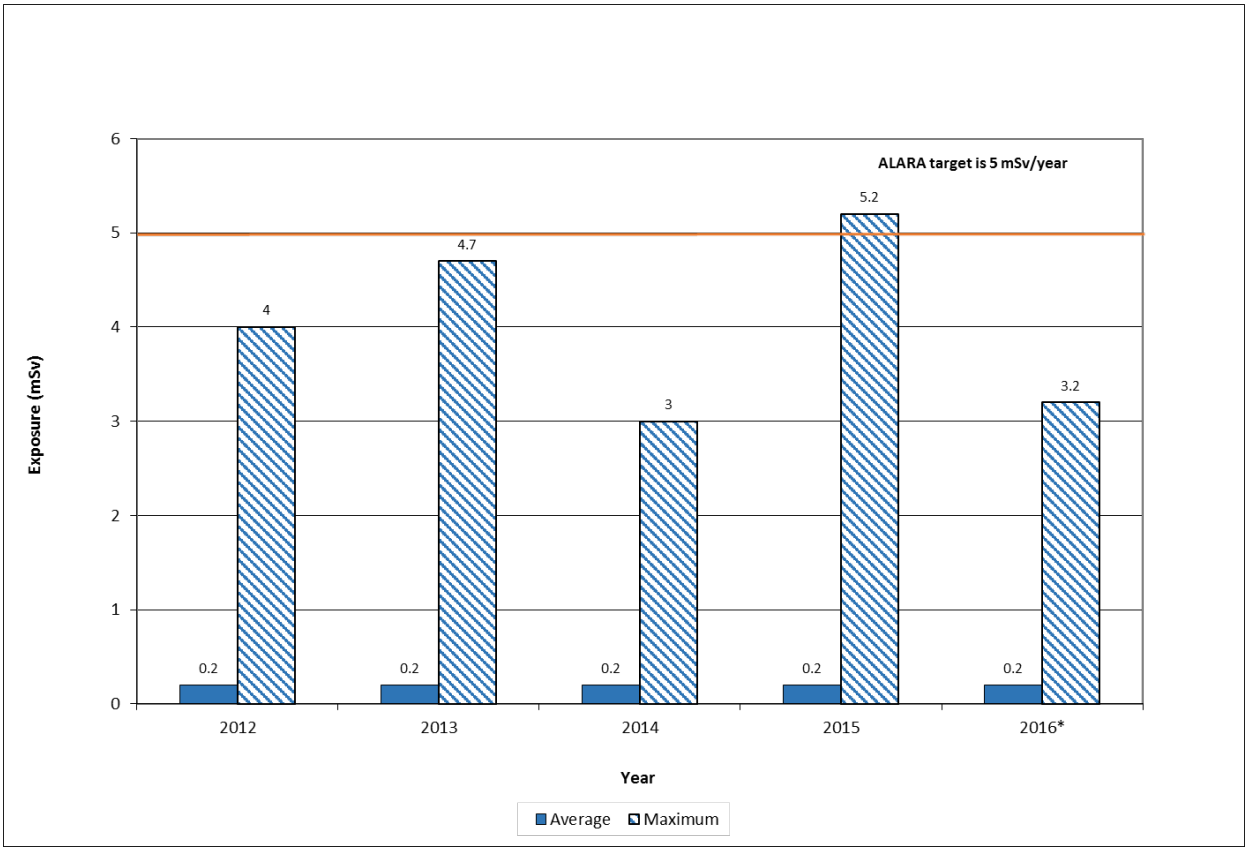
Figure 7 – Dose to the public for licence period



* Note: 2016 results as of June 30, 2016

The dose to the public from PHCF is calculated from the ORL, which is set at 0.3 mSv/year to ensure that it remains well below the regulatory dose limit of 1 mSv/year. The dose to the public has been maintained throughout the licence period at a fraction of this licence limit. It is based on three components: dose to the public from air emissions, from water discharges and from gamma radiation. For PHCF, dose to the public from air and water emissions is a small fraction of the public dose limit (typically <0.003 mSv). Therefore, the gamma component represents virtually all the estimated public dose. This is further discussed in section 3.9. Throughout the licence period, PHCF remained well below the operating limit and the regulatory limit for dose to the public.

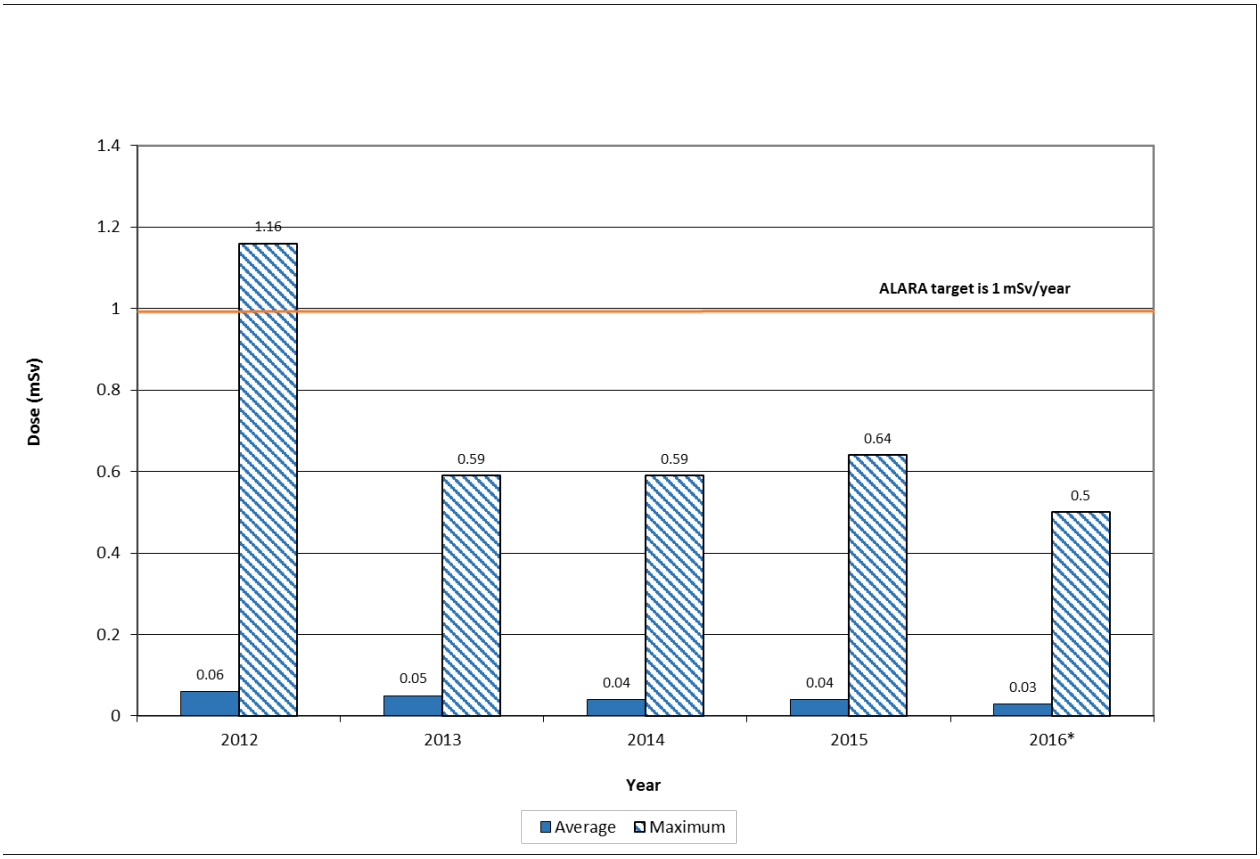
Figure 8 – Effective dose component – external whole body dose to workers



* Note: 2016 results as of June 30, 2016

The average whole body doses for NEWs were extremely low during the current licence period at 0.2 mSv. Less than 0.03% of all annual whole body doses were above the site ALARA target of 5 mSv/year for external exposure. Managing external exposure dose at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

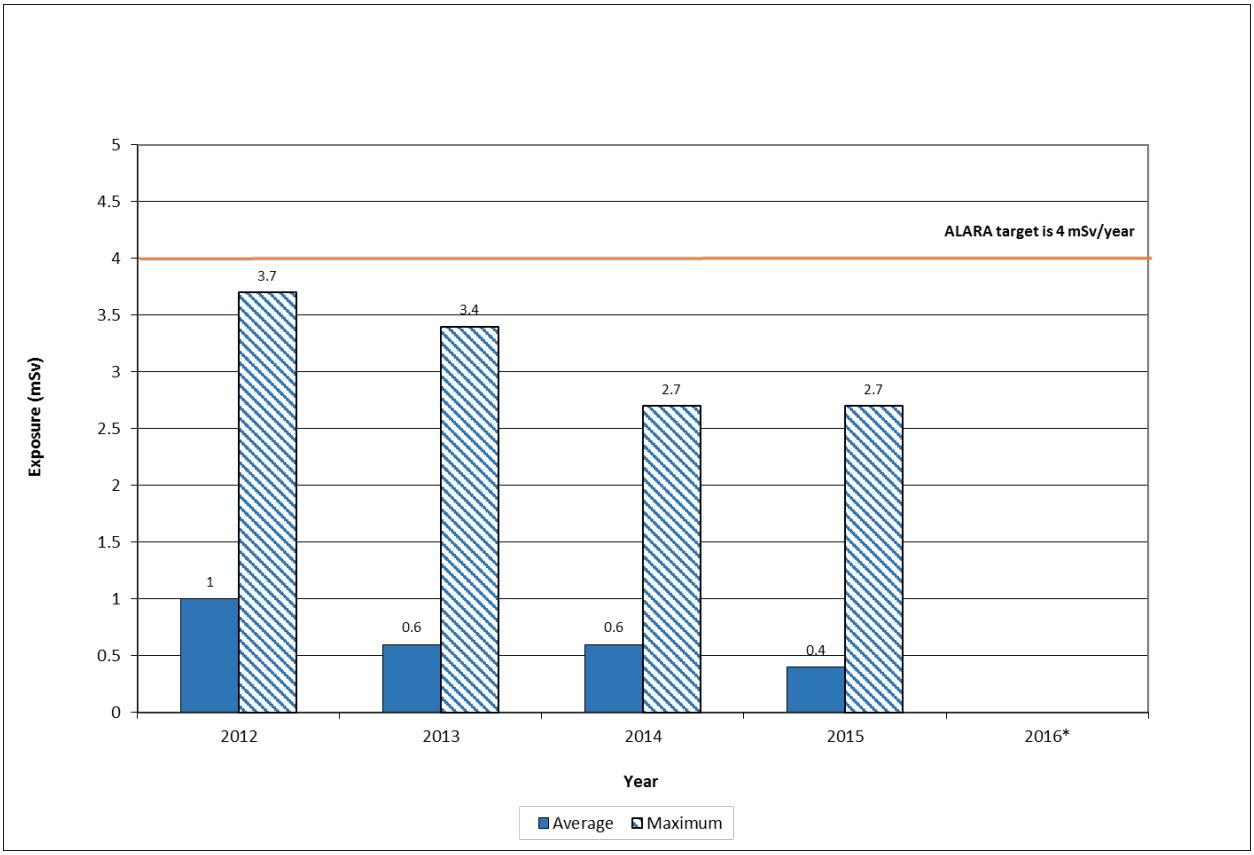
Figure 9 – Effective dose component – internal whole body dose (urine analysis)



* Note: 2016 results as of June 30, 2016

The average internal doses for NEWs from urine analysis were extremely low during the current licence period. Through this period, the urine analysis dose assignment system was expanded to automatically assign dose to all dosimetry samples above the detection level for contractors. The average annual internal dose from urine analysis for NEWs is less than 0.07 mSv. Less than 0.04% of all internal exposure doses were above the site ALARA target of 1 mSv/year for the urine internal exposure component. Managing the internal dose component from urine analysis at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

Figure 10 – Effective Dose Component – Internal Whole Body Dose (Lung Count) to workers



* Note: 2016 results are not available as lung dose is assigned annually following the 2017 lung count.

As part of the licensed internal dosimetry program, Cameco employs the use of a lung counter to monitor and assess uranium exposure in the lungs of NEWs working at PHCF. The average internal doses determined through lung counting were consistent during the period. The average annual internal dose from lung counting for NEWs is at or below 1 mSv. No annual doses from lung counting over the current licence period were above the ALARA target of 4 mSv/year for internal exposure from lung counting. Managing the internal dose component from lung counting at these levels ensures that total effective dose for workers remains a small fraction of the CNSC annual limit of 50 mSv.

PHCF's audit program includes audits of all elements of the site RPP at least once every three years. An independent third-party also conducts audits of the FSD internal dosimetry program. In the licence period, 14 audits including assessment of components of the RPP were conducted. No significant issues were identified during these audits, opportunities for improvement and minor findings were investigated with appropriate action taken and documented in CIRS.

PHCF prepares compliance reports that outline the performance and operation of the facility and provide details of the monitoring conducted through the RPP. These reports are made available to the public through www.camecoporthope.com.

3.7.3 Future Plans

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

PHCF will continue to enhance the program through physical, procedural and monitoring improvements as identified by the radiation protection sub-committee (part of the employee-led safety program), the audit and corrective action processes, and new regulatory requirements.

3.7.4 Challenges

VIM will increase the number of contractors and will increase the number of persons who handle radioactive sources such as the legacy wastes and buildings materials. Existing planning tools as described in the RPP, waste management program, and associated documents will be used to ensure appropriate resources are available to support the safe execution of the project.

3.7.5 Requests

PHCF has no requests at this time.

3.8 Conventional Health and Safety

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

3.8.1 Relevance and Management

A key element of a safe, clean and reliable operation is a comprehensive and well-established worker protection program, which is in place at 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 PHCF. In addition, Cameco's safety, health, environment and quality policy and corporate health and safety program provide direction for site programs and procedures. Cameco has five key principles that form the framework of how safety is managed. These are:

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

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

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

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

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:

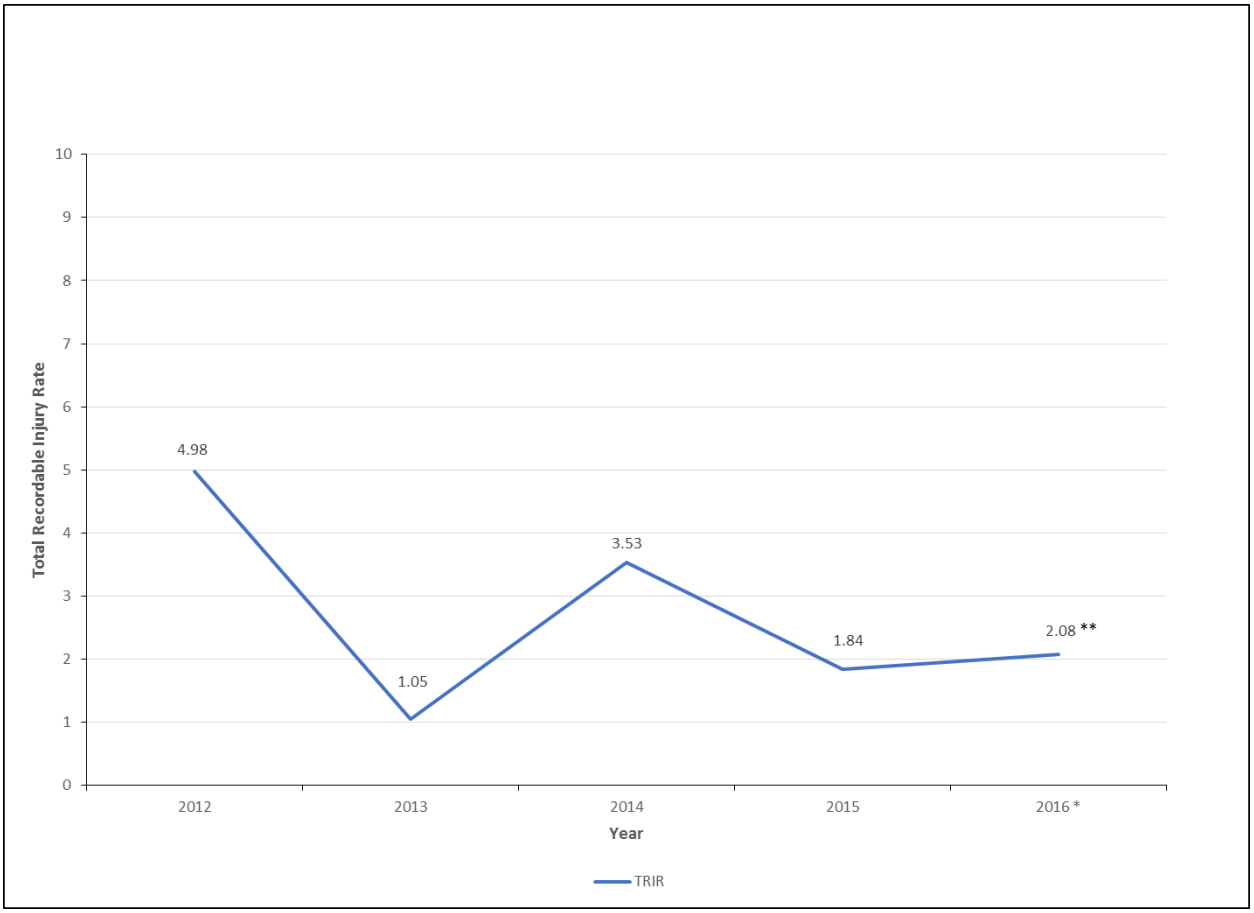
- Fall Prevention;
- Hazard Identification Risk Assessment and Controls;
- Personal Protective Equipment;
- Radiation Protection;
- Industrial Hygiene;
- Hoisting and Rigging; and
- Confined Space.

3.8.2 Past Performance

Figure 11 and Table 1 summarize the site safety performance during the current licence period. Lost time injuries have remained relatively stable over the period, averaging one

per year in the current licence period (2012-2016). Total recordable injury rate (TRIR) is a tool to measure the frequency of less severe injuries in the workplace – specifically the number of injuries requiring medical treatment or restricted work per 100 employees per year. This gives a number that can compare safety performance year to year – the lower the TRIR the better the safety performance. The focus on safety at PHCF in the current licence period has improved safety performance dramatically. In the current licence period, PHCF had the two safest years of operations recorded at the facility in 2013 and 2015.

Figure 11 – Total Recordable Injury Rate



*2016 results as of July 31, 2016
**TRIR reported for 2016 is a rolling 12-month statistic

Table 1 – Lost Time Injuries

Year / Parameter	2012	2013	2014	2015	2016*
Lost Time Injuries	1	0	1	1	2

*2016 results as of July 31, 2016

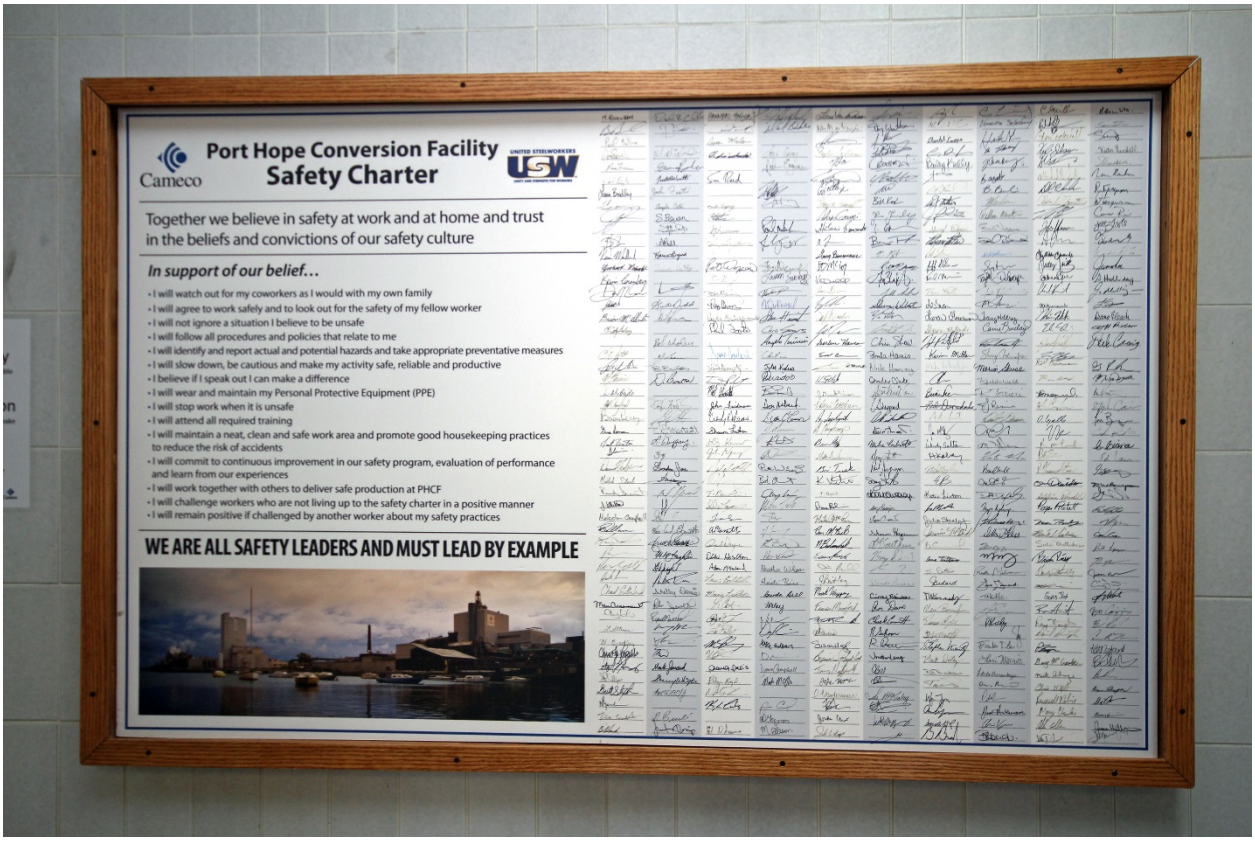
Other activities to support improved safety performance in the licence period include:

- Completing the safety incident investigation process within 24 hours of an incident, involving a CSSC member in the investigation and documenting all investigations and corrective actions in CIRS;
- Development of PHCF's Safety Charter by the employees for all employees as shown in Figure 12. This expresses PHCF employee's collective sense of safety values and direction and our general commitments to health and safety. It is a cornerstone for health and safety planning and permeates our work ethic on site and – ideally – at home as well;
- Implementation of the "Safety Win" approach. A Safety Win can be initiated by any employee and is any proactive safety improvement that is permanently implemented via all appropriate PHCF process controls (i.e. design change, work notifications or work procedures). Safety Wins are tracked by department across the facility;
- Implementation of the corporate safety standard for control of hazardous energy (lock-out/tag-out);
- PHCF was recognized for its 2013 safety performance with the corporate Mary-Jean Mitchell Green Safety Award presented annually to a Cameco site in recognition of its safety performance; and,
- A corporate safety culture assessment was completed in 2015. The assessment indicated the safety culture at PHCF continues to improve. Follow-up actions are being developed to continue to enhance the site's safety culture.

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

PHCF's audit program includes audits of the site OH&S program. All elements of the program are audited at least once every three years. Any issues identified during these audits are documented in CIRS so corrective actions can be identified and followed through to completion. In the licence period, 18 audits included assessment of components of the OH&S program. No significant issues were identified during these audits. Opportunities for improvement and minor findings were investigated and all appropriate actions were taken and documented in CIRS.

Figure 12 – Safety charter at PHCF main entrance



3.8.3 Future Plans

PHCF will continue to implement new corporate safety standards as well as maintain and enhance its safety program where opportunities are identified during the upcoming licence period. We continue to strive for zero injuries through all of our operations.

3.8.4 Challenges

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

3.8.5 Requests

PHCF has no requests at this time.

3.9 Environmental Protection

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

3.9.1 Relevance and Management

PHCF maintains an appropriate environmental protection program (EPP) that meets the requirements of the ISO14001 standard and Cameco's corporate requirements. Environmental protection is regulated by both federal and provincial regulatory authorities at PHCF. Requisite provincial approvals are in place for the various discharges from the facility. PHCF monitors air and liquid discharges to ensure they meet applicable provincial and federal requirements. The documents that comprise the EPP identify 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.

Air emissions monitoring consists of source and ambient monitoring. Routine source sampling is continuous and includes sampling the main UF_6 and UO_2 stacks for uranium. The UO_2 main stack is also continuously sampled for ammonia. Uranium and ammonia samples are analyzed in PHCF's laboratory on a daily basis. Fluoride emissions from the main UF_6 stack are sampled and analyzed on a continuous basis using on-line analyzers and the data is collected on the plant computer system. The ambient air program has been established to measure the quality of the air surrounding the facility using lime candles (fluoride), dustfalls (uranium and fluoride), and high volume samplers (uranium). Vegetation and soil surveys at selected locations around the facility and the local area are also performed.

PHCF does not discharge any liquid process effluent to the Port Hope harbour or Lake Ontario. Other liquid discharges from the facility include once-through, non-contact cooling water, sanitary sewer discharge, and storm water and groundwater discharges. All of these discharges are monitored as per the frequencies and parameters established in the EPP. The ambient water quality program monitors discharges to the harbour from storm water and groundwater.

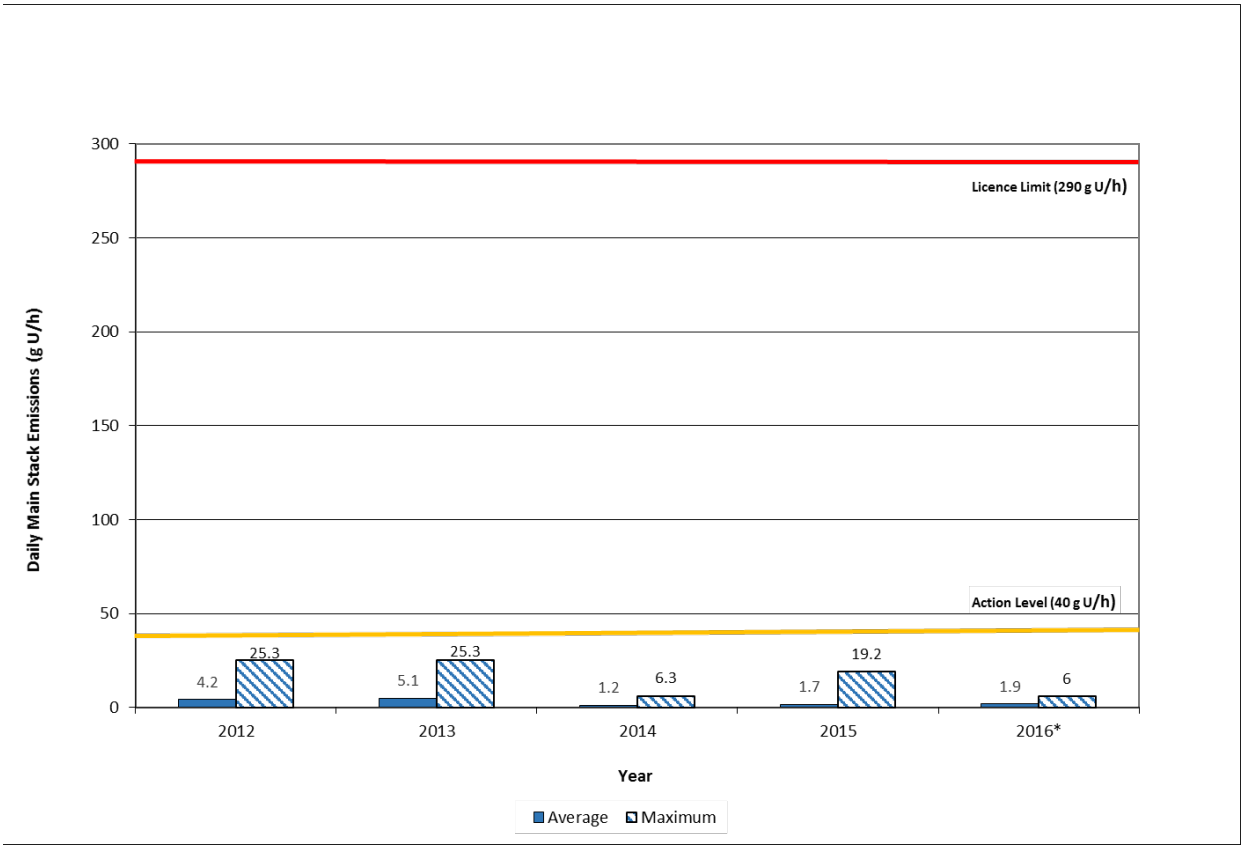
3.9.2 Past Performance

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

Source Monitoring

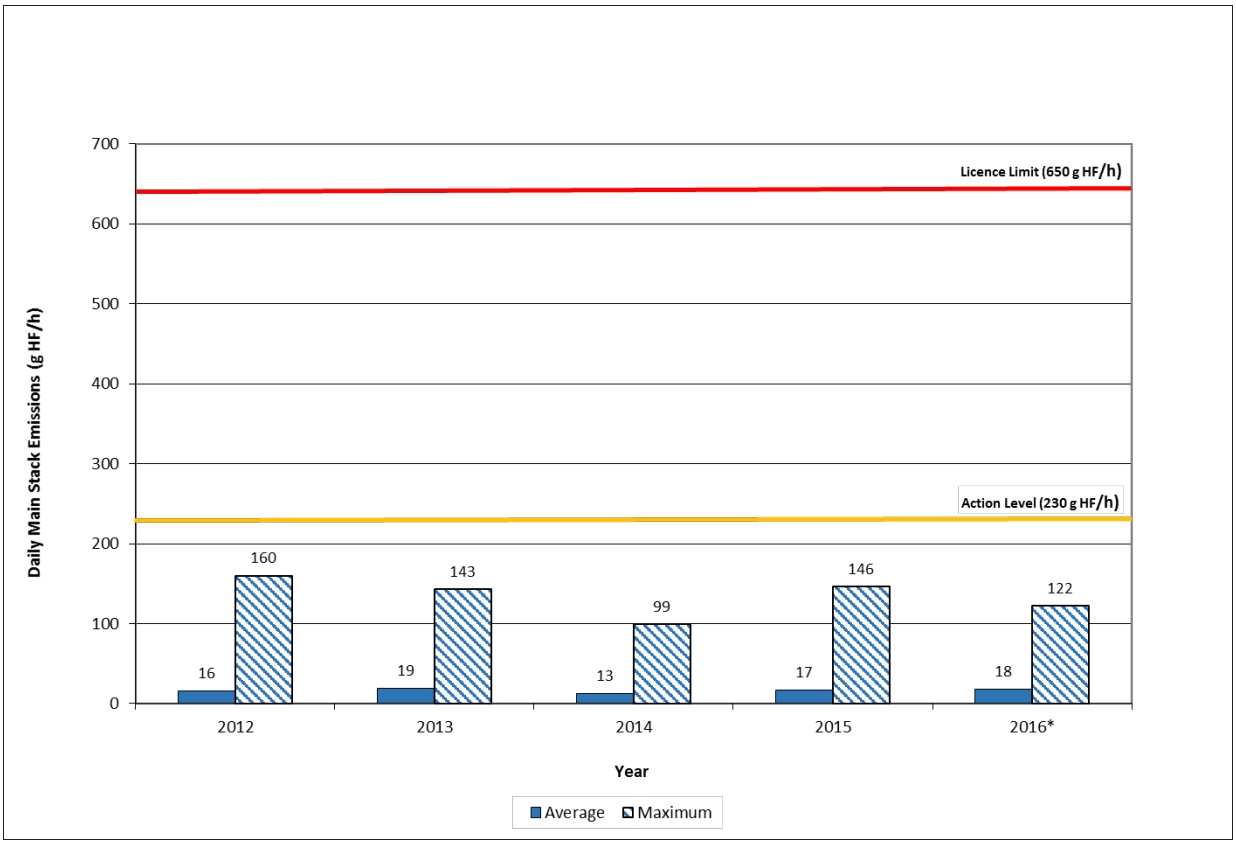
The results from the air emissions monitoring are set out in Figures 13 through 16. The data shows that air emission discharges continue to be well below the emissions limits.

Figure 13 – UF_6 plant main stack uranium emissions



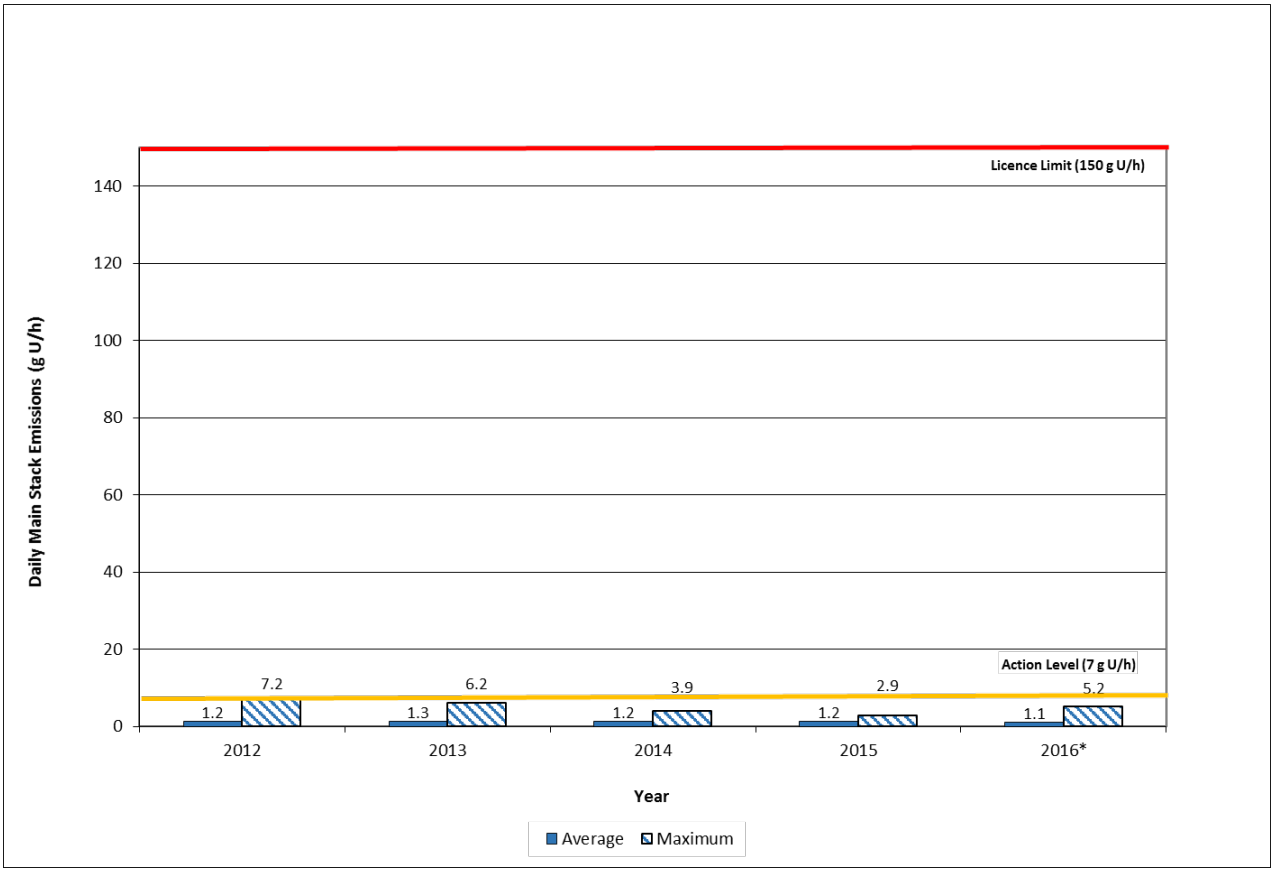
*2016 results as of June 30, 2016

Figure 14 – UF_6 plant main stack fluoride emissions



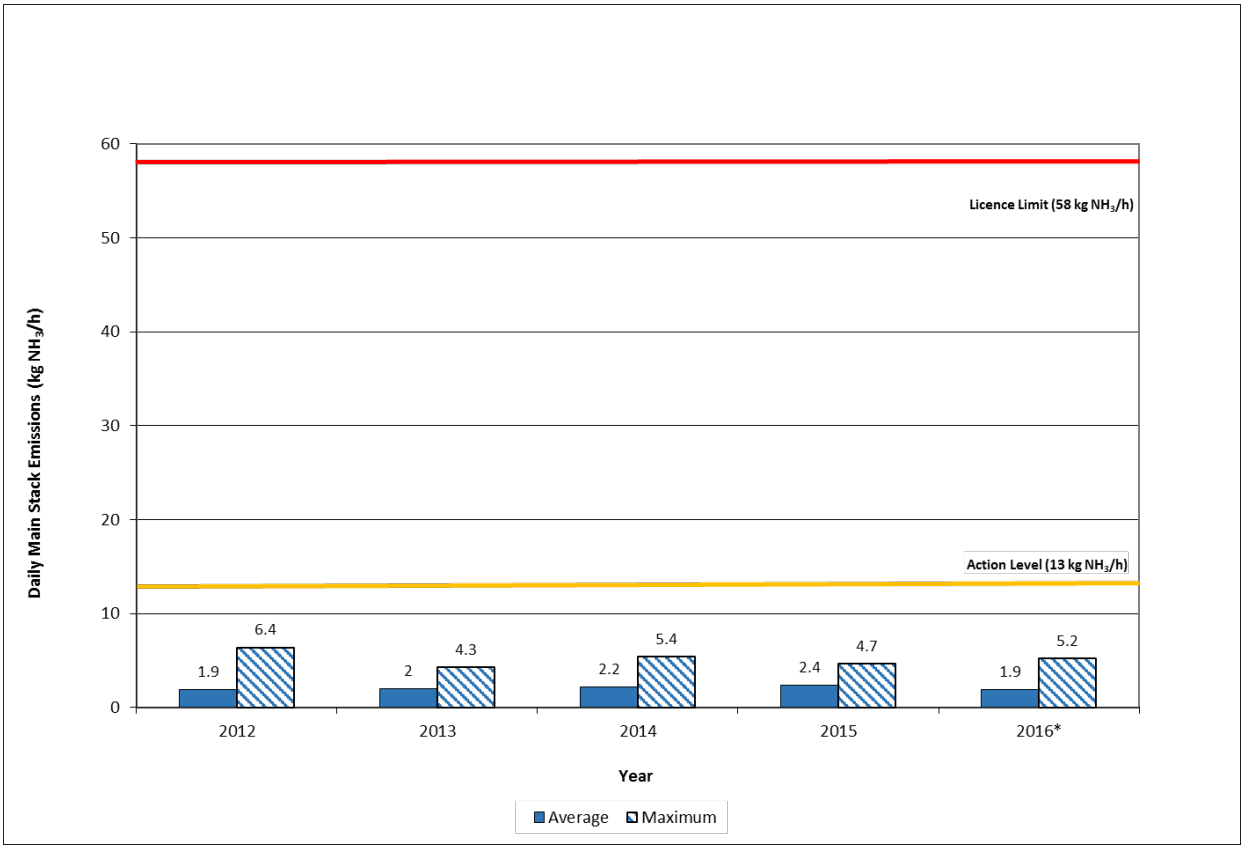
*2016 results as of June 30, 2016

Figure 15 – UO_2 plant main stack uranium emissions



*2016 results as of June 30, 2016

Figure 16 – UO_2 plant main stack ammonia emissions



*2016 results as of June 30, 2016

In the current licence period, PHCF has focused emissions reduction activities on reducing uranium emissions through projects that are part of its air emissions management strategy. This included installation of HEPA filters and a new tail gas Venturi scrubber in January 2014, which reduced the UF_6 main stack uranium emissions by more than 50%. The site received the Cameco Environmental Leadership Award in 2015 for the tail gas scrubber project.

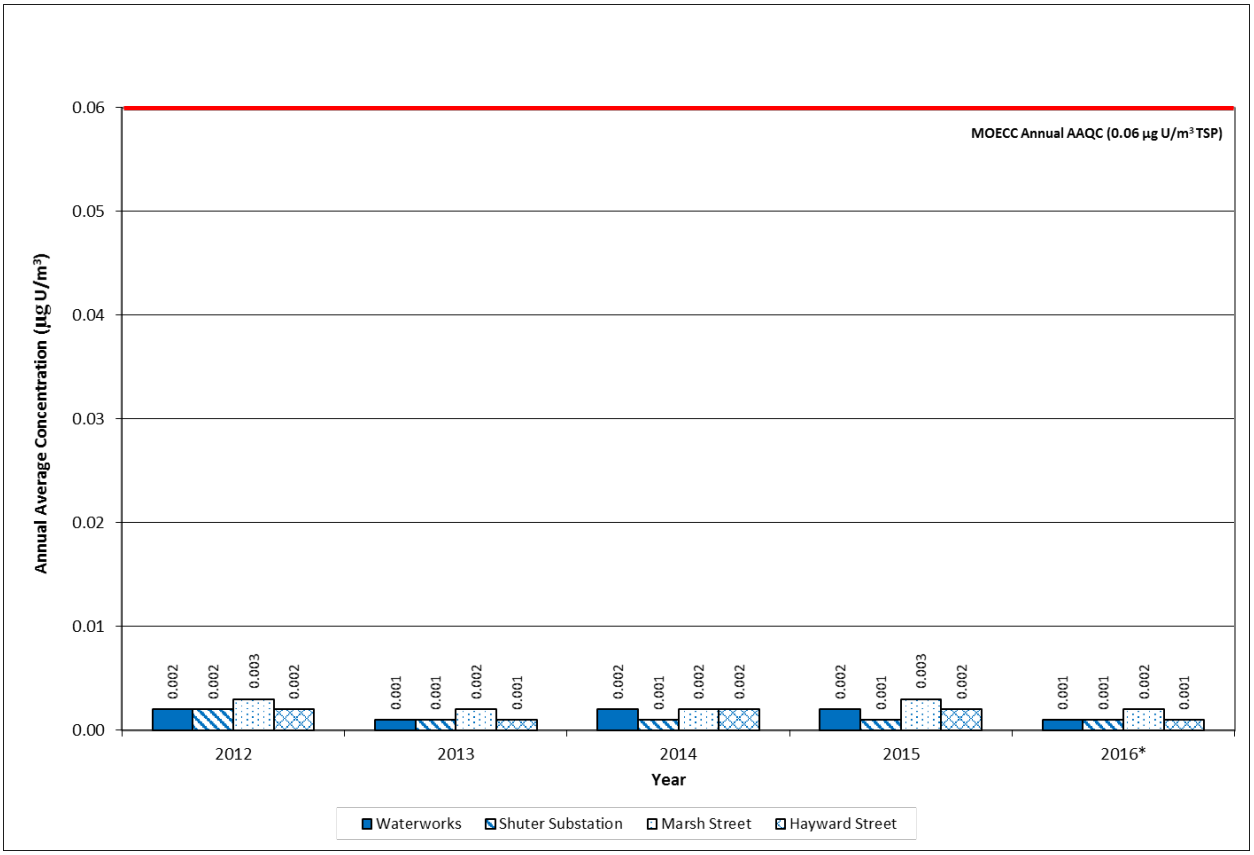
The stack action level at the UO_2 plant was exceeded once in the licence period. The investigation determined the cause to be related to plant maintenance. Changes to start-up procedures were made to address these issues.

During the licence period, 15 minor environmental spills were reported to CNSC and the MOECC. These events included discharges of potable water, steam condensate, groundwater, hydraulic fluid to the harbour and carryover of materials to a rooftop stack. All of these events had negligible impact on the environment. They were investigated, documented in CIRS and corrective actions were implemented.

Ambient Monitoring

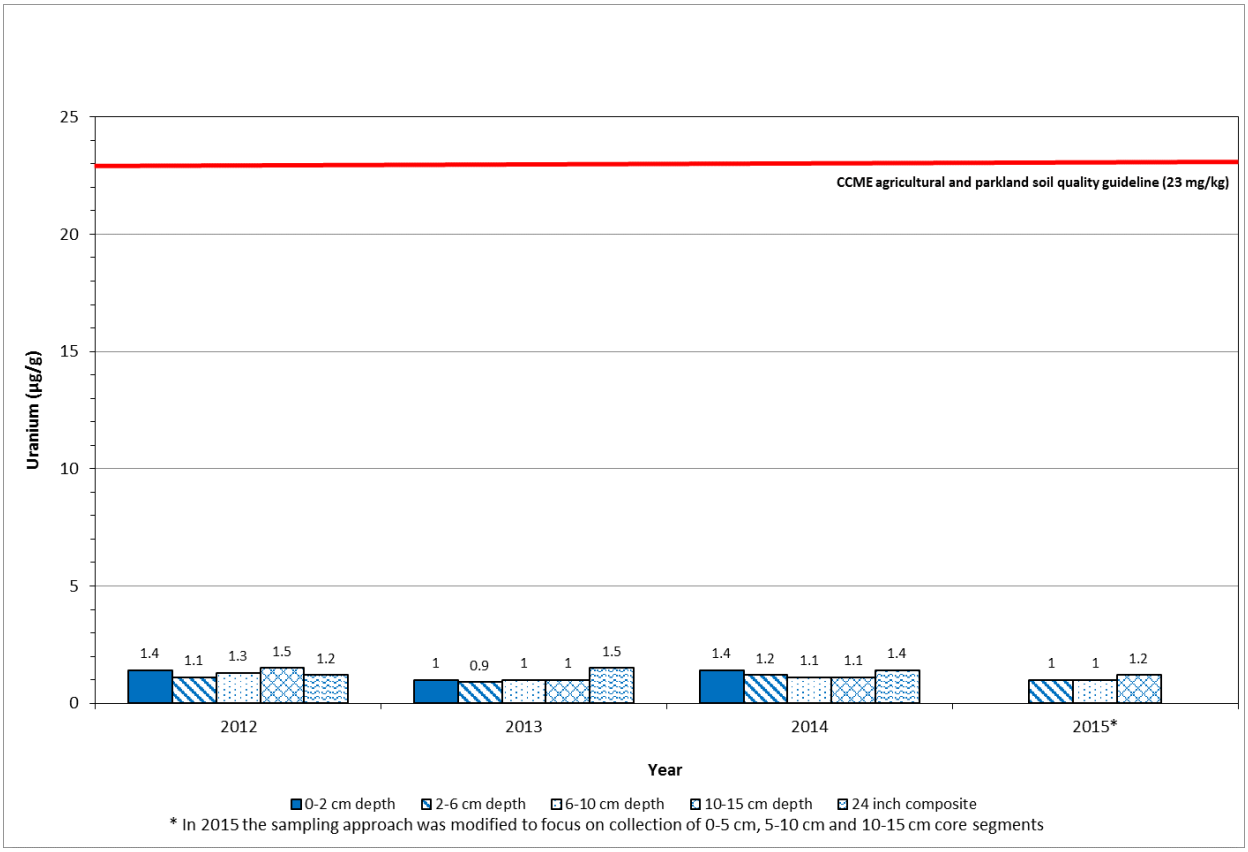
The ambient air monitoring and terrestrial monitoring programs supported the stack monitoring program with results being a small fraction of the applicable federal and/or provincial objectives, guidelines and criteria as illustrated in Figures 17 through 19.

Figure 17 – Ambient air quality as measured by hi-volume samplers



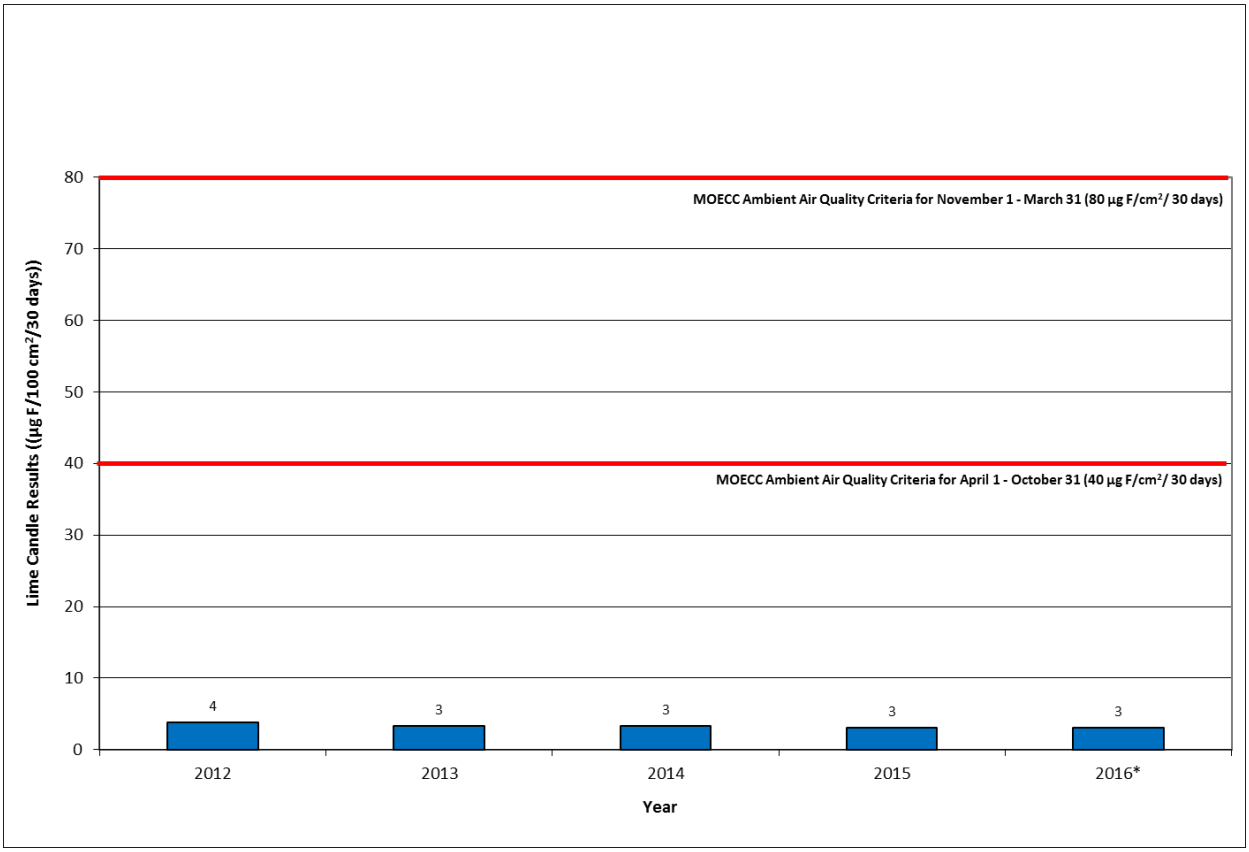
*2016 results as of June 30, 2016

Figure 18 – Uranium concentration in clean soil plot



*2016 results as of June 30, 2016

Figure 19 – Ambient air quality as measured by lime candles



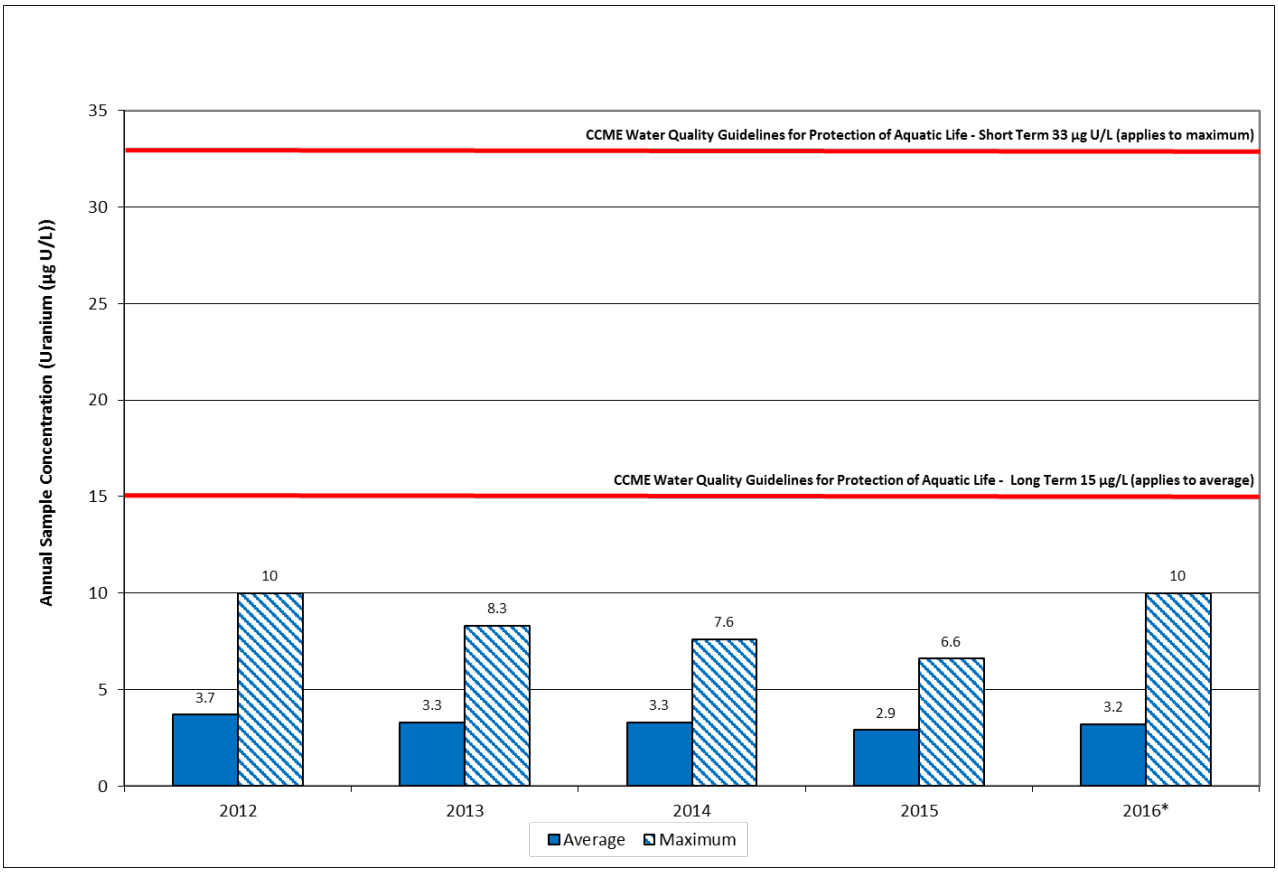
*2016 results as of June 30, 2016

Water Monitoring

PHCF uses a harbour water once-through cooling water system, supplemented with municipal potable water. The cooling water system takings, operations and discharges are regulated by the provincial MOECC via a Permit to Take Water (PTTW) and an Environmental Compliance Approval (ECA).

Ambient surface water monitoring demonstrates that the uranium concentration has decreased slightly in the licence period.

Figure 20 – Average Uranium Concentration in Harbour Water



*2016 results as of June 30, 2016

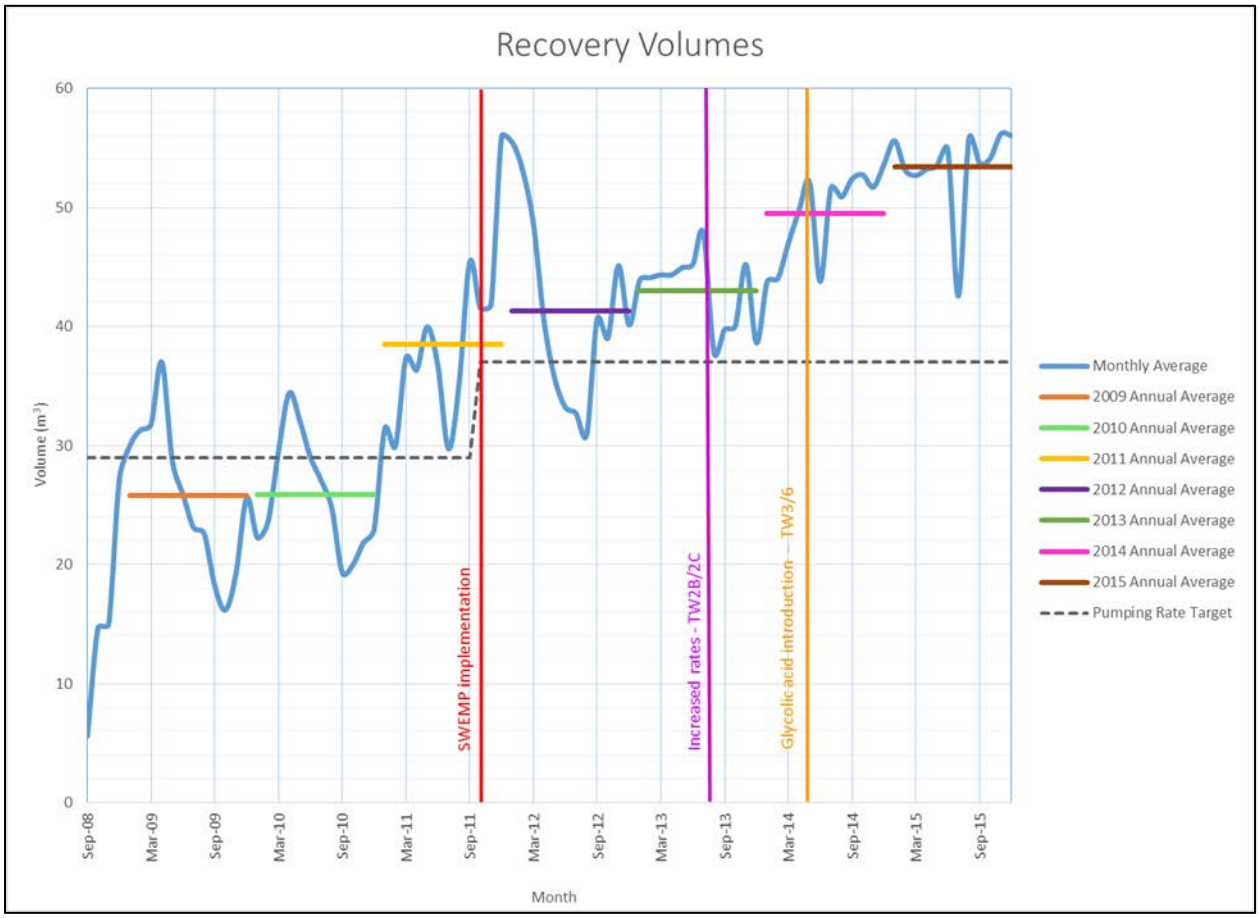
Groundwater

Groundwater is being treated through an extensive pump-and-treat system, which significantly reduces loadings of key contaminants of potential concern such as fluoride, uranium, ammonia, and arsenic. The primary purpose of the pump-and-treat system is to ensure the subsurface contamination beneath the UF_6 plant remains in place by maintaining a zone of groundwater capture around the building. The second purpose for the system is to reduce the overall contaminant loadings to the harbour from the groundwater by reducing the total volume of groundwater that reaches the harbour and/or the contaminant source material in the water table. The groundwater monitoring program is used to ensure the pump-and-treat system meets these objectives and is reviewed on an annual basis.

Third-party experts update the groundwater model annually with the actual pumping rates and volumes as well as the groundwater elevations and analytical data. This information is used to calculate the total mass of contaminants of potential concern and is provided in the annual groundwater review that PHCF submits to both the CNSC and MOECC. These reviews monitor the zone of groundwater control, the removal of source material from the subsurface, movement of source material mass into the zone of groundwater capture and potential impact on the Port Hope harbour.

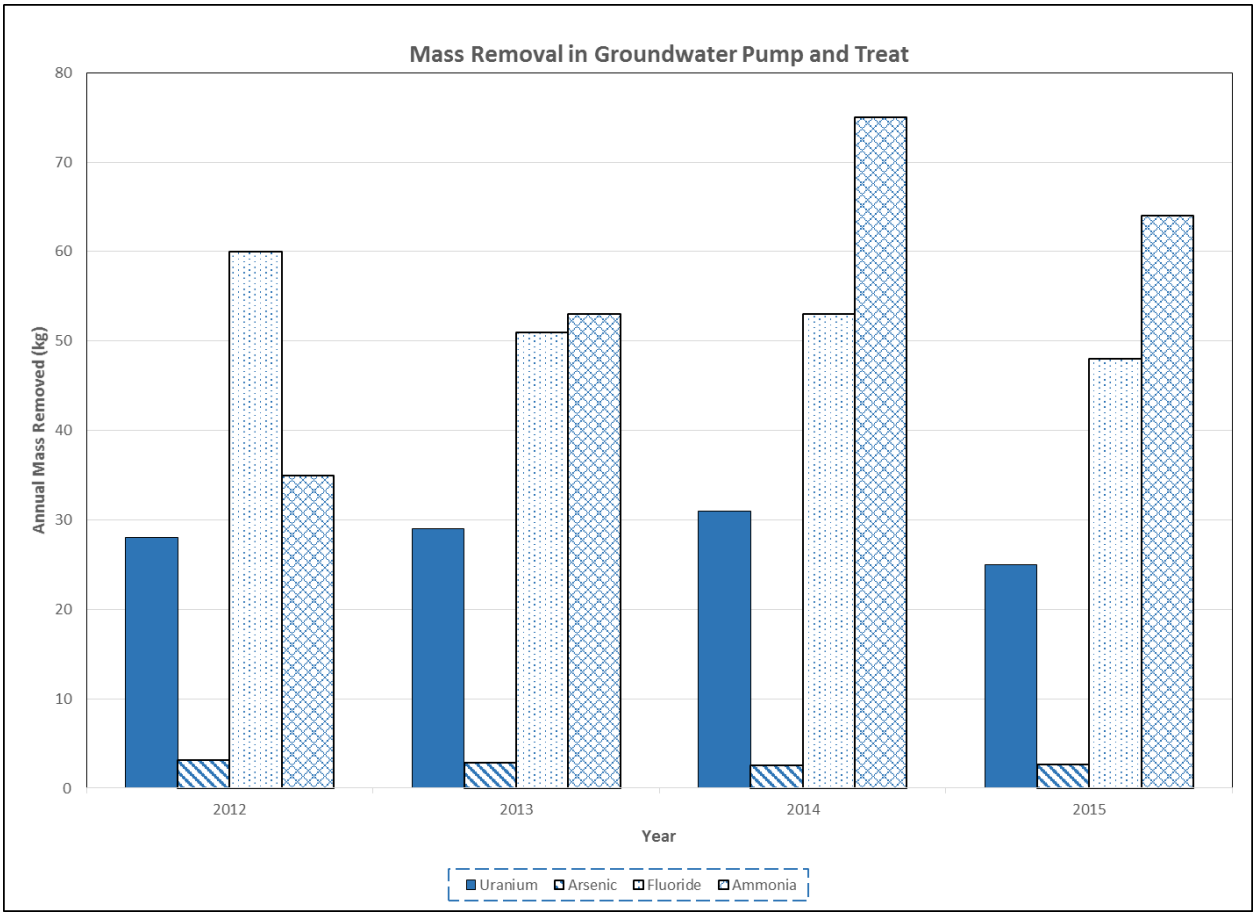
Mean pumping-well recovery rates have significantly and steadily increased from 2009, the first full year of system operations. The 2015 mean recovery rate was approximately 53.4 m^3/day, a 107% increase from 2009. Improvements in recovery volumes have resulted from continual improvements to the well maintenance program, targeted increases in recovery rates at the UO_2 plant, improved reliability of wastewater treatment plant operations, and a 2011 pumping well expansion. Figure 21 illustrates the average monthly and annual total system recovery volumes observed since 2008 with reference to the current target cumulative pumping rate.

Figure 21 – Groundwater recovery volumes



These pumping rates translate to strong groundwater control at the site. Estimated mass removals of contaminated source material during the current licence period are summarized in Figure 22. This demonstrates that since its installation, the pump-and-treat system operations have had a positive environmental impact in terms of contaminant mass that is no longer being discharged to the harbour.

Figure 22 – Contaminated source removal through groundwater pump and treat



PHCF's audit program includes audits of the site EPP, with all elements audited at least once every three years. In the current licence period, 20 audits included assessment of components of the EPP. No significant issues were identified during these audits, opportunities for improvement and minor findings were investigated with appropriate action taken and documented in CIRS.

Though the EPP has been demonstrated to be effective, PHCF implemented several improvements to operations over the current licence period that have enhanced PHCF's EPP and environmental performance. These improvements have included:

- Implementation of a new corporate laboratory information management system;
- Improvements to scrubbing systems for hydrogen fluoride and uranium at the UF_6 plant;
- Refinement of uranium emissions calculations for building ventilation;
- Upgrades to the UO_2 main stack air emission monitoring system;

- Improvements to the stormwater system, including a reduction in the number of discharge points, repairs to subsurface lines and implementation of a maintenance program; and
- Continued enhancements to the groundwater pump-and-treat system to control subsurface contamination.

Other activities supporting the EPP carried out in the current licence period include:

- Received amended ECA for cooling water and storm sewer works with limited operational flexibility;
- Received amended ECA for air and noise with limited operational flexibility;
- Completed an ERA that meets the requirements of CSA N288.6-12 (Environmental Risk Assessment); and
- Completed an update to the DRL study that meets the requirements of CSA N288.1-14 (Derived Release Limit).

PHCF maintains an appropriate EPP that meets the requirements of the ISO14001 standard and Cameco's corporate requirements. During the current licence period, PHCF initiated a project to align its EPP with the applicable CSA N288 series standards, which provide guidance on the framework and methodology for establishing a standardized EPP that is protective of people and the environment. This includes the assessment of risk and enhancement of monitoring plans to address these risks and demonstrate regulatory compliance.

3.9.3 Future Plans

PHCF is committed to complying with the applicable CSA N288 series standards. This includes the assessment of risk and the enhancement of monitoring programs to address these risks and demonstrate regulatory compliance. This will further strengthen the EPP at the facility.

In 2016, CNSC staff accepted PHCF's ERA that was completed to meet the requirements of CSA N288.6-12 (Environmental Risk Assessment). The ERA did not identify any areas of significant risk to people or the environment. PHCF will use the recommendations from the ERA, as well as the guidance outlined in CSA N288.4-10, *Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills* and CSA N288.5-11, *Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills* to update the site EPP documentation. These documents will be fully aligned with the requirements of these standards by the end of 2017. Other recommendations from the ERA will be appropriately dispositioned in 2017 in consultation with the appropriate regulatory agencies.

In 2016, CNSC staff also accepted PHCF's DRL report that was completed to meet the requirements of CSA N288.1-14 (Derived Release Limits). The conceptual model for the DRL and ORL for water releases has been improved in the 2016 study and gamma modelling receptors have been expanded to be consistent with the ERA and VIM gamma modelling work. This ensures that all potential exposure pathways for the public

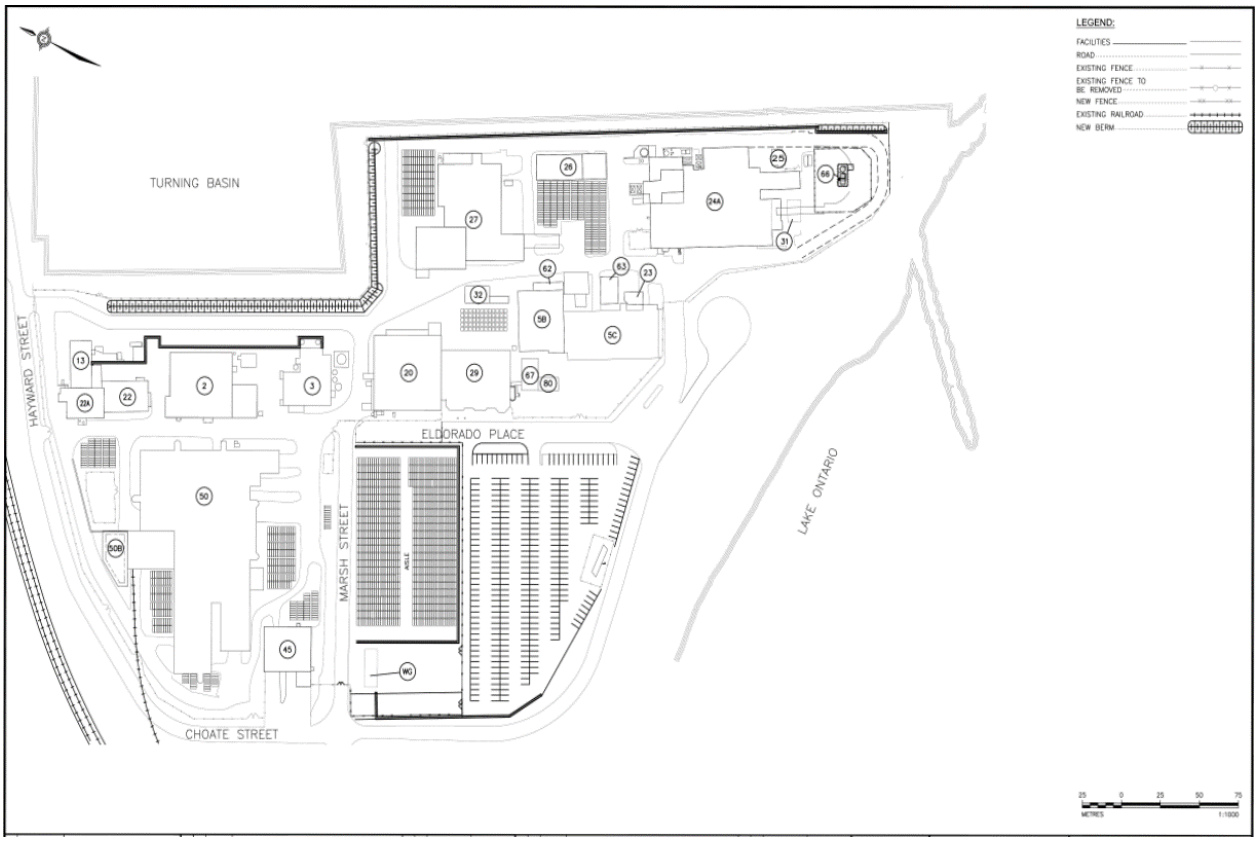
have been assessed. These changes have not altered the overall conclusion that the facility operates well within the public dose limit set out in the *Radiation Protection Regulations* of 1 mSv/year. These changes will be incorporated into the PHCF monitoring program and reporting by the end of the first quarter of 2017. Using this conceptual model, PHCF will undertake a systematic review of the scientific rationale for the non-uranium stack emission limits and submit it to CNSC staff for review and acceptance by the end of second quarter of 2019.

The following CSA standards will be implemented at PHCF in the next licence period and the divisional implementation plan will be developed and submitted to CNSC staff by the end of 2017:

- CSA N288.7-15 *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.8 *Guidelines for establishing and implementing environmental action levels to control emissions from nuclear facilities*

Physical upgrades to PHCF during the next licence period as part of VIM are expected to have benefits to the EPP. These upgrades include physical works on the storm water system, the addition of groundwater collection wells at the south end of the facility, source removal of subsurface contamination at the north end of the facility, a reduction in the footprint of the facility around the harbour, and landscaping to enhance flood protection at the facility. The proposed layout of the facility after VIM is shown in figure 23.

Figure 23 – Port Hope Conversion Facility Site Layout Post VIM



Over the proposed licence period, PHCF will update the ERA and DRL reports twice (every five years) to revalidate the basis for the EPP. Each update will incorporate, where applicable, recommendations from CNSC staff, industry practice, scientific literature, operating experience and/or regulatory documents and standards to enhance the robustness of the analysis. Recommendations from these assessments may drive additional changes to the EPP.

3.9.4 Challenges

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

3.9.5 Requests

PHCF has no requests at this time.

3.10 Emergency Management and Fire Protection

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

3.10.1 Relevance and Management

Emergency planning for nuclear facilities is a requirement of the NSCA, the *Class I Nuclear Facilities Regulations* and the Licence. In addition to the CNSC licensing requirements, ECCC and the MOECC have requirements related to emergency planning and spill prevention. The federal *Environmental Emergency Regulations* identify specific chemicals and quantity levels that require the facility to develop release scenarios and conduct drills at prescribed frequencies as part of an environmental emergencies plan. Provincial regulations require the site to maintain a site-specific spill prevention and contingency plan as a resource for preventing, detecting and responding to spills.

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

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

The fire protection program establishes provisions to prevent, mitigate and respond to fires such that fire risk to workers, the public, the environment and PHCF property is acceptably low and controlled. It meets internal Cameco requirements and the requirements of the *National Fire Code of Canada*, 2005, the *National Building Code of Canada*, 2005 and NFPA 801. The purpose of this program is to define management responsibilities, program objectives, program elements and program controls required to achieve the fire safety objectives. It applies to all existing buildings at the facility and to the design and construction of new buildings and facilities, to the modification of existing facilities, and through their different operational stages, including shutdown and decommissioning.

The emergency response organization comprises of the local emergency response team, which deals with the event at the site level, and the divisional Local Crisis Management Team, which is supported by the Cameco Corporate Crisis Management

Team. These multiple layers of support ensure any emergencies within the organization are dealt with appropriately.

3.10.2 Past Performance

Each year, PHCF conducts a number of internal drills and training exercises to test the effectiveness of the site and the emergency response organization. The following is a general list of the types of internal drills and activities in which the emergency response organization participated in during the current licence period. The figures in brackets are the number completed between January 2012 and June 2016:

- Full simulations with uranium materials such as UF_6 (8)
- Hazardous and/or radioactive materials response drills and full simulations, to include AHF, nitric acid, ammonia, UF_6, other uranium compounds and hydrogen fire response (35)
- Fire alarm response drills (18)
- Medical assistance drills (7)
- Building evacuation drills (8)
- ERT recall drills (6)
- Joint exercises (the Municipality, Port Hope Fire and Emergency Services, etc.) (9)
- Table-top exercises (8)

All drills were completed successfully, followed by a full debrief including lessons learned. Corrective actions identified from the lessons learned are tracked through CIRS. The emergency response and training assistance agreement between PHCF and the Municipality continues to ensure the two response organizations are provided the opportunity to train together to prepare for emergencies that could require a joint response. Also, as part of the agreement, Cameco continues to provide Port Hope Fire and Emergency Services with the necessary equipment and training to effectively respond to emergencies at PHCF.

Facility fire inspections are carried out for every area of the facility. Any areas for improvement are documented and tracked in CIRS to ensure the corrective actions are taken. Annual third-party assessments/audits are carried out with the following focus:

- Fire Protection Audit
- Plant Conditions Inspection
- Sprinkler Inspections
- Alarm Inspection and Verification

Any deficiencies identified are documented and tracked in CIRS to ensure corrective action is taken.

3.10.3 Future Plans

The requirements of CSA N393-13 (Fire Protection) and REGDOC-2.10.1 *Nuclear emergency preparedness and response* will be fully incorporated into the appropriate site emergency management and fire protection documents, including the FHA by the end of 2017.

3.10.4 Challenges

PHCF has not identified any challenges associated with this SCA.

3.10.5 Requests

PHCF has no requests at this time.

3.11 Waste Management

Waste management covers the internal waste-related programs, which form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. It also covers the planning for decommissioning.

3.11.1 Relevance and Management

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

- Routine waste management of radioactive, conventional, hazardous and mixed waste (Waste Management Plan);
- Removal of obsolete buildings, equipment and materials and the processing of these materials (Clean Up Program); and,
- Decommissioning strategy and planning (Preliminary Decommissioning Plan).

Waste Management Plan

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

The waste management plan has the following objectives:

- To implement waste segregation, volume reduction and waste recycle/utilization programs which are environmentally sound and economically viable to minimize the amount of waste which must be managed at 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 other 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; and,
- To provide sufficient information to the regulatory agencies and to the public to demonstrate conformance to these objectives.

Clean-Up Program

The Clean-Up Program (CUP) is responsible for removal of obsolete buildings, equipment and materials for the purpose of reducing environmental liabilities, creating useable space and improving the appearance of PHCF. CUP activities can be generally broken down into routine operations and CUP projects.

Routine operations include activities such as collecting, reducing the size of, decontaminating, and monitoring scrap metal so it can be released from the site as well as the day-to-day implementation of activities under the waste management plan.

CUP projects include activities such as removing out of service equipment, dismantling process systems, removing structures, demolition of buildings, decontaminating operating plant items and other remediation activities.

VIM meets the definition of a large CUP project and will be specifically discussed in section 4.9.

Preliminary Decommissioning Plan

Cameco maintains a PDP and financial guarantee for PHCF. These documents meet the requirements of G-219 (Decommissioning Planning) and G-206 (Financial Guarantees). The PDP is reviewed and revised as appropriate every five years and will be reviewed and updated at least twice in the proposed licence period. This is also discussed in Section 4.5.

3.11.2 Past Performance

Solid wastes contaminated by uranium are reprocessed, recycled and re-used to the extent possible. Waste materials that cannot be reprocessed, recycled or re-used are safely stored onsite until appropriate disposal options are available. Between 2012 and 2016, PHCF safely managed ongoing waste streams as described in the waste management plan through the following pathways:

- Disposal at a local landfill;
- Recovery at a recycling facility;
- Fluoride product processing for uranium recovery at a licensed facility;
- Ammonium nitrate to a local fertilizer company;
- Combustible materials to the BRR incinerator;
- Metal decontamination to free-release and recovery at a scrap metal facility;

- Disposal of contaminated materials at appropriately licensed hazardous waste facilities; and,
- Storage of materials not meeting the above streams.

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

- During the licence period, waste management accomplishments included:
- Processing fluoride product for uranium recovery at Cameco's Key Lake facility;
- Characterizing stored wastes based on a 500 ppm uranium threshold for eligibility for management at a hazardous waste landfill; and,
- Developing plans for management of wastes not eligible for disposal at the LTWMF.

In the current licence period, CUP has safely carried out numerous small and large projects to remove redundant equipment and clean-up under-utilized buildings. In 2014 and 2015, large-scale "SuperCUP" campaigns were carried out, during which additional employees were temporarily transferred to CUP, where they were trained and qualified to perform CUP activities.

In late 2015 and early 2016, Cameco safely demolished the above-grade portions of Buildings 42 and 43A on the Centre Pier. Building 41 may be demolished as early as 2017. All other buildings on the Centre Pier are used to store drummed legacy wastes and will remain in place until those materials are transferred to the LTWMF. The work will improve the management of radiation, safety and environmental risks associated with the structures.

The Centre Pier and SuperCUP projects have allowed the development and testing of planning, execution and monitoring strategies that will be used during VIM. Approximately 270 tonnes of scrap metal was processed for recycling during these projects.

3.11.3 Future Plans

In the next licence period, the FSD has a plan to dispose of its legacy waste materials in an appropriate recycle or licensed hazardous waste management facility within the next five years, assuming the LTWMF is available according to the current schedule. As the legacy waste aspect of the plan is implemented, focus will turn to divisional efficiencies in managing waste.

Through VIM, Cameco will deliver an allowance of qualifying waste materials to the LTWMF and remediate and improve the PHCF. VIM meets the criteria of a large CUP project and is expected to be implemented during the proposed licence period in conjunction with the PHAI. The VIM project is responsible for the preparation and transport of the wastes destined for the LTWMF, including stored wastes, building

materials, contaminated soils and other Cameco decommissioning waste as defined by the waste delivery plan agreement between Cameco and Natural Resources Canada.

As part of the ongoing improvements to the regulatory framework, in the next licence period, PHCF will implement the relevant aspects of CSA N292.3-14 *Management of low- and intermediate-level radioactive waste* and CSA N292.0-14 *General principles for the management of radioactive waste and irradiated fuel*. PHCF has committed to implement these standards for active waste starting in September 2017. The standards will not be applied to wastes destined for disposal at the LTWMF.

3.11.4 Challenges

Cameco has not been able to find any commercially viable low-level radioactive waste management facilities in Canada. While the majority of waste at PHCF is eligible for the PHAI Port Hope project, this creates a challenge following the closure of that facility. Cameco intends to meet this challenge through recycling initiatives and using foreign disposal opportunities to reduce the waste inventory at PHCF.

3.11.5 Requests

Cameco has no requests at this time.

3.12 Security

This SCA covers the programs required to implement and support the security requirements stipulated in the *General Nuclear Safety and Control Regulations* (GNSCR), the *Nuclear Security Regulations* and other CNSC requirements.

3.12.1 Relevance and Management

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 GNSCR. The objective of the security plan is to ensure safe and secure operation of the facility, by maintaining protection through use of equipment, personnel, and procedures. The PHCF Security Plan has continued to evolve to meet all regulatory requirements and commitments over the current licence period.

3.12.2 Past Performance

During the licence period, the CNSC's Nuclear Security Division conducted four security compliance inspections. PHCF uses the findings and recommendations of CNSC staff to improve the overall security program.

3.12.3 Future Plans

Though the PHCF security program is well managed and developed, the facility will continue to look for opportunities to enhance the existing program. Through collaboration with Cameco's FSD, the PHCF will work to further refine the systems, processes and training that support the successful operation of the security program. Cameco will continue to maintain and enhance if necessary, it's Security Plan during the upcoming licence period.

3.12.4 Challenges

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

3.12.5 Requests

Cameco has no requests at this time.

3.13 Safeguards

Safeguards cover the programs required for the successful implementation of the obligations arising from the Canada/International Atomic Energy Agency (IAEA) Safeguards Agreement.

3.13.1 Relevance and Management

Cameco complies with IAEA Document SG-SGOB-3105 *Integrated Safeguards Procedure* for conversion and fuel fabrication.

The site maintains separate inventories for natural, depleted and enriched uranium where receipts and shipments are recorded. Monthly inventory reports are submitted to the CNSC 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 to comply with the applicable nuclear materials safeguards requirements of the CNSC.

3.13.2 Past Performance

The facility maintains a natural uranium inventory system in which receipts and shipments are recorded as per the requirements of RD-336. Periodic audits of the inventory system are conducted by the IAEA, the CNSC and by Cameco internal auditors. During the period 2012-2016 a total of seven short notice random inspections, four physical inventory verifications, four international shipment inspections, one physical inventory taking verification and five other inspections were carried out by the

IAEA as part of safeguards activities. CNSC staff participated in 13 of these activities. The facility continues to work with both the CNSC and IAEA on continual improvement in this area.

3.13.3 Future Plans

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

3.13.4 Challenges

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

3.13.5 Requests

Cameco has no requests at this time.

3.14 Packaging and Transport

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

3.14.1 Relevance and Management

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

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

3.14.2 Past Performance

UO_2 is produced, packaged in drums and transported by road from the PHCF to Cameco's Fuel Manufacturing 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 countries such as Japan, Korea and Romania. 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 as specified in the PTNSR.

UF_6 is produced and transported in 48X or 48Y cylinders certified by the CNSC as Type H(M) and H(U) packages for transport by road, rail or marine from the PHCF to the USA or overseas, including but not limited to, the United Kingdom, Germany, Holland and Japan. UF_6 may also be transported in 30B cylinders certified by the CNSC as Type B(U)F-96 or AF-96 packages for transport by road or marine.

In addition to UO_2 and UF_6, scrap material is transported to the PHCF from the USA and Europe by road, rail or marine.

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 Global Affairs Canada.

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.

In the current licence period, CNSC staff was notified of four minor transportation occurrences by PHCF, none of which were reportable under the PTNSR. Two were minor traffic accidents and two were related to labelling/placarding errors. These were investigated, corrective actions put into place, and no environmental impacts occurred as a result. In addition, over this period, PHCF provided response assistance to other sites and/or licensees as per the terms of the Cameco emergency response assistance plans.

3.14.3 Future Plans

PHCF will continue to comply with all applicable federal and international transportation regulations as appropriate.

3.14.4 Challenges

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

3.14.5 Requests

Cameco has no requests at this time.

4.0 OTHER MATTERS OF REGULATORY INTEREST

4.1 Environmental Assessment

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

A comprehensive study-type EA was completed under the *Canadian Environmental Assessment Act* (CEAA 1992) with the CNSC as the responsible authority. The environmental impact statement and supporting documentation was submitted by Cameco in December 2010 and the CNSC comprehensive study report was issued in May 2012. These documents 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.

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

4.2 Aboriginal Consultation

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

Cameco includes the Chiefs of the five nearest First Nations bands and the Métis Nation of Ontario on its mailing list to ensure Aboriginal stakeholders 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 as per its public information program described in Section 4.7.

As part of this licence renewal, Cameco initiated additional outreach to the following First Nations and Métis organizations:

- Alderville First Nation
- Hiawatha First Nation
- Mississaugas of Scugog Island

- Mohawks of the Bay of Quinte
- Curve Lake First Nation
- Métis Nation of Ontario

Cameco sent a letter in early 2016 to the identified Aboriginal groups outlining the request for a new licence, significant planned activities and the length of the licence term. The letter included an invitation for a meeting. The letter was followed up with telephone calls to confirm the letter receipt and to confirm whether there is interest in a meeting. None of the groups identified expressed interest in the proceedings or meeting with Cameco.

4.3 Other Consultation

PHCF completed a self-assessment in relation to the cooling water intake from Lake Ontario to determine if a *Fisheries Act* authorization is required. The self-assessment determined that much less than one kilogram of fish was lost to the ecosystem with the existing cooling water operation and mitigation in place. At this low potential impact an authorization is not required. At the time of the submission of this CMD, PHCF's self-assessment was under review by CNSC staff. Cameco will work with CNSC staff to ensure regulatory requirements in this area continue to be met.

4.4 Cost Recovery

Cameco is current on its cost recovery payments.

4.5 Financial Guarantees

The PHCF maintains a preliminary decommissioning plan (PDP), which is prepared based on guidance provided in G-219 (Decommissioning Planning). The current financial guarantee, maintained in the form of two irrevocable letters of credit totaling $101.7 million reflects the PDP accepted by the Commission during the previous licensing proceedings.

The PDP was updated and accepted by CNSC staff in 2016 in support of the current licence renewal. The PDP outlines the general requirements for returning the site to the status of unrestricted use and outlines the controls required for the protection of the environment during the decommissioning process. As part of this process the financial guarantee was re-evaluated in accordance with the criteria set out in CSA N294-09 (Decommissioning of Nuclear Facilities), G-219 (Decommissioning Planning) and G-206 (Financial Guarantees). Once the value of the financial guarantee has been approved by the Commission, Cameco will increase one of its existing irrevocable letters of credit

by $26.9 million to cover the full amount of $128.6 million as determined through the updated PDP.

4.6 Other Regulatory Approvals

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

- ECA for air and noise emissions
- ECA for cooling water and storm sewer works

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

- PTTW for its cooling water intake
- PTTW for its groundwater collection system

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

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

4.7 Licensee's Public Information Program

The objective of the Public Information Program (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 CNSC RD/GD 99.3, *Public Information and Disclosure*.

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.

The PHCF remains committed to ensuring that information is made available to the Port Hope community and other interested stakeholders. Information made available through the PIP includes:

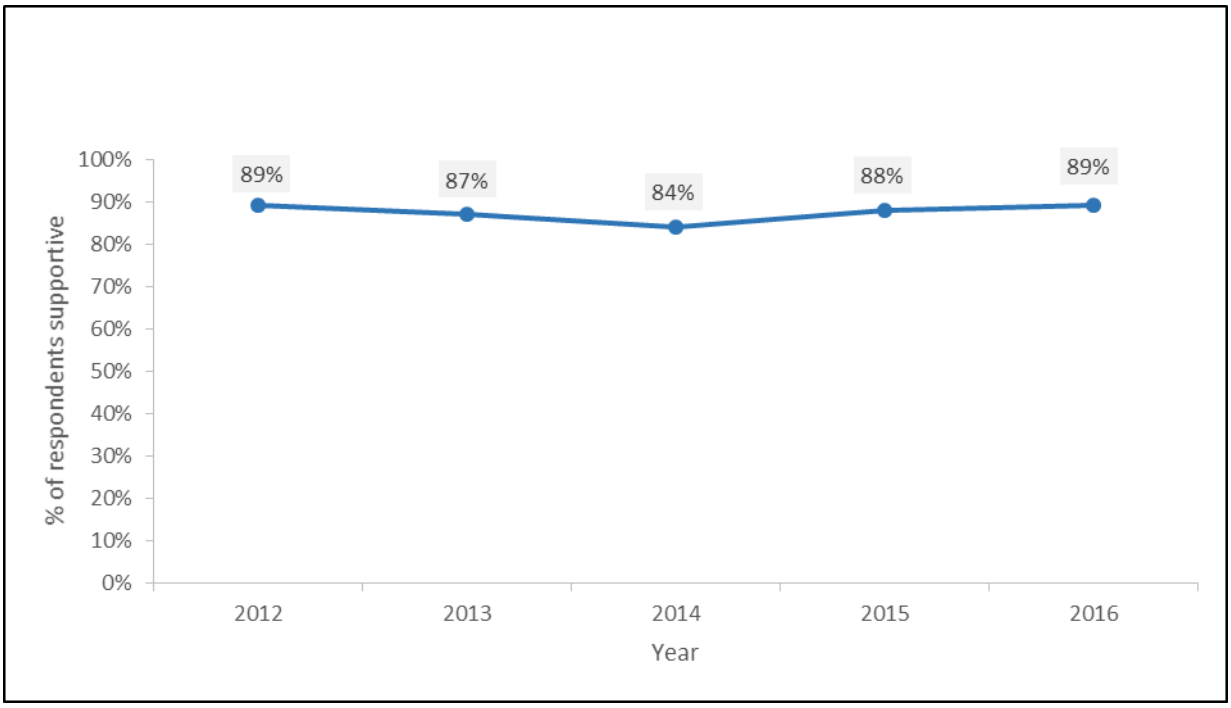
- an overview of the production process;
- quarterly and annual compliance reports that summarize performance in areas of environment, radiation protection, health and safety, fire protection,

emergency response, waste management, reportable incidents and other areas of interest to the public;
- providing information related to significant projects at the PHCF (i.e. new construction, process changes, risk assessments);
- information regarding safety, radiation protection, environment or other studies that support the safe operation of the facility
- providing information related to the environment, including long-term effects of uranium emissions; and,
- Providing information written in plain language that addresses the effects of PHCF's activities on the environment and the health and safety of employees and the community.

In the current licence period, PHCF has adapted its PIP to include social media (Twitter and Facebook), and further developed the FSD website to make information on local operations easier to access for the community. Conventional media and public disclosure tools such as advertisements, newsletters, and press releases, as well as outreach activities such as community forums, presentations to town council, involvement in community activities (i.e. fall fair) and facility tours have also been maintained. Aboriginal consultation has been maintained as described in section 4.2

Cameco has retained outside expertise for more than a decade to measure public opinion in Port Hope to help determine the effectiveness of its PIP. Looking at the results for the period 2012– 2016 shown in Figure 24, nearly nine out of every ten residents remain supportive of the continuation of Cameco's operations in Port Hope. In fact, these levels of support are considered "best in class" for many industries and communities.

Figure 24 – Public support for Cameco's operations in Port Hope



The results of this public opinion research confirm that Cameco's public information program is seen as effective and appropriate by the vast majority of Port Hope residents. Cameco will continue to enhance its PIP as needed in the next licence period to maintain the very strong levels of support demonstrated by the Port Hope community.

4.8 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.

4.9 Additional/Other Matters

Vision in Motion

In the upcoming licence term, Cameco is proposing to undertake a major site cleanup and renewal of PHCF. This undertaking is known as VIM. Further details regarding the current scope of the project were submitted to CNSC staff, the Secretariat and are available on the FSD website. A 10-year licence term will provide sufficient flexibility to address potential delays to the project due to internal or external factors.

This project is a unique and timely opportunity that has been made possible because of the PHAI being undertaken by Canadian Nuclear Laboratories and includes the construction of a LTWMF in the Municipality. VIM will require effective co-ordination with the PHAI to ensure success. Remediation activities in the Port Hope harbour area as well as the transfer of drummed waste, demolition wastes and soil that meet the waste acceptance criteria at the LTWMF are among the activities where effective coordination is paramount. Cameco and PHAI personnel have established working groups to coordinate various aspects of both projects including management oversight, legal agreements, technical/engineering planning (remediation, demolition), regulatory requirements coordination (licensing, safeguards), technical support (environment, radiation protection, waste management), and communications. A senior management coordination team regularly reviews the progress of the project teams at a joint meeting.

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 being constructed in the Municipality. 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 VIM is being targeted to specific areas. The scope is based on modelled improvements to groundwater, including a risk based approach. VIM will be undertaken within the general framework of the environmental and health and safety programs currently in place at PHCF. In addition, specific plans have been developed to guide VIM-specific activities. The following works and activities will be completed as part of VIM:

- Demolition activities: These activities include removal of equipment, material and building services; cleaning of building interiors; building dismantlement; and management of removed demolition waste;
- Excavation activities: Soil 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, lighting and finished grading; and,
- 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 PHCF within the defined remediation scope will have been transferred to the LTWMF (or other waste outlets as appropriate);
- New or modified infrastructure such as roadways, berms and retaining walls, and subsurface piping will have been commissioned as needed to support the project objectives;
- Targeted removal of heavily contaminated soils and enhancement of the groundwater treatment system will be complete; and
- Improvements to PHCF which are consistent with the municipal planning objectives for development of the waterfront will have been completed, as defined within the details of the project scope.

In February 2016, Cameco made a supplemental submission that provided additional detail regarding the scope, schedule, controls and expected outcomes of VIM. This document was provided as part of the August 4, 2016 supplemental submission to the Commission.

As part of licence renewal activities occurring in 2016, Cameco has requested that the operating licence for PHCF specifically provide the authorization for PHCF to engage in clean-up, decontamination, demolition and remediation activities (including VIM) that are currently part of the licensing basis.

REFERENCES

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

1. Cameco Corporation. 2015. *2017 Licence Renewal Application for the Port Hope Conversion Facility*. November 20, 2015.

2. Cameco Corporation. 2016. *2017 Licence Renewal Application for the Port Hope Conversion Facility Supplemental VIM Submission*. February 1, 2016.

3. Cameco Corporation. 2016. *2007-2015 Operational Performance Report and Forward Outlook in Support of the Renewal of: Port Hope Conversion Facility Operating Licence FFOL-3631.00/2017*. August 4, 2016.

4. Cameco Corporation. 2016. *Technical Reports Public Summary Preliminary Decommissioning Plan.*

5. Cameco Corporation. 2016. *Technical Reports Public Summary Environmental Risk Assessment*

6. Cameco Corporation. 2016. *Technical Reports Public Summary Safety Report*

7. Cameco Corporation. 2016. *Technical Reports Public Summary Derived Release Limit*

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

8. Canadian Standards Association (CSA). 2009. B51-09 *Boiler, pressure vessel, and pressure piping code*

9. Canadian Standards Association (CSA). 2014. B51-14 *Boiler, pressure vessel, and pressure piping code*

10. Canadian Standards Association (CSA). 2012. N286-12 *Management system requirements for nuclear facilities*

11. Canadian Standards Association (CSA). 2014. N288.1-14 *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*

12. Canadian Standards Association (CSA). 2010. CSA N288.4-10, *Environmental monitoring programs at class I nuclear facilities and uranium mines and mills*

13. Canadian Standards Association (CSA). 2011. CSA N288.5-11, *Effluent monitoring programs at class I nuclear facilities and uranium mines and mills*

14. Canadian Standards Association (CSA). 2012. CSA N288.6-12 *Environmental risk assessment at class I nuclear facilities and uranium mines and mills*

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

16. Canadian Standards Association (CSA). Unpublished standard. CSA N288.8 *Guidelines for establishing and implementing environmental action levels to control emissions from nuclear facilities*

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

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

19. Canadian Standards Association (CSA). 2009. CSA N294-09 *Decommissioning of facilities containing nuclear substances*

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

21. Canadian Nuclear Safety Commission (CNSC). 2000. G-219: *Decommissioning planning guide for licensed activities*

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

23. Canadian Nuclear Safety Commission (CNSC). 2014. REGDOC 2.2.2 – *Personnel Training*

24. Canadian Nuclear Safety Commission (CNSC). 2014. REGDOC 2.10.1 – *Nuclear emergency preparedness and response*

25. Canadian Nuclear Safety Commission (CNSC). 2010. RD-336. *Accounting and reporting of nuclear material*

26. International Organization for Standardization (ISO). 2004. ISO 14001:2004 *Environmental Management System Standard*

27. National Fire Protection Association (NFPA). 2008. NFPA 801 *Standard for fire protection for facilities handling radioactive materials*

GLOSSARY

AHF	anhydrous hydrogen fluoride
AAQC	ambient air quality criteria
ALARA	as low as reasonably achievable
BRR	Blind River Refinery
Cameco	Cameco Corporation
CANDU	Canada deuterium–uranium
CCME	Canadian Council of Ministers of the Environment
CFM	Cameco Fuel Manufacturing Inc.
CIRS	Cameco Incident Reporting System
CMD	Commission Member Document
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CSSC	Conversion Safety Steering Committee
CUP	Clean-Up Program
DRL	Derived Release Limit
EA	Environmental Assessment
ECA	Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
EIR	Event Initial Report
EPP	environmental protection program
ERA	Environmental Risk Assessment
FFOL	Fuel Facility Operating Licence
FHA	fire hazards analysis
FLM	Facility Licensing Manual
FSD	Fuel Services Division
g	gram
GNSCR	*General Nuclear Safety and Control Regulations*
HAZOP	hazards and operability
HEPA	high efficiency particulate arresting
HF	hydrogen fluoride
ISO	International Organization for Standardization
IAEA	International Atomic Energy Agency
kg	kilogram
KPI	key performance indicator
L	litre
LCH	Licence Conditions Handbook
Licence	FFOL-3631.0/2017

LTWMF	long term waste management facility (specifically the one being constructed in Port Hope for the Port Hope Area Initiative)
MOECC	Ministry of the Environment and Climate Change (Ontario)
mSv	millisievert
Municipality	the Municipality of Port Hope
NEW	nuclear energy worker
NFPA	National Fire Protection Association
NH_3	ammonia
NSCA	*Nuclear Safety and Control Act*
OH&S	Oocupational health and safety
ORL	Operating Release Level (used to set site-specific release limits)
PDP	Preliminary Decommissioning Plan
PEM	Plant Engineering and Maintenance (Magazine)
PHCF	Port Hope Conversion Facility
PHAI	Port Hope Area Initiative (specifically referring to the Port Hope Project)
PM	preventative maintenance
PIP	public information program
PTNSR	*Packaging and transport of nuclear substances regulations*
PTTW	Permit to Take Water
REGDOC	CNSC Regulatory Document
RPP	radiation protection program
Safety Report	the safety analysis for the PHCF
SCA	Safety and Control Area
SuperCUP	a campaign under the Clean-Up Program
TDGR	*Transport of dangerous goods regulations*
TRIR	total recordable injury rate
TSSA	Technical Standards and Safety Authority
µg	microgram
UO_2	Uranium dioxide
UF_6	Uranium hexafluoride
VIM	Vision in Motion
WAC	waste acceptance criteria