2017 Annual Compliance Monitoring
&
Operational Performance Report

Reporting Period January 1 – December 31, 2017

Port Hope Conversion Facility
Operating Licence
FFOL-3631.00/2027

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Submitted to:
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I Executive Summary

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

Cameco operates a Class IB nuclear facility in Port Hope, Ontario and employs approximately 330 workers. In 2017, the facility operated under operating licence FFOL-3631.00/2017 until February 28, 2017 and then under the renewed operating licence FFOL-3631.00/2027, which is valid until February 28, 2027.

The current licence allows for the production of uranium as uranium dioxide (UO_2) and uranium as uranium hexafluoride (UF_6). The facility currently processes and/or stores various natural, depleted and enriched uranium compounds.

Cameco is committed to the safe, clean and reliable operation of all of its facilities and continually strives to improve safety performance and processes to ensure the safety of both its employees and local residents. PHCF maintains the required programs, plans and procedures in the areas of health and safety, radiation protection, environment, emergency response, fire protection, waste management, and training. As a result of these actions, PHCF's operations have maintained employee radiation exposures well below the regulatory dose limits. Environmental emissions and public radiation exposures are being controlled to levels that are a fraction of the regulatory limits.

The PHCF's Management Systems program identifies the controls required to ensure all processes are conducted in a safe manner and that processes applying to licensed activities are conducted in accordance with applicable CNSC Management Systems and other regulatory requirements. There were no significant issues identified during the internal or external audits completed in 2017.

Operators in both UF_6 and UO_2 plants participated in area specific qualification training or re-training, as per individual and plant requirements.

Many UF_6 operators were transferred to support the site clean-up initiative (SuperCUP), during a planned UF_6 plant shut down, and training was provided to ensure all transferred operators had the skills necessary to perform assigned tasks in a safe and efficient manner. A few UF_6 operators were transferred to the UO_2 plant in support of the UO_2 ramped up production schedule. As these activities ended, UF_6 operators (Level 2 and 3) completed start-up evaluations in all their respective qualified/training areas, prior to assuming normal duties.

A wide range of mandatory legislative and other job specific training activities were also carried out in 2017. This training ensures that all personnel have the level of training related to radiation safety, fire safety, chemical safety, on site-emergency arrangements, environmental protection, and conventional health and safety, appropriate for their duties.

To operate in a safe, clean and reliable manner PHCF has programs and procedures that comprise the safety analysis for the site including the safety report, a fire hazard analysis (FHA), an environmental aspects registry, a chemical hazard assessment and other assessments for safety and/or risk. The safety report is a licence requirement that summarizes the systematic review of the site operations to identify and assess hazards and potential risks to the public and environment from PHCF.

PHCF has conducted specific assessments to ensure the safety of its operations. These studies have included, but are not limited to, an environmental risk assessment, a flood study, a harbour wall study, and screening level risk assessments for UF_6 and anhydrous hydrogen fluoride (AHF) service. There were no modifications made in 2017 that affected the safety case for the PHCF. The safety-significant systems at the facility have been identified and a preventive maintenance program is in place to ensure that the equipment associated with these systems is properly maintained.

Changes to the physical design of equipment, processes and the facility with the potential to impact safety are evaluated from project planning through to the completion of the project. A site design control procedure is in place which ensures that any equipment changes or modifications will not have an adverse effect on the environment or on the health and safety of employees or members of the public. In the fourth quarter 2017, CQP-113 Process and Design Change Control was updated to reflect the new Management of Change SAP-based program that is being implemented at the PHCF.

The Operational Reliability program, which was introduced in late 2010, consists of four focus areas deemed key to improving and maintaining reliable operations. They include materials management, work management, reliability engineering, and operations improvement. Work continued in 2017 in all four focus areas.

The radiation protection program at the PHCF is well established, with detailed procedures outlining the processes under each element of the program. Review of the 2017 dose data indicates that the program is effective in the prevention of unreasonable risk to the health and safety of workers. Though the radiation protection and as low as reasonably achievable (ALARA) programs have been demonstrated to be effective, the PHCF has also made improvements as part of its continual improvement program.

The health and safety management program fosters and promotes a strong sustainable safety culture. Under the Operational Excellence initiative, PHCF strives for a safe, healthy and rewarding workplace. The effectiveness of the conventional Occupational Health and Safety (OH&S) system can be evaluated by the responsiveness of the site to leading safety activities such as the Conversion Safety Steering Committee (CSSC), audits, inspections, evaluations, reviews, benchmarking, training and employee participation and engagement. The PHCF was successful in meeting the expectations of these various initiatives. Occupational health and safety efforts at PHCF are supported by one joint committee, the CSSC. The CSSC, created in 2013, incorporates the previously-existing Policy Health and Safety Committee (PHSC) and Workplace Health and Safety Committee (WHSC) into one committee.

In 2017, PHCF advanced several improvements to the environmental protection program. The Environmental Management Program documents were updated to come into full compliance with CSA standards N288.4 Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills and N288.5 Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills. Waste management projects continued, as part of the long-term waste management plan, to dispose of contaminated materials at appropriately licensed hazardous waste facilities.

PHCF maintained its emergency preparedness and response program while looking for opportunities to further improve. As a result, there was significant activity in 2017. This activity and associated records are subject to various audits and are incorporated into the PHCF annual management review. In 2017, third party verifications were conducted in order to confirm the effectiveness of the Fire Protection Program through a Site Condition Inspection.

PHCF has a waste management plan in place at the facility in compliance with applicable regulatory and licence requirements. The most recent revision of the preliminary decommissioning plan was submitted to the CNSC in May 2016 and has been accepted by the CNSC.

PHCF maintains a comprehensive security program which meets the requirements of the General Nuclear Safety and Control Regulations, the Nuclear Security Regulations and other CNSC requirements.

A comprehensive uranium inventory system to demonstrate compliance with safeguards requirements is maintained. PHCF participated in four safeguard inspections in 2017.

The scope of transportation activities at the PHCF includes the transport of Class 7 radioactive materials outlined in the Transportation of Dangerous Goods Act SOR/2008-34. There were no reportable transportation events that occurred at the PHCF in 2017.

Cameco works to build and sustain the trust of local communities by acting as a good corporate citizen in the communities it operates. A key element of building and sustaining that trust is a commitment to provide those in the community with accurate and transparent reporting of environmental practices and performance. Cameco continued its comprehensive approach to community outreach in 2017 with the continuation of community forums, newsletters, and other information initiatives.

The nuclear criticality safety program at the PHCF follows the criticality control principles as described in Radiation Protection Program Manual. The PHCF met all site-specific reporting requirements.

Vision in Motion is Cameco's plan to clean up and renew the PHCF. The project builds on work now under way through the Port Hope Area Initiative (PHAI) to address historic low-level radioactive waste issues in the Municipality of Port Hope.

In conclusion, in 2017, the PHCF continued to operate within the framework of the Nuclear Safety and Control Act (NSCA) and met all requirements as per its operating licence.

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1.0 INTRODUCTION

1.1 General Introduction

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

Cameco operates a Class IB nuclear facility in Port Hope, Ontario and employs approximately 330 workers. In 2017, the facility operated under operating licence FFOL-3631.00/2017 until February 28, 2017 and then under the renewed operating licence FFOL-3631.00/2027, which is valid until February 28, 2027.

PHCF is situated on the north shore of Lake Ontario in Ward 1 of the Municipality of Port Hope, Ontario. 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. Eldorado Place bisects the southern portion of the site, with the employee parking lot located further to the west. Site 1 also includes the centre pier property, which is bounded by Hayward Street to the north, the Port Hope Harbour to the west, Lake Ontario to the south and the Ganaraska River to the east. Site 2 is a storage facility situated in the Nelson Street and Dorset Street East area.

Vision in Motion (VIM) is Cameco's plan to clean up and renew the PHCF. The project builds on work now under way through the Port Hope Area Initiative (PHAI) to address historic low-level waste issues in the Municipality of Port Hope. It provides Cameco with an opportunity to deliver an allowance of qualifying waste materials to the Long-Term Waste Management Facility (LTWMF) that will be constructed by the PHAI on the site of the licensed Welcome Waste Management Facility. In 2017 key activities included the initiation of detailed design; repackaging of stored wastes in preparation for transferring them to the LTWMF (executed using PHCF site resources during the Super CUP campaign); as well as asbestos abatement and electrical upgrades in the former UF_6 plant to prepare it for future equipment removal and demolition activities.

Figure 1 – Site 1, Port Hope Conversion Facility

Figure 2 – Site 2, Storage Facility

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

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

As a result of these actions, PHCF has continued to produce uranium products for the Canadian and international nuclear industry while at the same time maintaining radiation exposures to the workforce well below the dose limits. Environmental emissions and public radiation exposures are being controlled to levels that are a fraction of the regulatory limits.

The submission of this report fulfills the requirement of Section 4.2 of the operating licence for PHCF (FFOL-3631.00/2027). The annual compliance report was prepared in accordance with the CNSC document *Annual Compliance Monitoring and Operational Performance Reporting Requirements for Class 1 A & B Nuclear Facilities* (March, 2011). This report describes the facility operations and provides a summary of the Safety and Control Areas for 2017.

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

During 2017 PHCF experienced the following reportable incidents. All these events were thoroughly investigated with corrective action plans developed. There was no risk to the public related to any of these incidents. Cameco is confident that through the corrective actions implemented, the review of the incidents that occurred and robust management systems the PHCF will continue to operate in a safe, clean and reliable manner.

On January 7, 2017, a leaking gasket in the cold trap area let to an emergency response activation.

On February 2, 2017, a compressor failed within the fluorine compressor room, leading to a release of fluorine.

On February 19, 2017, a valve failed within the fluorine compressor room, leading to a release of fluorine.

On April 30, 2017, a small insulation fire in the UO_2 plant led to an emergency response activation.

In 2016 and early 2017 as part of the relicensing process, a daily sanitary sewer action level of 100 µg/L and a monthly mean release limit of 275 µg/L were developed and accepted. Between May 1 and June 30, 2017, the sanitary sewer discharge action level was reached or exceeded on multiple occasions as a result of groundwater infiltration to the sanitary sewer system. Infiltration has been linked to anomalous spring precipitation and record Lake Ontario surface water elevations.

On May 2, 2017, rainwater was pumped from an excavation site onto the roadway leading to the Port Hope harbour.

On May 5, 2017, a small hydrogen fluoride (HF) fume release occurred and was contained within the UF_6 plant during preventative maintenance activities.

On July 1, July 2 and October 9, 2017, the sanitary sewer discharge action level was exceeded and attributed to groundwater infiltration associated with significant precipitation events.

On August 14, 2017, a sprinkler head failure led to an emergency response activation.

The Ontario Spills Action Centre (SAC) was contacted and the CNSC was notified six times during the Super CUP campaign to report ambient station high volume air sampler exceedances of total suspended particulate (TSP), which is above the ECCC and MOECC 120 ug/m^3 TSP dust criteria for visibility. The uranium levels in the samples were not elevated indicating the particulate was due to dry conditions and dust generated from traffic on the public roadway adjacent to monitoring locations.

The Emergency Response Team (ERT) was activated on October 18, 2017 to respond to a small fire and tail gas (mostly F_2 and HF fumes) release from piping around the uranium hexafluoride (UF_6) compressors in the cold trap area. There were no environmental or personnel impacts as a result of this event.

In addition to the CNSC, the PHCF is regulated by other federal and provincial regulators, such as the Ontario MOECC, Environment and Climate Change Canada (ECCC), Employment and Social Development Canada (ESDC), and Transport Canada (TC).

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

Table 1

ACRONYMS USED WITHIN THIS REPORT	
ACRONYM	**DESCRIPTION**
AAQC	Ambient Air Quality Criteria
AEMS	Air Emission Management Strategy
AHF	Anhydrous Hydrogen
ALARA	As Low As Reasonably Achievable
BRR	Blind River Refinery
Bq/cm^2	Becquerel per Square Centimeter
Cameco	Cameco Corporation
CaO	Calcium Oxide
CBT	Computer Based Training
CCC	Criticality Control Committee
CCM	Contaminated Combustible Material
CCME	Canadian Council of Ministers of the Environment
CFM	Cameco Fuel Manufacturing
Charter	The Safety Charter
CIRS	Cameco Incident Reporting System
CNC	Contaminated Non-Combustible Material
CNSC	Canadian Nuclear Safety Commission
CofA	Certificate of Approval
COC	Contaminants of Concern
CSSC	Conversion Safety Steering Committee

C-TPAT	Customs-Trade Partnership Against Terrorism
CTI-RC	Cameco Technology and Innovation Research Centre
DRD	Direct Reading Dosimeter
ECCC	Environment and Climate Change Canada
ECA	Environmental Compliance Approval
EHS	Environmental Health and Safety
EMP	Environmental Monitoring Program
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESDC	Employment and Social Development Canada
FHA	Fire Hazard Analysis
FBW	Filter Backwash
FFI	Facility Fire Inspections
FPP	Fire Protection Program
FSD	Fuel Services Division
gU/h	Grams of Uranium per hour
HAZOP	Hazard and Operability Analysis
HEPA	High Efficiency Particulate Absorption
HIRAC	Hazard Identification, Risk Assessment and Control
I&E	Impingement and Entrainment
IAEA	International Atomic Energy Agency
ITM	Inspection, Testing and Maintenance
JTA	Job Task Analysis
KPI	Key Performance Indicator
LCH	Licence Conditions Handbook
Licence	Licence FFOL-3631.00/2027

LIMS	Laboratory Information Management System
LOPC	Loss of Primary Containment
LTWMF	Long Term Waste Management Facility
MISA	Municipal/Industrial Strategy for Abatement
MOECC	Ontario Ministry of the Environment and Climate Change
mSv	Millisievert
NEW	Nuclear Energy Worker
NO_x	Nitrogen Oxides
NO_2	Nitrogen Dioxide
NO_3	Nitrate
NSCA	Nuclear Safety Control Act
NUO_2	North UO_2 Plant
OH&S	Occupational Health and Safety
OJT	On the job training
PDP	Preliminary Decommissioning Plan
PHAI	Port Hope Area Initiative
PHCF	Port Hope Conversion Facility
PHFES	Port Hope Fire and Emergency Services
PM	Planned Maintenance
PTTW	Permit to Take Water
QA	Quality Assurance
SAP	SAP is a corporate wide enterprise application software for asset management, maintenance management, accounting and purchasing functions
SAT	Systematic Approach to Training
SCBA	Self-Contained Breathing Apparatus
SCR	Selective Catalytic Reduction

SEU	Slightly Enriched Uranium
SHEQ	Safety Health Environment and Quality
SPOC	Single Point of Contact
SSC	Systems Structures and Components
SWCS	Storm Water Control Study
SWEMP	Site-Wide Environmental Management Plan
SWRA	Site-Wide Risk Assessment
TC	Transport Canada
UF_6	Uranium Hexafluoride
µgU/L	Micrograms of Uranium per Litre
ULN	Upper Limit of Normal
UO_2	Uranium Dioxide
UO_2N	Combined Effluent
UO_2S	UO_2 plant cooling water
UO_3	Uranium Trioxide
µR/h	Microroentgen per Hour
µSv	Microsievert
WSIB	Workplace Safety and Insurance Board

1.2 Facility Operation

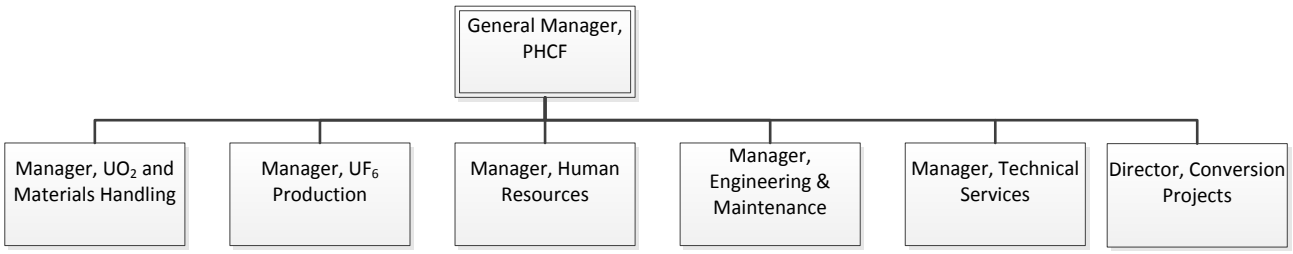
Cameco continues to strive for operational excellence at all of its facilities through consistent application of management systems across its operations to ensure that they operate in a safe, clean and reliable manner. Corporate policies and programs, including that for safety, health, environment and quality (SHEQ) provide guidance and direction for all site-based programs and procedures that define the PHCF Quality Management System.

The general manager is accountable for the programs and procedures for operating and maintaining the facility. The responsibilities for these programs and procedures have been delegated amongst the management team at PHCF and their respective personnel. All members of the site's management team are held accountable for the roles and responsibilities that they hold.

The Science and Technology group located at PHCF, under the direction of the director, science and technology was disbanded in May 2017.

An organizational chart for PHCF for 2017 is shown in Figure 3.

Figure 3 - PHCF Organizational Chart



The manager, technical services reports directly to the general manager and has delegated day-to-day communications with CNSC staff related to specific activities to the senior specialist, quality, regulatory compliance and licensing. This position is responsible for coordinating and tracking compliance actions, maintenance of the facility's safety report and serves as the single point of contact (SPOC) with the CNSC for licensed activities at the site.

PHCF has a Licence Conditions Handbook (LCH), issued by the CNSC. The purpose of this handbook is to establish and consolidate into one document the compliance framework related to the Cameco PHCF licence. The LCH outlines CNSC expectations by defining the licensing basis, explaining the regulatory context related to each licence condition, and identifying the verification criteria for each licence condition.

In addition to Cameco requirements regarding management systems, the facility's quality program has been designed to meet section 3(d) of the *Class I Nuclear Facilities Regulations*. This program provides the controls to ensure all processes are conducted in a safe manner and that processes applying to licensed activities are conducted in accordance with applicable CNSC quality requirements and other regulatory requirements. The application of the quality requirements is scaled according to the safety significance (complexity and hazard potential) of a particular activity.

PHCF was the first site in Cameco registered to the ISO 14001 Environmental Management System Standard, which is an internationally recognized standard for environmental management. As part of the management system programs, the facility conducts audits during the course of a year to assess the level of conformance to these management systems. In addition, the facility also conducts compliance audits in the areas of health safety and environmental legislation to ensure PHCF continues to meet all applicable regulatory requirements. Lastly, corporate technical experts perform periodic audits of the site management systems programs to ensure the site complies with corporate expectations.

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

In the fourth quarter 2017, CQP-113 Process and Design Change Control was updated to reflect the new Management of Change SAP-based program that is being implemented at the PHCF.

Both UF_6 and UO_2 plants resumed operations in January after a shutdown period.

There were scheduled shutdowns of both the UO_2 and UF_6 plants in the summer of 2017. The summer shutdown allowed for planned maintenance activities and for employees to utilize vacation time. The start-up of the plants after the extended shutdown periods was routine.

During periods of shutdown in the UF_6 operations, a minimum crew was maintained in the UF_6 plant, while remaining operators were deployed to Super CUP activities. The 2017 Super CUP campaign was focused on repackaging of stored wastes in preparation for transferring them to the Long Term Waste Management Facility (LTWMF), asbestos

abatement and electrical upgrades in the former UF_6 plant to prepare it for future equipment removal and demolition activities.

The UO_2 and UF_6 plants were safely shutdown in December 2017. Production targets were achieved for UO_2 operations during the year, and were slightly under target for UF_6 operations due to operational issues.

The depleted circuit, in the UO_2 plant, was operational from February 8 to March 3, 2017.

As discussed in the previous section, PHCF experienced eleven reportable events in 2017 related to site operations.

On January 7, 2017, a leaking gasket in the cold trap area let to an emergency response activation.

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

The performance of the facility in 2017 demonstrates that Cameco is qualified to carry out the activities permitted under the Licence. All activities on the defined site in the licence are subject to the Nuclear Safety and Control Act (NSCA). Cameco is committed to take all reasonable precautions to protect the environment and the health and safety of employees and the public, to maintain the security of the facility and the nuclear substances associated with the facility, and the necessary measures to facilitate Canada's compliance with international safeguards obligations.

1.3 Production or Utilization

The maximum daily production rate for the UF_6 plant did not exceed the licensed limit of 45 tonnes uranium as UF_6. The annual production of uranium in the UF_6 plant did not exceed the limit of 12,500 tonnes uranium as UF_6.

The annual production of uranium as UO_2 did not exceed the licensed limit of 2,800 tonnes uranium.

Detailed plant production information is considered “Protected Proprietary” and is submitted to the CNSC on an annual basis under a separate cover.

1.4 Facility Modification

There were no modifications affecting the safety analysis of the licensed facility made in 2016 that required written approval of the Commission or a person authorized by the Commission.

The following PHCF documents referenced in the LCH were revised in 2017:

- Public Information Program;
- Management Systems Program Manual;
- Emergency Response Plan;
- Environmental Protection Program documents;
- CQP-113 Process and Design Change Control;
- CQP-501 In Service Inspection of Safety Significant Systems/Structures/Components;
- CQP-706 Pressure and Safety Significant Piping and Vessel Control;
- WMP-01 Waste Management Plan;
- WMP-02 Clean-up Program;
- CQP-707 Registration and Inspection Requirements of Pressure Piping and Pressure Vessels; and,
- UF_6 Plant Operations Training Procedure.

On February 27, 2017, Cameco was granted a renewed operating licence FFOL-3631.00/2027, for a 10-year term, from the CNSC.

2.0 SAFETY AND CONTROL AREAS

2.1 Management

2.1.1 Management System

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

The PHCF's management systems program identifies the controls required to ensure all processes are conducted in a safe manner and that processes applying to licensed activities are conducted in accordance with applicable CNSC management systems requirements and other regulatory requirements. The application of management systems requirements is scaled according to the complexity and hazard potential of a particular activity.

The annual site management review meeting was held January 12 to 13, 2017 to review the suitability, adequacy and effectiveness of the SHEQ policy during 2016. The site management systems, which cover all site programs, were reviewed and sufficient information was provided to demonstrate effectiveness. Specific areas reviewed included, but were not limited to:

- Measuring and Test Equipment;
- Tender and Contract Review;
- Program Review – Radiation Protection Program;
- Legal and Other Requirements;
- Objectives and Targets;
- Corporate Oversight;
- Monitoring and Measurement;
- Resources, Roles and Responsibilities;
- Project Management; and,
- Special Processes.

In 2017, internal SHEQ and compliance audits (legal and other requirements) were conducted and all results have been reported in CIRS to ensure that findings, opportunities for improvement and areas of concern are reviewed by site management and processed accordingly.

As part of its management system the PHCF has a site audit program that routinely looks at various aspects of site operations related to the licensed activities. In addition to internal SHEQ and compliance audits, PHCF also had a number of external audits

completed in 2017 as shown below. It should be noted that the list does not include inspections completed by CNSC staff as part of their oversight of licence activities.

- A second party, corporate safety, health, environment and quality (SHEQ), audit was completed and results were received in late 2017.
- A second party compliance audit (legal and other requirements) was completed and results were received in late 2017.
- A second party audit of the FSD Internal Dosimetry Program was completed. This audit is a requirement under the quality assurance program developed for the Internal Dosimetry Services Licence issued to BRR, CFM and PHCF.
- Three third party audits were completed in 2017.

There were no significant issues identified during the internal or external audits completed in 2017. With respect to compliance audits, they are conducted each year against applicable federal and provincial environmental legislation. All regulations are audited at least once every three years. Audits will not be discussed elsewhere in this report. Details and findings related to the audit program will be submitted under separate cover due to the confidential nature of the information.

All procedures that support licensed activity are subject to the site document control process as described in the various site document control procedures. Procedures that support the licensed activity are maintained in electronic format on a database available to all site personnel. This includes, but is not limited to, procedures for operating and maintaining the facility, all environmental health and safety procedures, radiation protection and management systems.

In order to come into compliance with CSA N286-12 Management System requirements for nuclear facilities, Cameco replaced its Quality Management Program Manual with the Management Systems Program Manual.

PHCF follows a systematic evaluation method for its safety culture self-assessments which are generally completed every five years. The most recent self-assessment was completed in 2015. Cameco uses these assessments to shape the safety program improvements at each site. As a result of the most recent safety culture assessment, Cameco committed to accelerate the upgrade of site procedures taking into account human factors.

2.1.2 Human Performance Management

This safety and control area covers activities that enable effective human performance through the development and implementation of processes that ensure that licensee staff members are sufficient in numbers in all relevant job areas, and have the necessary knowledge, skills and tools in place, in order to safely carry out their duties.

In 2017, revisions to TP-01 Training Plan and CQP-942 UF_6 Plant Operator Training Procedure were submitted and approved by the CNSC to demonstrate PHCF's compliance to the systematic approach to training as outlined in CNSC REGDOC 2.2.2 Personnel Training.

PHCF operations continued to ensure that all training requirements were met for all personnel. In 2017, the site closed with a 97.2% compliance rate to all training related to mandatory, legislated and other job specific training activities. This training ensures that all personnel have the level of training related to radiation safety, fire safety, chemical safety, on site-emergency arrangements, environmental protection, and conventional health and safety, appropriate for their duties. Systems are in place to ensure employees only perform functions for which they are qualified.

UF_6 plant operations training continued as required, with operators completing new or re-qualification area specific training. UF_6 operators (Level 2 and 3) working outside of the UF_6 plant in support of SuperCUP operations, completed start-up evaluations in all their respective qualified/training areas, prior to assuming normal duties. Ongoing maintenance of operator qualifications includes testing, job task observations and a minimum 72 hours in an area was met with 100% compliance in each of their areas.

The UO_2 plant continued to train operators in specific areas, as required, including transferred UF_6 operators supporting the UO_2 ramped up schedule. These operators returned to the UF_6 plant, once UF_6 operations resumed. Continuous improvement efforts included training and conducting job task observations, learning moments conducted by area engineers and the identification of critical tasks on area tests.

New corporate safety initiatives were successfully deployed across PHCF operations, including Self-Check (Stop, Think, Act & Review); a new electrical safety standard and a standardized job task observation process. All activities are managed in Cameco's Learning Management System (ULearn).

Procedural (work instruction) updates and revisions continue in both the UF_6 and UO_2 plants. At the end of 2017, 219 of the identified 338 UF_6 procedures were updated.

During 2017, the PHCF maintained a sufficient number of production personnel and emergency response team members to ensure that operating production areas and the site were adequately staffed to run safely.

2.1.3 Operating Performance

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

In 2017, the PHCF continued to operate in a manner that supports safe, clean and reliable production and in compliance with applicable acts and regulations.

Both UF_6 and UO_2 plants resumed operations in January after a shutdown period.

There were scheduled shutdowns of both the UO_2 and UF_6 plants in the summer of 2017. The summer shutdown allowed for planned maintenance activities and for employees to utilize vacation time. The start-up of the plants after the extended shutdown periods was routine.

During periods of shutdown in the UF_6 operations, a minimum crew was maintained in the UF_6 plant, while remaining operators were deployed to Super CUP activities. The 2017 Super CUP campaign was focused on repackaging of stored wastes in preparation for transferring them to the Long Term Waste Management Facility (LTWMF), asbestos abatement and electrical upgrades in the former UF_6 plant to prepare it for future equipment removal and demolition activities.

The UO_2 and UF_6 plants were safely shutdown in December 2017. Production targets were achieved for UO_2 operations during the year, and were slightly under target for UF_6 operations due to operational issues.

The depleted circuit, in the UO_2 plant, was operational from February 8 to March 3, 2017.

PHCF's operating performance is tracked using a comprehensive set of key performance indicators (KPIs) and objectives. In addition, the CNSC and other regulatory agencies have conducted facility inspections to verify compliance with applicable acts and regulations.

As part of its management system, the PHCF has a site audit program that routinely looks at various aspects of site operations related to the licensed activities. This is discussed in detail in the Management System section.

2.2 Facility and Equipment

2.2.1 Safety Analysis

This safety and control area covers the maintenance of the safety analysis which supports the overall safety case for the facility. This safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards.

PHCF has a safety report that documents the detailed safety analysis carried out for the facility. The safety report summarizes the systematic review of the site operations to identify and assess hazards and potential risks to the public and environment from PHCF operations. Cameco uses a hazards and operability (HAZOP) approach to assess new processes or equipment. This focuses on equipment, instrumentation, human actions and other factors that impact on the process. HAZOPs are conducted prior to making any plant modifications that may affect the safety case for the facility, with the site safety report updated at least every five years to include the findings from any HAZOP's completed since the last revision to the report. The safety report was most recently updated in 2015 and accepted by CNSC staff in 2016.

There were no modifications made in 2017 that affected the safety case for PHCF. The safety-significant systems at the facility have been identified and a preventive maintenance program is in place to ensure that the equipment associated with these systems is properly maintained.

2.2.2 Physical Design

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

As part of Cameco's budgeting process for capital expenditures, plant improvements related to physical design are identified and prioritized. A Stage Gate process is used at PHCF to review capital projects at up to four points in the design process. This process includes sign-off by site management (or designate), to ensure that these requirements are addressed in every capital project.

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.

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

PHCF has a contractual arrangement with the provincial Technical Standards and Safety Authority (TSSA) to ensure that oversight of pressure retaining components and systems continues to be carried out by a third-party expert. As part of this process, PHCF utilizes 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.

There were no significant changes to systems, structures and components that occurred at the PHCF in 2017.

In the fourth quarter 2017, CQP-113 Process and Design Change Control was updated to reflect the new Management of Change SAP-based program that is being implemented at the PHCF.

2.2.3 Fitness for Service

This safety and control area covers activities that impact on the physical condition of SSCs, to ensure that they remain effective over time. This includes programs that ensure all equipment is available to perform its intended design function when called upon to do so.

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

Work continued in 2017 in all areas of the Operational Reliability program that was launched in late 2010. Highlights by focus area include:

- Work Management
  - Continued working on aspects of work management opportunities through the Community of Practice.
  - Workshops were held with a Prometheus training consultant which will allow PHCF to improve its day-to-day use of the software and allow full transition from Primavera to Prometheus shutdown planning.
- Materials Management
  - Master Data Governance improvement project has been the focus to ensure successful implementation.
  - Obsolescence work continues.
  - Reviews of inventory levels continues, beginning with high cost inventory, resulting in significant reductions.
- Reliability Engineering
  - Preventive maintenance (PM) optimization activities have been completed and implemented for Level 4 and Level 5 assets in the UF_6 plant.
  - Safety significant system reviews have been completed for air emissions and UF_6.
  - Powerhouse boiler reliability-centered maintenance (RCM) was completed.
  - Sixty preventive maintenance (PM) plans were updated in 2017 based on feedback from trades' personnel.
  - Predictive Maintenance:
    - Vibration
      - Millwrights given additional hands-on training on equipment in November;
      - 67 assets covering 250 check points currently checked quarterly; and,

        - Transition to monthly PM's (best practice), first stage implementation began in December 2017.
    - Thermography
        - Reliability Engineer completed Level 1 training;
        - Approximately 200 current assets were reviewed on an annual PM frequency, the Reliability Engineer in conjunction with an electrician conducted an initial PM round and consequently will be assessing the value of moving to more frequent checks; and,
        - New report to be generated using training from Level 1 for analysis.
    - Oil analysis
        - Reliability Engineer completed Level 1 training.
- Operations Improvement
    - Piping and instrumentation drawing verification and valve tagging is 80% complete in the UO_2 plant with the balance to be completed in 2018.
    - Piping and instrumentation drawing verifications are virtually complete in the Powerhouse with some final verifications remaining.
    - Implementation of Adroit has been completed in the Powerhouse.
- General
    - A number of associated procedures were revised as a result of new business processes.

The effectiveness of the program, as it pertains to reliability of equipment and systems, continues to be measured through a number of leading and lagging metrics. Program effectiveness is defined by upward trends of these indicators to reach world class standards for chemical manufacturing industries.

Testing and verification activities are integrated into the preventive maintenance strategy for any SSCs. Compliance to the activities is measured on a weekly basis.

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

PHCF has an established Planned Maintenance (PM) program whereby all tasks are initiated and documented through the work notification system in SAP (SAP is a 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. KPIs are in place to monitor the effectiveness of the program.

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

Based on the maintenance related KPI's, the maintenance program, which includes the aging management component, is considered to be effective.

In the fourth quarter 2017, CQP-113 Process and Design Change Control was updated to reflect the new Management of Change SAP-based program that is being implemented at the PHCF.

2.3 Core Control Processes

2.3.1 Radiation Protection

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

PHCF has an extensive Radiation Safety Program in place to meet the requirements of the *Nuclear and Safety Control Act* and the *Radiation Protection Regulations* and ensure exposures are kept to levels as low as reasonably achievable (ALARA). The program includes the following aspects:

- External dosimetry – personal monitoring;
- Internal dosimetry – urine analysis & lung counting programs;
- Workplace air sampling program;
- Respirator program; and
- Radiation & contamination surveys.

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

For various radiological parameters, Cameco has established action levels, which are well below regulatory limits that may be indicative of a potential loss of control for that specific parameter. These action levels serve as an early warning of a condition that warrants further investigation. In addition, as a continual improvement tool, Cameco has established lower-tier internal administrative levels, which are set below the action levels and provide very early warning of a potential concern. A result above an internal administrative level is also investigated and remedial actions taken if necessary.

Radiation protection objectives and targets are established jointly by the site management team, site specialists and FSD specialists, including the health physicist, to ensure there is agreement, commitment and awareness of these objectives and targets. These objectives and targets can address, among other things, worker dose reduction initiatives and other projects which examine ways to reduce in-plant uranium-in-air concentrations. The status of these objectives and targets is reviewed by the site management team and resources are allocated as required to achieve the targets.

Audits and inspections were performed in accordance with licence conditions. Refer to the Management Systems section of this report for further details.

The performance of the Radiation Protection Program is tracked using KPIs. The KPIs for this program include but are not limited to risk control, training, objectives and targets, operational controls, and monitoring.

The radiation protection program at PHCF is well established, with detailed procedures outlining the processes under each element of the program. Review of the 2017 dose data indicates that the program is effective in the prevention of unreasonable risk to the health and safety of workers.

Though the radiation protection and ALARA programs have been demonstrated to be effective, PHCF has also made significant improvements as part of its continual improvement program, including:

Program Improvements

- As per CNSC recommendations, the External Dosimetry Administrative and Regulatory Action Levels for monthly whole body exposure has changed to 1.2 mSv and 2.0 mSv. The PHCF Radiation Protection Program Manual is in the process of being updated to reflect this change.
- A hand and foot monitor was installed outside of the UO_2 lunch room in building 24.
- A routine protocol has been created for frequent urinalysis investigations for the same individual due to procedural non-compliances to decrease occurrences.

Procedural Improvements

- CQP-044 Managing the ALARA Program;
- CAP:RAD:2 Radiological Monitoring of UF_6 Cylinders;
- CAP:RAD:9 Preparation and Collection of Track Etch Radon Detectors;
- CAP:RAD:11 In-Plant Air Sampling for Uranium;
- CAP:RAD:19 External Dosimetry – Thermoluminescent Ring Dosimeter Program;
- CAP:RAD:22 Internal Dosimetry – In Vivo – Lung Counting Program;
- CAP:RAD:25 Measurements for Radon and Radon Daughters;
- CAP:RAD:28 Room Surveys;
- CAP:RAD:29 Monitoring Procedure for Free Release;
- CAP:RAD:31 Monitoring Procedures for Plant Areas;
- CAP:RAD:32 Monitoring Procedures for Transfer of Equipment Between Zones;
- CAP:RAD:33 Procedures for Control of Radioactive Spills;
- CAP:RAD:37 Fenceline Radiation Monitoring;
- CAP:RAD:42 Assigning Internal Dose for Lung Count Data;

- CAP:RAD:44 iCAM – Continuous Air Sampling for Uranium;
- CAP:RAD:46 Routine iCAM Maintenance;
- CAP:RAD:47 Surface Contamination Monitoring on Shipments of Drummed Materials;
- CAP:RAD:53 Relocating the Lung Count Trailer to the Blind River Refinery; and,
- CAP:RAD:59 Compliance to Dosimetry Programs.

PHCF's performance in 2017 regarding the ALARA targets is summarized below:

- Maintain employee maximum radiation exposures to ALARA levels or below:
    - The 5 mSv for external whole body dose was met. The maximum dose of 3.16 mSv in 2017 was received by a Materials Handling operator
    - The 20 mSv for external skin dose was met. The maximum dose of 13.7 mSv was received by a UF_6 operator.
    - The 1 mSv for internal dose – urine analysis was met. The maximum dose of 0.47 mSv was received by two employees (a maintenance employee and a UF_6 employee).
    - The 4 mSv for internal dose – lung counting was met. The maximum dose of 1.4 mSv was received by a maintenance employee.
- Utilized the 'top five' approach in order to follow up on the five workers with the highest year-to-date doses in each dose component. Results were tracked monthly and the approach was found to be effective in meeting the ALARA targets for internal urine analysis and external whole body dose.
- Achieved 98.9% compliance to scheduled urine sample submissions.
- Supported the production team with improving engineering and administrative controls to address radiation issues associated with operation of flame reactors and management of ash cans.

The 2018 ALARA targets are following:

- Dose targets: Whole body dose < 5 mSv;
- Skin dose < 20 mSv;
- Urine analysis dose < 1 mSv; and,
- Lung dose < 4 mSv.

Radiation protection initiatives planned for 2018 include:

- Continue to utilize the 'top five' approach in order to follow up on the five workers with the highest year-to-date (YTD) doses in each dose component;
- Achieve 98% compliance to scheduled urine sample submissions;
- Improve the site's contamination and zone control programs; and,
- Continue to support the production team to develop and implement a plan for engineering and administrative controls to address radiation issues associated with operation of flame reactors and management of ash cans.

PHCF uses a licensed dosimetry service provider that is accredited by the CNSC. The dosimetry service provides optically stimulated luminescence (OSL) dosimeters to PHCF for use by employees, contractors, and visitors. An OSL badge is used to monitor whole body and skin dose. Dosimeters are changed monthly for production, maintenance and support services and quarterly for all other employees. The provider reports the OSL results to the National Dose Registry (NDR) as well as provides a copy to PHCF.

In 2017, PHCF did not exceed any CNSC licensed limits or action levels with respect to radiation protection.

NEW training is conducted for each employee or contractor, who is likely to receive dose above 1 mSv or requires unlimited access to Zone 3 areas. All employees and contractors receive annual refresher training in the form of a monthly safety meeting presentation which includes a competency assessment. In 2017, PHCF recorded 99.7% compliance to Radiation Protection training requirements.

The radiation monitoring instrumentation was maintained as per regular calibration and maintenance schedules.

Inventory of sealed and unsealed sources that are used or possessed on site are listed in the radioisotope source control procedure. Regular inspection and leak tests of the sealed sources were carried out in 2017 according to this procedure. Results showed that sources are in a state of safe operation and pose no undue risk to workers. Control of sealed sources was maintained throughout the year.

Internal doses are assigned through urine analysis and lung counting programs which are part of Cameco's licensed internal dosimetry service.

The following tables and graphs summarize employee dose results, including contractors that are designated as NEWs. All data from previous years is also presented with these groups of individuals, which may result in slight differences from previously reported summary data. Note that in figures with ranges on the horizontal axis, a range of 1 – 2, for example, means all results are greater than 1 and less than or equal to 2.

Whole Body Dose

Distributions of 2017 external whole body dose are shown in Table 2 and Figure 4. More than 96% of the whole body exposures were below 1 mSv with a total of 10 workers receiving a whole body dose greater than 2 mSv.

Table 2

2017 Whole Body Dose Distribution	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 1	96.2
1 – 2	2.4
2 – 3	1.1
3 – 4	0.3
4 – 5	0.0
> 5	0.0

Figure 4

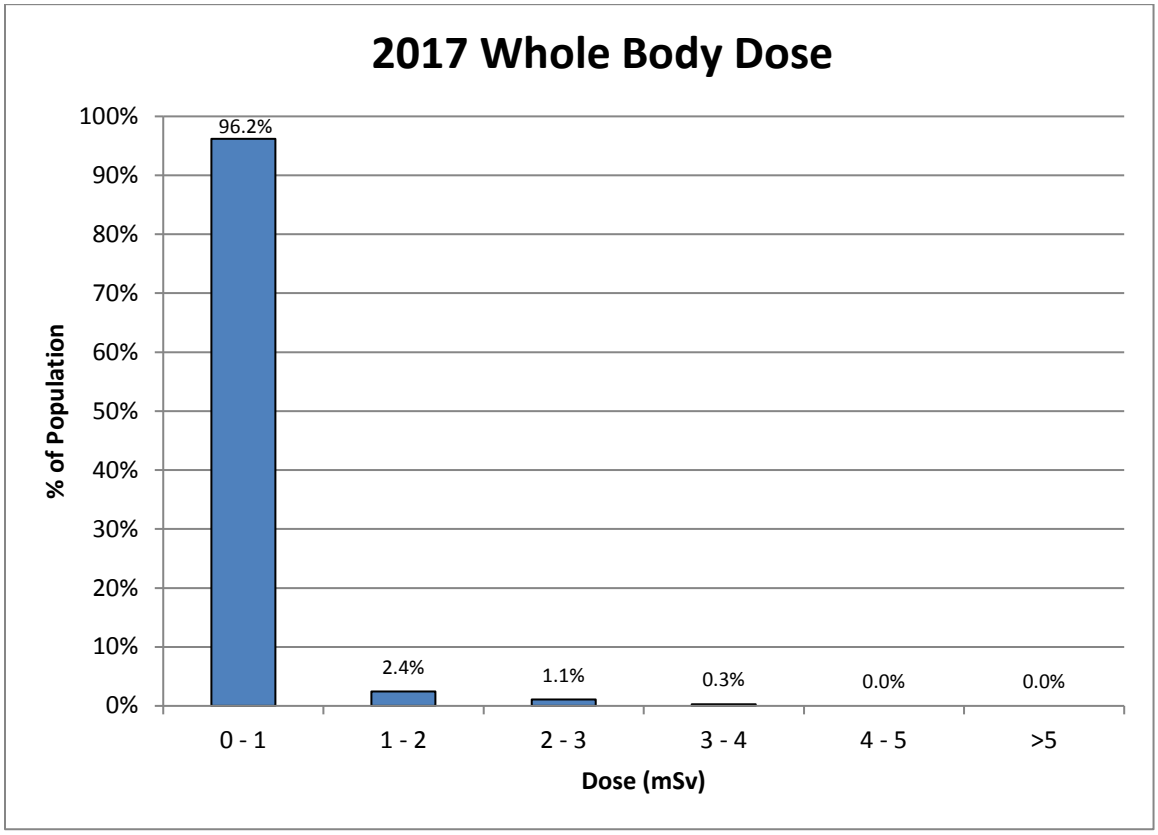
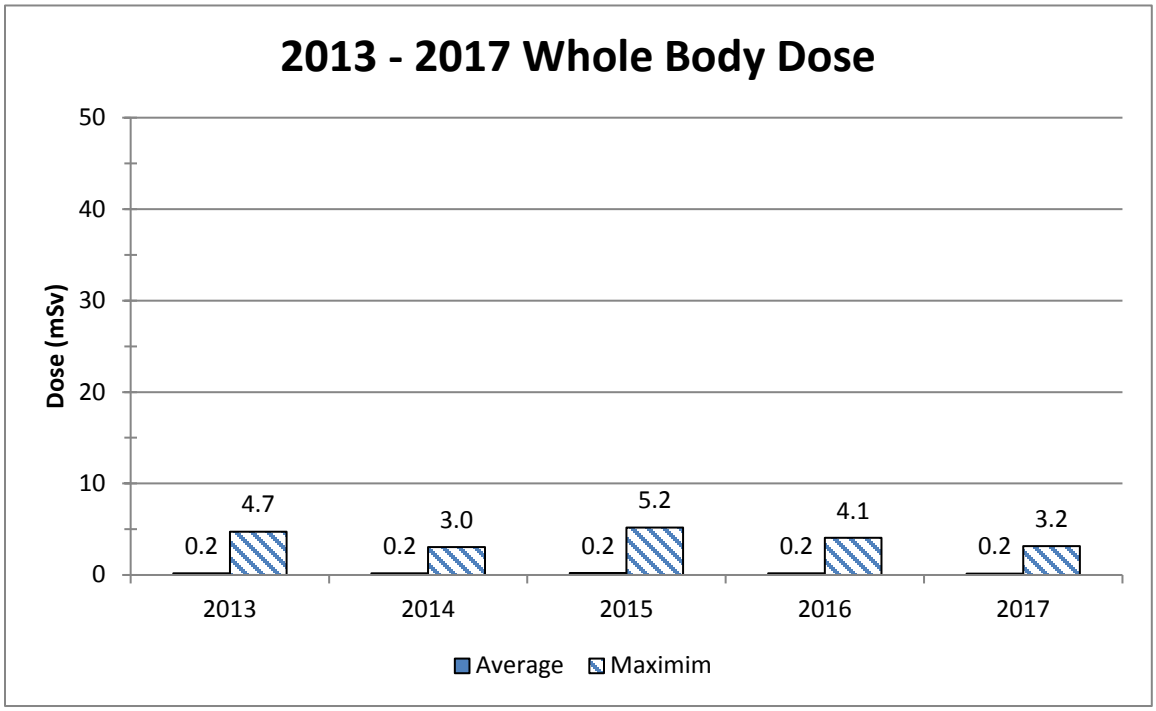


Table 3 and Figure 5 show the employee average and maximum individual external whole body dose for the five year period from 2013 – 2017. This data includes contractors with NEW status. The average dose in 2017 was comparable to the average dose from 2013 through 2016. The maximum individual external whole body dose was 3.2 mSv received by a Materials Handling operator.

Table 3

2013 – 2017 Whole Body Dose				
Year	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum (mSv)**
2013	794	0.2	0.0	4.7
2014	726	0.2	0.0	3.0
2015	809	0.2	0.0	5.2
2016	777	0.2	0.0	4.1
2017	740	0.2	0.0	3.2

Figure 5



Skin Dose

Distributions of 2017 external skin doses are shown in Table 4 and Figure 6. Over 99% of the external skin doses were below 10 mSv.

Table 4

2017 Skin Dose Distribution	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 10	99.7
10 – 20	0.3
20 – 30	0.0
30 – 40	0.0
40 – 50	0.0
> 50	0.0

Figure 6

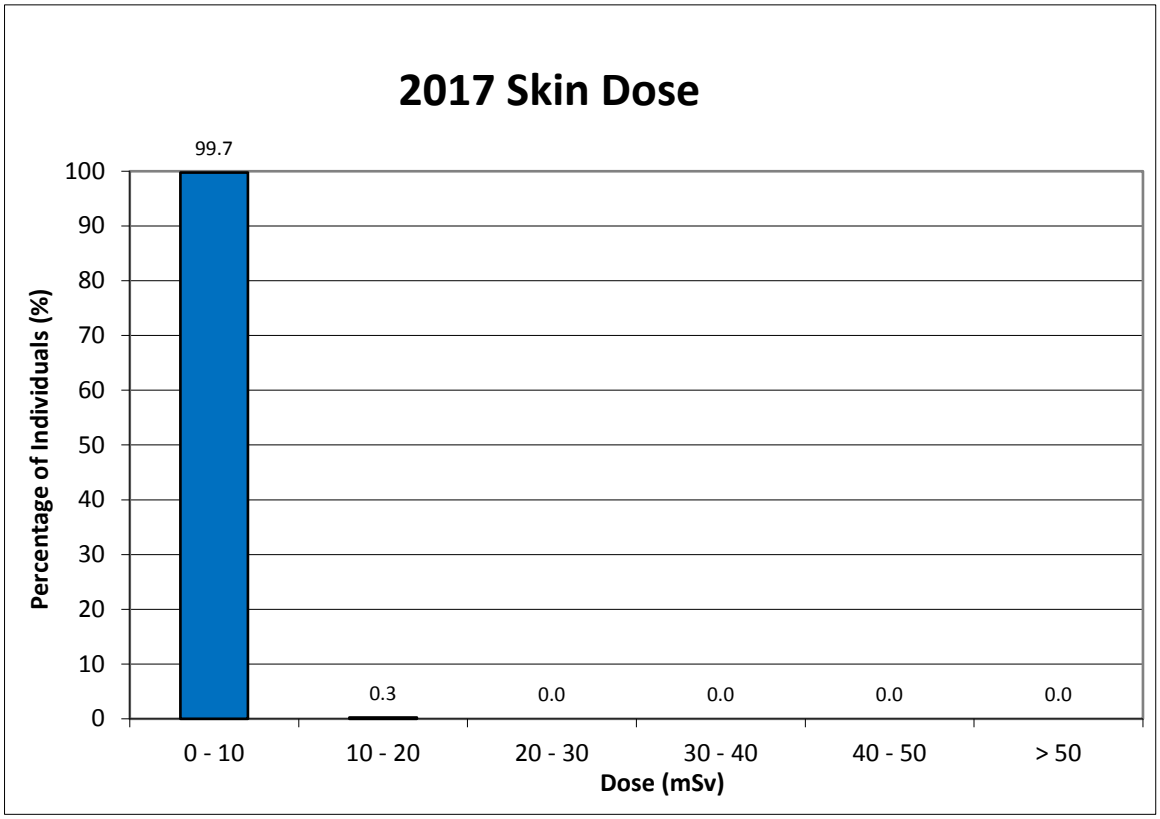


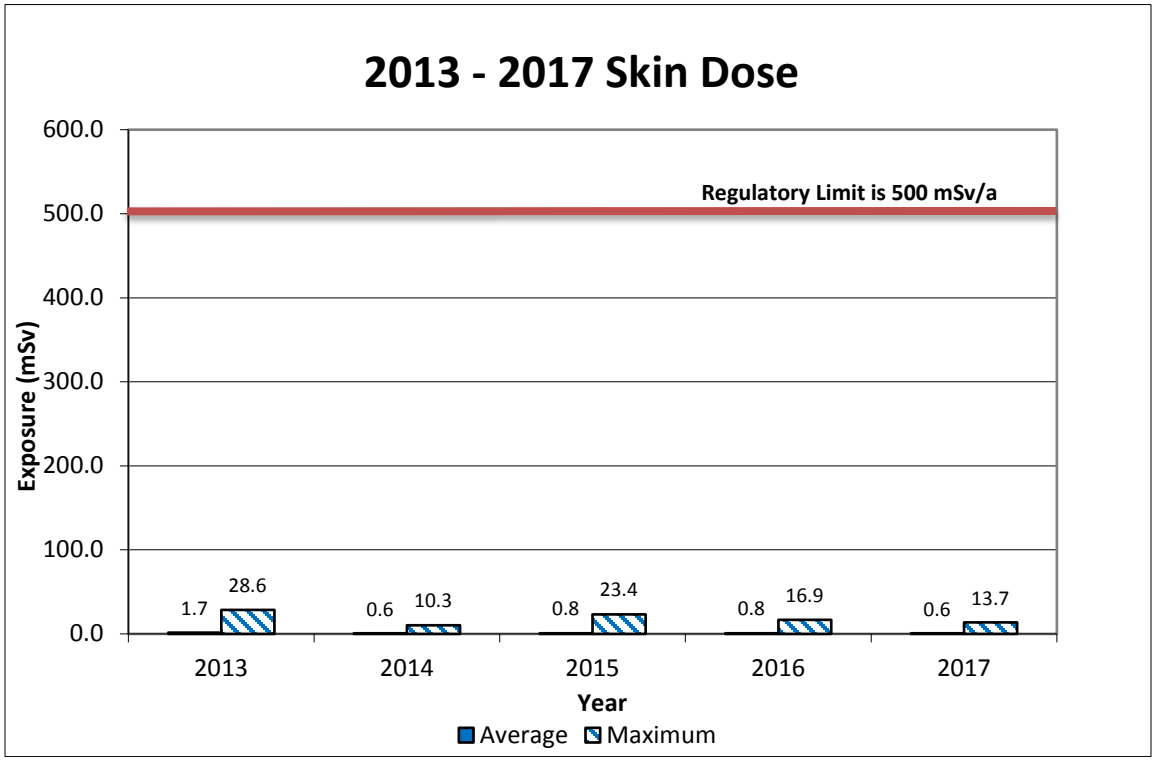
Table 5 and Figure 7 show the employee average and maximum individual skin dose for the five-year period from 2013 – 2017 including contractors (NEW). Average dose

remained the same over the period. The maximum individual skin dose was lower than the previous year. The maximum individual dose in 2017 was 13.7 mSv, which is below 5% of the CNSC annual limit of 500 mSv for skin dose. The individual with the highest exposure was a UF_6 operator.

Table 5

2013 – 2017 Skin Dose				
Year	**Number of Individuals**	**Average**	**Minimum**	**Maximum**
2013	794	0.8	0.0	28.6
2014	726	0.6	0.0	10.3
2015	809	0.8	0.0	23.4
2016	777	0.8	0.0	16.9
2017	740	0.6	0.0	13.7

Figure 7



Site visitors and non-NEW contractors may also be issued dosimeter badges. The average and maximum whole body results for these individuals were < 0.1 mSv and 0.20

mSv, respectively. The average and maximum non-NEW contractor/visitor skin dose results were < 0.1 mSv and 0.22 mSv, respectively.

Urine Analysis

Table 6 shows the distribution of urine results for 2017. A total of 39,015 urine samples were collected and analyzed for uranium and/or fluorides during 2017. The majority of uranium in urine results (> 98%) were less than 5 µg U/L in 2017.

Table 6

2017 Urine Analysis Results	
Distribution of Results	**2017**
Number of Samples ≤ 5 µg U/l	27,329
Number of Samples >5 to ≤ 25 µg U/l	301
Number of Samples >25 to ≤ 50 µg U/l	15
Number of Samples > 50 µg U/l	5
Number of Uranium in Urine Samples Analyzed	27,650

The distribution of 2017 internal urine dose for employees is shown in Table 7 and Figure 8. Approximately 95% of the individual assigned doses were below 0.2 mSv.

Table 7

2017 Internal Dose Distribution (Urine Analysis)	
Dose Range (mSv)	**Percentage of Individuals (%)**
0.0 – 0.2	95.5
0.2 – 0.4	3.8
0.4 – 0.6	0.7
0.6 – 0.8	0.0
0.8 – 1.0	0.0
> 1.0	0.0

Figure 8

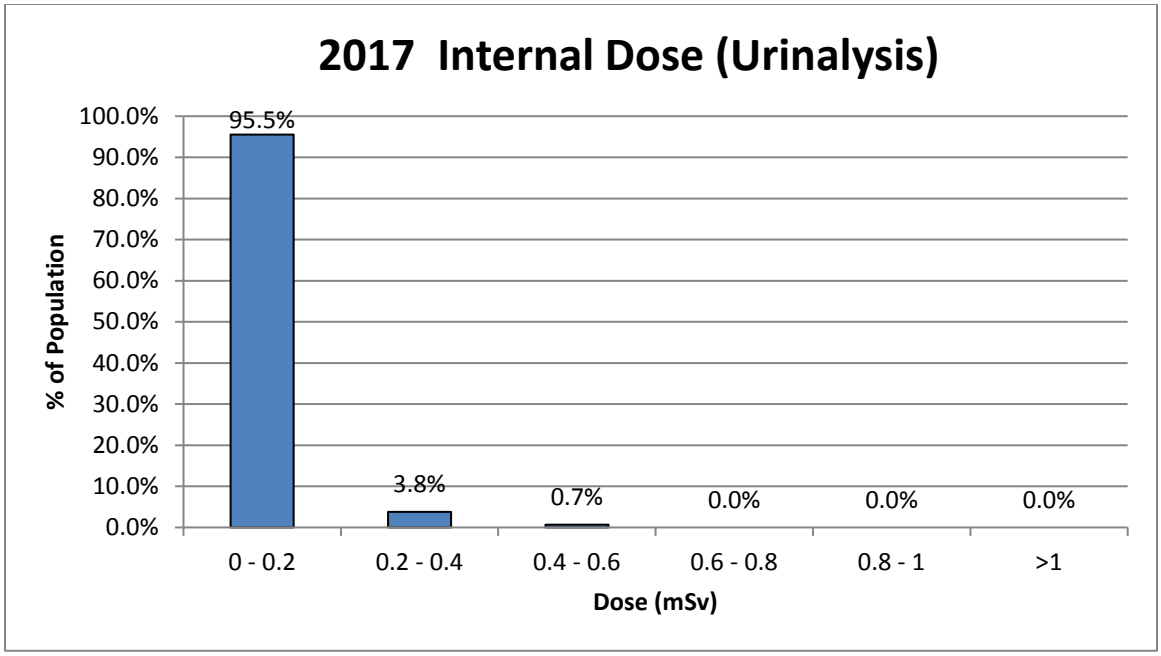


Table 8 and Figure 9 present the average and maximum internal urine analysis doses for the 2013 through 2017 period. A total of 578 employees, contractors and visitors were monitored by the urine analysis program during 2017. The average and maximum internal urine analysis doses in 2017 (including contractors) were 0.04 mSv and 0.47 mSv respectively which were comparable to previous years. The maximum dose of 0.47 mSv was received by two employees (maintenance and UF_6).

The annual ALARA target for internal urine analysis exposure of 1 mSv was not exceeded in 2017.

Table 8

2013 – 2017 Internal Dose (Urine Analysis)				
Year	**Number of Individuals (Includes Contractors)**	**Average Dose (mSv)**	**Minimum Dose (mSv)**	**Maximum Dose (mSv)**
2013	583	0.05	0.00	0.58
2014	610	0.04	0.00	0.59
2015	657	0.04	0.00	0.64
2016	599	0.05	0.00	0.72
2017	577	0.04	0.00	0.47

Figure 9

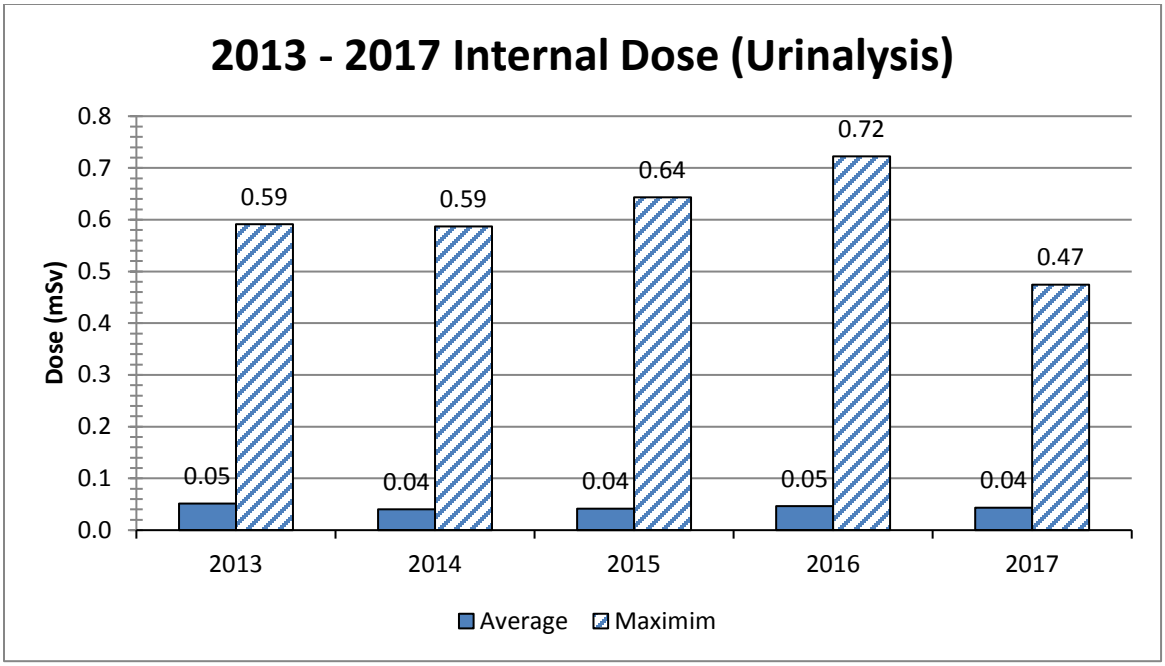


Table 9 shows a comparison of the annual exposure results for whole body dose, skin dose and urine analysis broken down by work group. The highest doses are from the operations work group, consisting of production, materials handling, waste management and maintenance personnel.

Table 9

2017 Annual Exposure Results by Work Group									
Work Group	**Whole Body (mSv)**			**Skin Exposure (mSv)**			**Urine Analysis (mSv)**		
	Avg	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**
UF_6 Plant	0.39	0.00	2.87	2.12	0.00	13.70	0.10	0.00	0.47
UO_2 Plant	0.69	0.01	1.29	2.77	0.01	6.04	0.08	0.01	0.24
Maintenance	0.24	0.00	0.81	1.71	0.00	9.18	0.12	0.00	0.47
Technical Support [1]	0.09	0.00	3.16	0.17	0.00	4.22	0.02	0.00	0.20
Administration[2]	0.00	0.00	0.12	0.01	0.00	0.22	0.01	0.00	0.07
Total (Max)	**0.15**	**0.00**	**3.16**	**0.58**	**0.00**	**13.7**	**0.04**	**0.00**	**0.47**

[1] Includes contractors (NEWs)
[2] Includes outside contractors

Lung Counting

As part of the licensed internal dosimetry program Cameco employs the use of a lung counter to monitor and assess exposure of uranium in the lungs of its employees and contractors (NEW) at PHCF. This equipment is capable of measuring extremely low levels of contamination to the point where an employee's exposure could be stopped well before it could become an issue.

A total of 802 internal lung count doses were assigned at the PHCF in 2017. There were no investigations triggered by the lung counting program during the year and no regulatory action level was exceeded for lung count measurements. An intercomparison (independent test) was completed in November 2017 by Health Canada to validate, test and certify the lung counting system.

The estimates of 2017 internal exposures, based on the lung counting program, were assigned for 241 employees and the prorated actuals of 2017 internal exposures were calculated for 561 contractors (NEW) and administrative employees. The 2017 average internal lung counting dose assigned was 0.27 mSv. The maximum dose of 1.4 mSv, received by a maintenance employee, was slightly lower than the 2016 value of 2.4 mSv. The annual ALARA target for lung counting of 4 mSv was not exceeded in 2017.

Taking into consideration counting statistics and the minimum detectable activity (MDA) of the lung counter, six basic dosimetry groups were created with a greater number of workers in each to increase the accuracy of dose assessment. These dosimetry groups are: the UF_6 plant; UO_2 plant; maintenance; technical support; administration; and NEW contractors. The technical support dosimetry group includes materials handling, science & technology, environmental and radiation safety personnel, and engineering work groups.

Table 10 and Figure 10 show the distribution of assigned lung counting doses. All assigned lung doses were below 4 mSv.

Table 10

2017 Internal Dose Distribution (Lung)	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 1	91.4
1 – 2	8.6
2 – 3	0
3 – 4	0
4 – 5	0
> 5	0

Figure 10

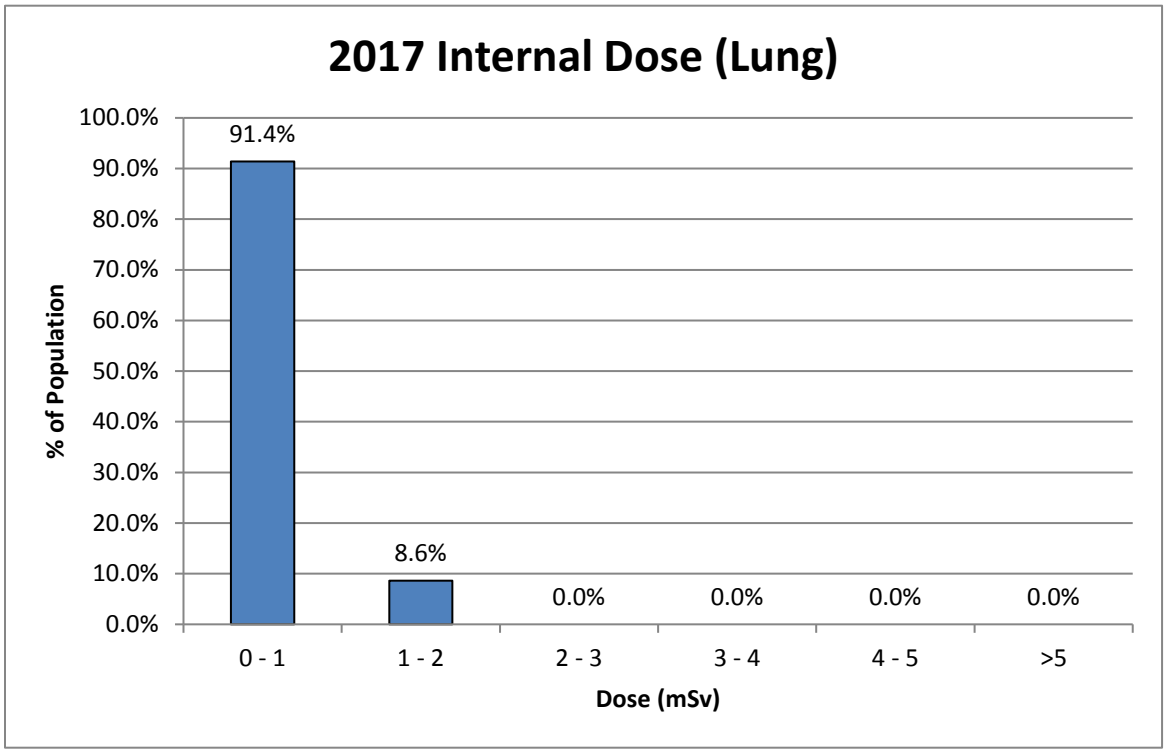


Table 11 presents the internal lung counting dose indicators for 2013-2017 period.

Table 11

Internal Lung Count Exposures 2013 - 2017				
Year	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum[1] (mSv)**
2013	789	0.5	0.0	3.4
2014	840	0.5	0.0	2.7
2015	857	0.4	0.0	2.7
2016	824	0.4	0.0	2.4
2017	801	0.3	0.0	1.4
[1]Maximum annual dose to an individual				

Table 12 shows the assigned internal lung count doses for 2017.

Table 12

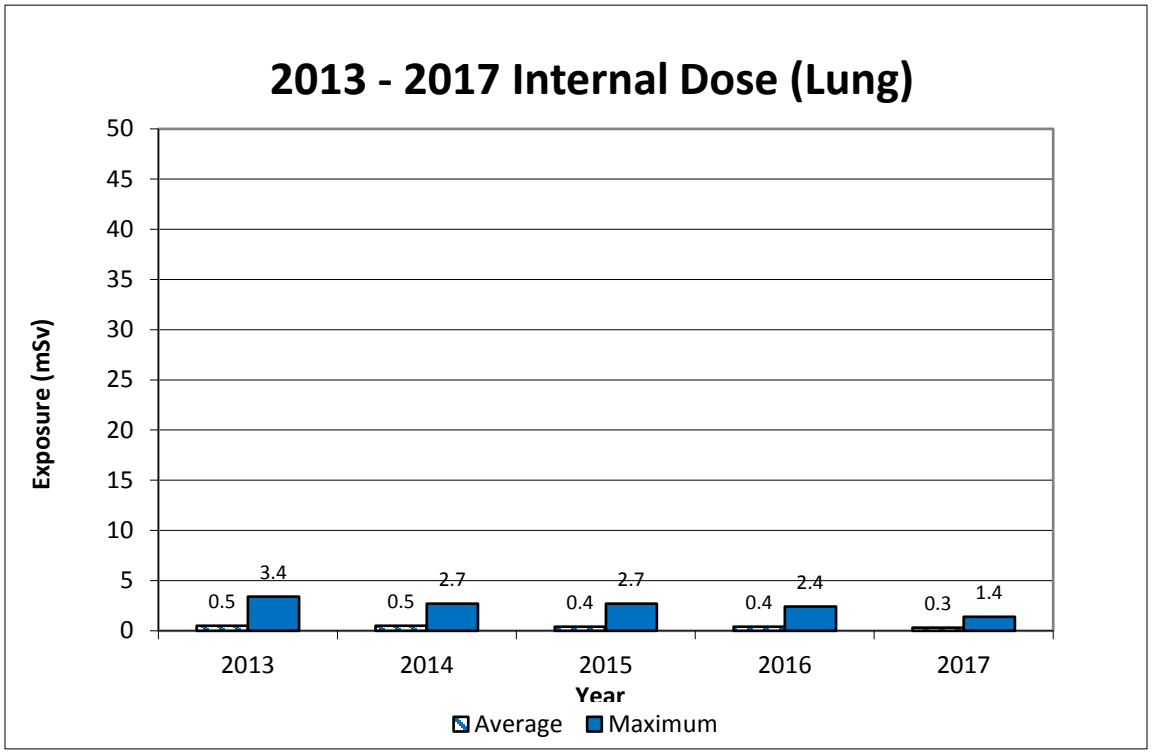
Assigned Internal Lung Count Doses 2017				
Dosimetry Group	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum[1] (mSv)**
UF_6 Plant	91	0.7	0.0	1.2
UO_2 Plant	23	0.3	0.0	0.8
Maintenance	69	1.1	0.0	1.4
Technical Support[2 3]	507	0.1	0.0	1.4
Administration[2]	111	0.0	0.0	0.1
Regulatory Limit - annual (5 years)		50 (100)		
[1]Maximum annual dose to an individual				
[2]Includes prorated doses				
[3]Includes Contractors (NEW)				

In 2017, no lung count measurements exceeded the Decision Level (DL) of the lung counter; therefore, lung doses for all individuals were based and assigned on group averages. Differences in individual lung doses within the same group are due to different fractions of the group average being applied to the individual's annual dose, based on the date the individual's lung count occurred.

Differences in individual lung doses from year to year are due to correction factors. The 2017 lung doses assigned in March 2018 are estimates. The actual doses for 2017 will be produced in March 2019 (once lung counts for every individual have been completed in 2017) and the difference between 2017 estimates and actuals will be applied to 2018 estimates.

Figure 11 shows the average and maximum internal lung dose for PHCF employees for the 2013 through 2017 period, including the outside contractors work group (NEWs).

Figure 11



Total Effective Dose

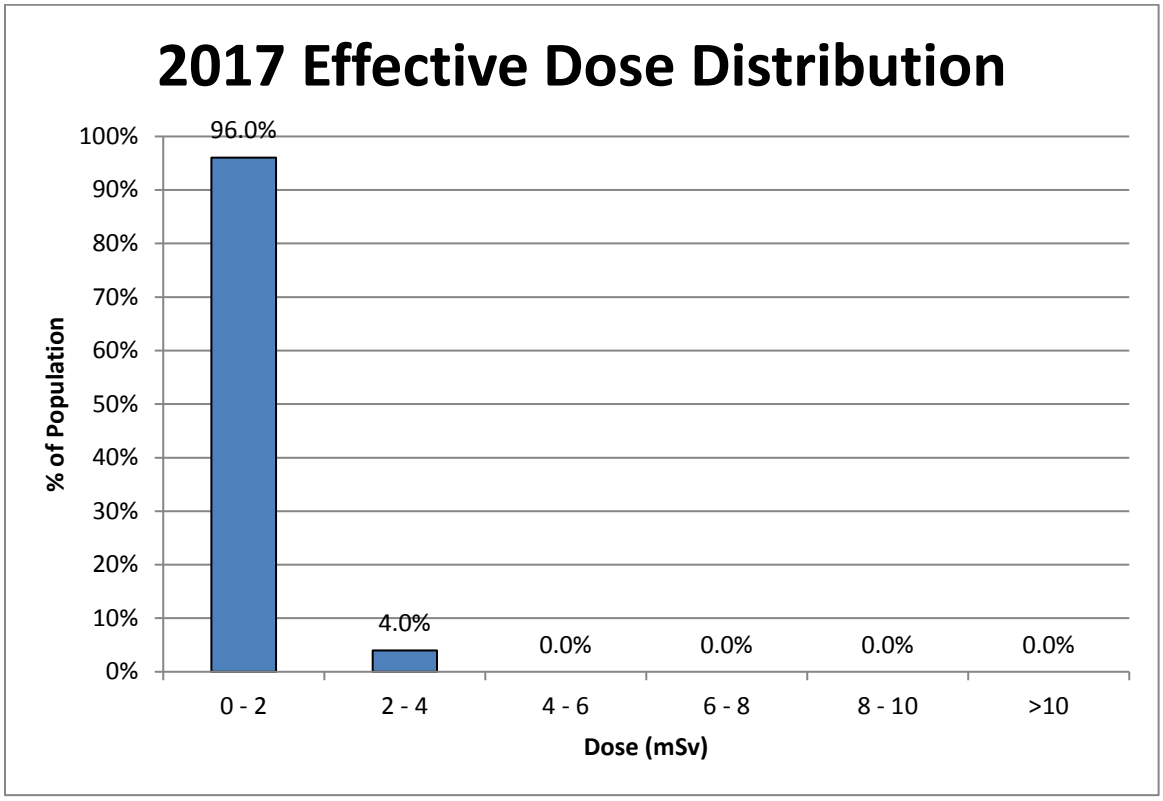
The total effective dose (TED) was assessed for 463 employees and 400 contractors. It should be noted that the internal lung dose component was assessed using the estimating function of the lung counting program management. The site average and maximum total effective dose for 2017 were 0.41 mSv and 3.94 mSv, respectively.

Table 13 and Figure 12 show the breakdown of the total effective dose for employees in 2017. 100 percent of employees or contractors (NEWs) had an effective dose of 4 mSv or less.

Table 13

2017 Total Effective Dose Distribution	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 2	96.0
2 – 4	4.0
4 – 6	0.0
6 – 8	0.0
8 – 10	0.0
> 10	0.0

Figure 12



The average employee effective dose in 2017 was slightly lower than the average effective dose recorded in 2016. This is likely due to lower lung count group averages for 2017.

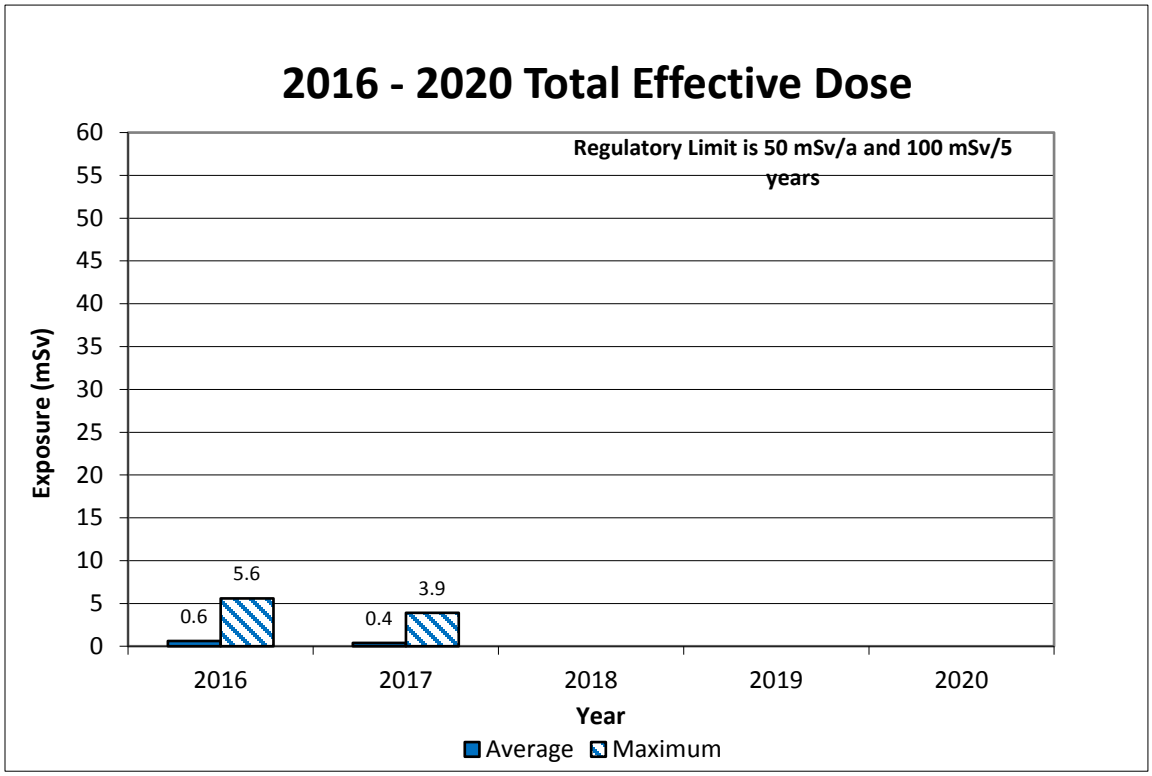
Table 14 and Figure 13 present the total effective dose for employees during the 2016-2020 periods.

The five year regulatory limits established in the Radiation Protection Regulations (SOR/2000-203) apply to unique five year periods of time. The current period extends from January 1, 2016 to December 31, 2020. The maximum individual effective dose for the current five year dosimetry period is 9.23 mSv which is well below the regulatory limits of 50 mSv/year and 100 mSv/5 years.

Table 14

Total Effective Dose 2016 - 2020				
Year	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum[1] (mSv)**
2016	859	0.6	0.0	5.6
2017	808	0.4	0.0	3.9
2018	-	-	-	-
2019	-	-	-	-
2020	-	-	-	-
[1]Maximum annual dose to an individual				

Figure 13



The average total effective dose five-year trend from 2013 through to the end of 2017, remains stable, with a maximum average of 0.79 mSv in 2014 and a minimum average of 0.41 mSv in 2017.

Table 15 shows the total effective dose broken down into urine analysis dose, lung count dose and external whole body dose for 2017.

Table 15

Dose Components & Total Effective Dose 2017												
Dosimetry Group	**Urine Analysis Dose (mSv)**			**Lung Counting Dose[1] (mSv)**			**External Whole Body Dose (mSv)**			**Total Effective Dose (mSv)**		
	Avg	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**
UF_6 Plant	0.10	0.00	0.47	0.74	0.01	1.17	0.39	0.00	2.87	1.21	0.01	3.60
UO_2 Plant	0.08	0.01	0.24	0.32	0.00	0.76	0.69	0.01	1.29	1.10	0.33	1.76
Maintenance	0.12	0.00	0.47	1.13	0.00	1.41	0.24	0.00	0.81	1.48	0.00	2.66
Technical Support	0.02	0.00	0.20	0.13	0.00	1.38	0.09	0.00	3.16	0.23	0.00	3.94
Administration	0.01	0.00	0.07	0.00	0.00	0.07	0.00	0.00	0.20	0.01	0.00	0.13
PHCF Average	**0.04**	**0.00**	**0.47**	**0.27**	**0.00**	**1.41**	**0.15**	**0.00**	**3.16**	**0.41**	**0.00**	**3.94**

[1]Based on estimated individual lung doses

Doses assigned by the urine analysis program continue to be minimal. No employee has exceeded the minimum detectable activity in the lung counting program since 2004 and all lung doses were assigned using a group average method. As with the previous year's data, the group averages for external whole body dose are low compared to maximally exposed individuals. This indicates that workplace controls are adequately controlling exposure for the group as a whole but the actions of specific employees are causing those individuals to receive unnecessary dose.

As indicated in Table 16, the individuals with the highest effective doses at the PHCF include an operator in the UF_6 plant, and material handling operators.

Table 16

2017 Five Highest Effective Dose Individuals				
Occupation	**Urine Dose (mSv)**	**Lung Dose (mSv)**	**External Whole Body Dose (mSv)**	**Effective Dose (mSv)**
Material Handling Operator	0.02	0.76	3.16	3.94
Material Handling Operator	0.07	0.76	3.04	3.87
Material Handling Operator	0.03	0.76	2.88	3.67
UF_6 Operator	0.16	0.57	2.87	3.60
Material Handling Operator	0.03	0.76	2.51	3.30

Contamination Control

PHCF is divided into three zones for contamination control purposes. Zone 1 areas (clean areas - no radioactive sources other than monitoring equipment) are clearly delineated. Whole body monitors are located at the Zone 1 boundary in the main lobby and at the Gate 12 vehicle port. A hand and foot monitor is located at the Gate 1 exit. In Zone 2 areas (transition areas – may contain limited amounts of uranium compounds), no visible contamination should exist and, when detected, loose contamination is promptly isolated, monitored, cleaned and monitored again to ensure the contamination has been removed. Zone 3 areas are production areas where uranium products are expected. Zone 1 and 2 areas are monitored on a weekly schedule (lunchrooms and change houses) and rotating monthly schedule (offices) so that each office area is monitored at least once annually. Additional monitoring is done on an as-needed basis (i.e. during an investigation, when requested or where contamination is suspected). The contamination readings above the internal administration level posed no significant risk to people or to the environment.

Table 17

Summary of PHCF Internal Administration Levels and Events in 2017				
Area	**Levels (Bq/cm^2)**		**Contamination Events**	
	Alpha	**Beta/Gamma**	**Number of Samples above Levels**	**Number of Samples Taken**
Zone 1	0.4	0.4	0	4,030
Zone 2	0.4	3.7	76	33,733

Contamination in Zone 2 was primarily detected in close proximity to production areas. Identified contamination is flagged and promptly cleaned up. Contaminated items that were unable to be cleaned were disposed of.

Vehicle contamination check verification forms are used to record contamination checks on vehicles leaving the site. Tires, seats, floors and pedals are checked for contamination. If necessary, vehicles are directed to the site truck wash booth to be decontaminated prior to leaving the site.

In-plant Air

The in-plant air monitoring program covers over 99 permanent monitoring stations across PHCF. Filters are changed and analyzed on a daily basis. Portable stations are also used on an as required basis.

Monthly averages of the airborne uranium activity concentration for each plant/area are reported as a fraction of the administrative level (AL) or derived air concentration (DAC). The DAC is based on the solubility class and particle size of uranium compounds found in the various plants.

Table 19 shows the average annual derived air concentration per work area for the 2013 through 2017 period. Air sampling data from the UF_6 plant enclosures that are permanently posted for respiratory protection has been omitted. As such, Table 18 values may not match data reported previously. The reduced number of air samples corresponding to a DAC greater than one may be attributed to the use of live-time air monitoring in the UF_6 and UO_2 plants which provides instant feedback and prompts immediate action.

It is important to note that in addition to the two plants having very different processes, there are several reasons for the differences in the total number of 1 DAC exceedances in the UF_6 and the UO_2 plants. The UF_6 plant is a larger building (10 floors versus 4 floors) which requires more fixed air monitoring locations (55 versus 25) than the UO_2 plant,

and the UF_6 plant operates continually, while the UO_2 plant operates 5 days a week, with samples collected daily during production. This results in a total number of data points for DAC in the UF_6 plant being approximately three times the number of data points in the UO_2 plant.

The DAC is based on the solubility class and particle size of uranium compounds found in the operating plants. The latest studies summarized in the "Internal Dosimetry Program – Technical Basis Document", show the average DAC values of 340 µgU/m^3 and 100 µgU/m^3 for the UF_6 and UO_2 plants, respectively. PHCF is taking a conservative approach by using the 100 µgU/m^3 as the DAC value across the site which means that for the UF_6 plant, PHCF is being more conservative than is required by the Technical Basis Document.

Table 18

Airborne Activity Concentration								
Year	**Annual Average (DAC) and Number of Samples >DAC**							
	UF_6		**UO_2**		**Waste Recovery**		**CUP**	
	Average	**>DAC[1]**	**Average**	**>DAC[1]**	**Average**	**>DAC[1]**	**Average**	**>DAC[1]**
2013	0.06	66	0.03	4	0.01	0	0.02	0
2014	0.06	94	0.03	3	0.02	1	0.01	0
2015	0.06	60	0.03	2	0.02	0	0.01	0
2016	0.05	60	0.04	2	0.05	11	0.01	0
2017	0.06	76	0.03	0	0.02	0	0.01	5
[1]Number of air samples greater than 1 DAC								

Gamma Surveys

Plant gamma surveys using hand-held meters are done on a routine basis throughout the site. The frequency of the readings and the number of readings taken in each area varies based on the area and the historical results from that area. Table 19 summarizes the results taken in each area in 2017.

The general processes and operations at the PHCF are well defined and stable, and the external gamma radiation levels were fairly constant in 2017. Gamma readings in the flame reactor areas and the drop line filter areas are highly variable and strongly dependent on the operational conditions of the UF_6 plant.

Areas with elevated gamma dose rates (i.e. flame reactors) require additional controls such as wearing direct reading dosimeters (DRDs) for routine work or radiation work permits for non-routine and project work to ensure worker's exposures are kept as low as reasonably achievable (ALARA).

Table 19

Summary of Plant Gamma Readings by Area (µSv/h)				
Building Number	**Location**	**Average**	**Minimum**	**Maximum**
2	1st Floor	3.33	0.63	13.90
	2nd Floor	2.51	0.26	5.66
	3rd Floor	0.87	0.29	2.08
5B	1st Floor	0.21	0.03	1.00
5C	1st Floor	0.30	0.15	0.40
7	1st Floor	0.52	0.29	0.98
12	1st Floor	6.83	0.25	17.3
24	1st Floor	2.96	0.60	6.87
	2nd Floor	1.60	0.07	3.77
	2nd Floor/Mezzanine	1.41	1.26	1.57
	3rd Floor	1.17	0.58	3.23
	4th Floor	2.71	0.43	5.28
50	1st Floor Flame Reactor Area	123	29.4	213
	1st Floor Tote Bin Area	7.34	3.07	11.6
	1st Floor Drop Line Filter Area	20.0	7.56	42.0
	1st Floor Cylinder Filling Area	0.91	0.75	1.06
	1st Floor Effluent Area	1.03	0.46	1.59
	2nd Floor Tower	2.78	0.02	6.26
	2nd Floor Flame Reactor Area	84.8	35.0	171
	2nd Floor Effluent Area	0.07	0.07	0.07
	3rd Floor Tower	4.84	1.95	8.43
	3rd Floor Flame Reactor Area	31.4	17.5	46.3
	3rd Floor Effluent Area	0.15	0.09	0.21
	3rd Floor Cold Trap Area	0.24	0.24	0.24
	4th Floor Tower	4.89	3.10	6.23
	4th Floor Flame Reactor Area	6.64	4.60	9.54
	5th Floor Tower	4.19	2.80	6.66
	5th Floor Flame Reactor Area	5.12	3.52	7.04
	6th Floor Tower	3.48	0.17	7.24
	7th Floor Tower	3.85	0.26	9.64
	8th Floor Tower	2.72	0.95	5.49
	9th Floor Tower	1.58	0.27	4.09

2.3.2 Conventional Health and Safety

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

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

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

Occupational health and safety (OH&S) efforts at PHCF are supported by one joint committee, the Conversion Safety Steering Committee (CSSC). The CSSC, created in 2013, incorporates the previously-existing Policy Health and Safety Committee (PHSC) and Workplace Health and Safety Committee (WHSC) into one committee. Time is allotted, actions are reviewed, issues discussed and minutes are maintained separately to address interests of both the WHSC and PHSC. The CSSC reviews and discusses matters involving OH&S policies, procedures and programs (composition of PHSC committee), safety performance, safety program performance, work refusals, safety related projects, and joint union/management OH&S issues that may arise from time to time (composition of WHSC committee). The CSSC meets three days per month in an effort to improve safety performance on site and creating a sustainable safety culture. Each member of the CSSC dedicates a fourth day a month for safety dedicated duties. This far exceeds the Canada Labour Code requirement of nine meetings per year. The CSSC is active in promoting continuous improvement and is effectively meeting the expectations of its mandate.

The health and safety of workers at PHCF is assured through site-specific safety and health management programs. These programs set out the requirements for management of health and safety aspects of the operation consistent with Cameco's corporate SHEQ policy, which is modeled on the OHSAS 18001 standard. Key components of the program include:

- compliance with all safety and health-related legal and regulatory requirements;
- the setting of site safety and health objectives;
- the implementation of corporate safety standards;

- the development and maintenance of a formal hazard recognition, risk assessment and change control processes; and
- the documentation of health and safety significant incidents from the start through to the verification of completion of corrective actions via the CIRS database.

The PHCF site program undergoes several review processes, including scheduled procedure reviews, program audits, and annual management review. Conformance to the program is also tested through various inspection programs, incident investigations, and ongoing analysis by the CSSC. Refer to the Management Systems section of this report for further details.

The effectiveness of the conventional OH&S system can be evaluated by the responsiveness of the site to leading safety activities such as audits, inspections, evaluations, reviews, benchmarking, training and employee participation and engagement. The PHCF was successful in meeting the expectations of these various initiatives.

Audits and inspections are conducted at PHCF to ensure regulatory compliance and compliance to Cameco's policies and procedures. Audit and inspection results are discussed with the managers responsible for the areas inspected and entered CIRS for resolution or management.

The PHCF has tracked leading and lagging safety indicators for many years. These consist of, but are not limited to, tracking safety meeting attendance, tracking the percentage of safety inspections completed and safety statistics. This data is reviewed by site and divisional management and has helped improve the overall safety performance at the facility.

The PHCF follows a systematic evaluation method for its safety culture self-assessments which are generally completed every five years. The most recent self-assessment was completed in 2015. Cameco uses these assessments to shape the safety program improvements at each site.

Table 20 compares the safety statistics for the PHCF over the past five years. The number of first aid injuries, medical diagnostic procedures, medical treatment injuries, lost time injuries, lost time frequency and lost time injury severity were consistent with previous years.

Table 20

2013 – 2017 Safety Statistics					
Year / Parameter	**2013**	**2014**	**2015**	**2016**	**2017**
First Aid Injuries	67	69	71	84	60
Medical Diagnostic Procedures	5	11	7	6	1
Medical Treatment Injuries	4	12	3	12	4
Lost Time Injuries	0	1	1	3	1
Lost Time Injury Frequency	0.00	0.27	0.26	0.80	0.28
Lost Time Injury Severity	0.00	0.00	7.64	2.40	1.67

All reported Occupational Health and Safety incidents are registered in CIRS for tracking and management. The CIRS system defines five categories of incidents based on actual and potential outcome, with Category I incidents being minor in scope and Category V incidents having the highest actual and potential consequences. Incidents captured by the Canada Labour Code (Part II) definition of hazardous occurrences fall under Categories III-V of the CIRS system.

On June 12, 2017 an employee injured a muscle in their right bicep while removing a drum from a conveyor in the UO_2 plant which weighed approximately 17 kg. The drum was lifted off the conveyor, at shin height, and over a safety cable, at waist height, before being placed on the floor. The employee continued to work with restrictions after the event and received surgery in July. Doctors instructed the employee to take time off after the surgery, resulting in 6 days lost time. Employees have been instructed to stop the practice of lifting drums over the safety cable and instead take the time to convey the unwanted drum around the conveying system to the designated drum removal location. All corrective actions have been implemented, with the exception of one - to lower the safety stop cord.

Several initiatives to improve OH&S were progressed in 2017, including:

- The CSSC steering committee and subcommittees committed to completing 8 targets outlined below. Several targets did not meet the scheduled timing, however there were many great accomplishments:
    - Implemented 100% employee involvement in safety;
    - A process was developed to efficiently follow up on injuries and HIRAC assessments;
    - Implemented improvements for subcommittee communication to the site;
    - Developed a CSSC three year plan;
    - Made improvements towards hand, eye and ergonomic injuries – 3 new gloves were implemented to improve hand safety as well as new safety

glasses with foam lining that can prevent dust from getting into the wearer's eyes;
    - Increase site resources for carrying out the completion of HIRACS through the development of a training video; and,
    - Support ALARA by decreasing the number of worker uranium uptakes – A HIRAC assessment was completed for a job task with historical worker uranium uptakes and corrective actions were assigned.
- Completed implementation of the new Electrical Safety Standard by the end of the year;
- Site roll out of Self Check tool was completed;
- The CSSC conducted monthly inspections to ensure that the entire site was inspected by year-end;
- The CSSC restructured the subcommittees to ensure continual improvement;
- The site commenced a 100% safety involvement process, where all employees take the time to perform a safety assessment or task every month
- 120 safety wins were implemented in 2017;
- 2017 was the second safest year in the last 5 years at PHCF with a TRIR of 1.67

Future OH&S initiatives include:

- Promote safety onsite through initiatives such as weekly safety announcements, health and safety moment videos, etcetera;
- Increase site resources for carrying out the completion of HIRACS through training;
- Develop HIRAC schedule and review effectiveness of implemented HIRAC actions;
- Develop a plan for prioritizing ergonomic assessments;
- Develop a plan to correct existing identified ergonomic concerns;
- Review effectiveness of mini inspections and make recommendations as required;
- Review effectiveness of 100% safety involvement and make recommendations as required;
- Revise CSSC subcommittee structure;
- Develop targets for active committees with the focus on completion of existing issues; and,
- Increase CSSC safety presence throughout VIM processes.

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 the *Canada Labour Code Part* II prescribe specific health and safety requirements that are met by the PHCF.

2.3.3 Environmental Protection

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

There are both federal and provincial regulatory authorities that have legislative jurisdiction over environmental protection at the facility. The PHCF's environmental monitoring program is comprised of the following components:

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

The program ensures that applicable provincial and federal requirements are met.

The key characteristics of the operation and activities that can have a significant environmental impact are monitored and measured and are described in the EMP and associated procedures. These documents 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.

The performance of the Environmental Protection Program is tracked using KPIs. The KPIs for this program include but are not limited to risk control, training and awareness, objectives and targets, operational controls, certification, and monitoring.

Audits and inspections were performed in accordance with licence conditions. Refer to the Management Systems section of this report for further details.

Cameco has established action levels, which have been accepted by the CNSC, for key environmental parameters. An exceedance of an action level does not pose a risk to people or the environment.

Though the environmental programs have been demonstrated to be effective, the PHCF advanced several improvements to the environmental protection program in 2017.

Program Improvements included:

- Implemented CSA standards N288.4 Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills and N288.5 Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills;
- Implemented CSA Standards N292.0 General principles for the management of radioactive waste and irradiated fuel and N292.3 Management of low- and intermediate radioactive waste; and,

- Waste management projects were deployed, as part of the long-term waste management plan, to dispose of contaminated materials at appropriately licensed hazardous waste facilities.

Procedural updates included:

- CAP:ENV:1 The Determination of Particulate Emissions by TSI Isokinetic Dust Sampling;
- CAP:ENV:17 Groundwater Monitoring Program for the Port Hope Conversion Facility;
- CAP:ENV:23 Cooling Water Effluent Monitoring Program;
- CAP:ENV:29 Stormwater Monitoring Program;
- Environmental Emergency Plan; and,
- Spills Prevention and Contingency Plan.

The environmental initiatives planned for 2018 include the following:

- Continue improvements to the PHCF sanitary sewer system;
- Continue to implement portions of the long-term waste management plan, to dispose of contaminated materials at appropriately licensed hazardous waste facilities; and,
- Continue to support Super CUP through onsite presence, data review/interpretation, troubleshooting support and event response/investigation.

Dose to Public

The Operating Release Level (ORL) is based on the releases of uranium and external gamma radiation to the environment that ensures the dose to the public from the PHCF is below 0.3 mSv/year with the air and water components each being less than 0.05 mSv/year and gamma component being less than 0.3 mSv/year to ensure the dose to the public remains well below the annual regulatory dose limit for a member of the public of 1.0 mSv.

An ORL equation has been developed to account for all public dose exposure pathways – gamma, air and water. In accordance with the requirements of the CNSC, the ORL for the PHCF was updated in 2016 and subsequently accepted by the CNSC. The 2016 report resulted in changes to dose calculations related to releases to water and the fenceline gamma locations used for reporting the dose to the public. These changes included calculating dose to the public from facility discharges to the sanitary sewer, as well as including a fenceline monitoring location closer to the operating facility than previously used in the dose to the public calculations and calculating two doses to a member of the public, one for a resident near Site 1 and the other for a resident near Site 2. Changes to

the ORL are incorporated into PHCF reporting effective the first quarter of 2017 and represent a more conservative estimate of dose to the public that can be used throughout the Vision in Motion project.

ORL equations for Site 1 and Site 2 have been derived and are expressed in the form shown below.

Public Dose = Dose $_{Air}$ + Dose $_{Water}$ + Dose $_{Gamma}$ <0.3 mSv/y

The 2017 annual dose from Site 1 and Site 2 are based on monitoring results for each dose component as shown in Table 21. This table illustrates the individual contributions from air, water and gamma as well as the total public dose from each site.

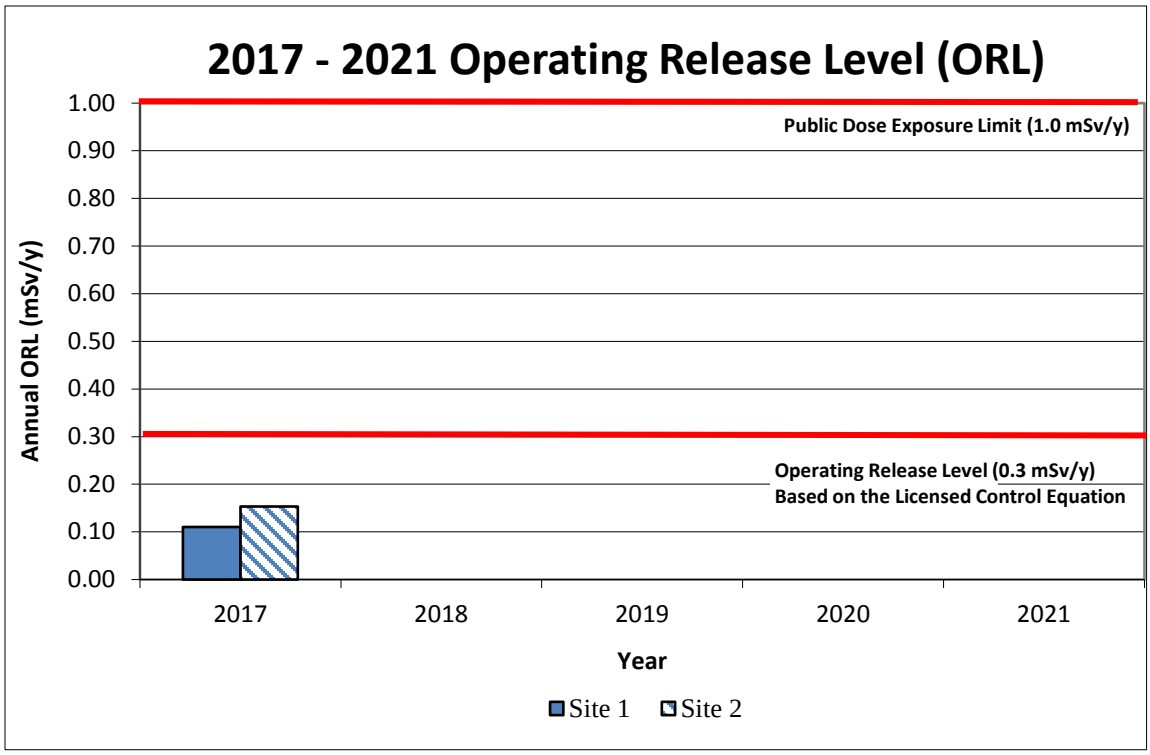
The ORL contributions are also shown graphically in Figure 14.

Table 21

Annual Dose (mSv/year)					
ORL Component	**2017**	**2018**	**2019**	**2020**	**2021**
Air	0.001	-	-	-	-
Water	0.001	-	-	-	-
Gamma – Site 1	0.109	-	-	-	-
Gamma – Site 2	0.152	-	-	-	-
Annual Dose – Site 1	0.110	-	-	-	-
Annual Dose – Site 2	0.153	-	-	-	-

The results beginning in 2017 cannot be compared to previous years due to significant changes in the ORL as accepted by CNSC. The perceived increase in dose to the public compared to previous years is a function of including fenceline gamma monitoring at the facility fenceline (Station 2 adjacent to the warehouse vs Station 14 at the Centre Pier as per previous ORL) in the calculations – and not a realized increase in emissions/dose from the facility. The current dose calculation is more conservative than was previously used.

Figure 14



Gamma Monitoring

In order to ensure that doses to local residents/critical receptors are ALARA and do not exceed the annual public dose limit of 1 mSv as defined in the Radiation Protection Regulations, environmental OSL dosimeters are strategically placed (at chest height) around the exterior perimeter of the licensed facility. The OSL dosimeters are deployed on a monthly basis. Gamma dose is measured in mSv which is converted into a dose rate in µSv/h. Eighteen locations at Site 1 (including main site and Centre Pier) and six locations at Site 2 have been selected around the fenced perimeter to cover all potential receptors in the public.

As per the 2016 ORL, dose to the public is calculated for both sites 1 and 2 using specific gamma fenceline monitoring locations. The results at stations 2 and 13 are used for Site 1 public dose calculations and the results at stations 2 and 21 are used for Site 2 public dose calculations. The results at these locations for this quarter are summarized and compared with regulatory action levels in Table 22.

Table 22

Maximum Monthly Public Dose Gamma Monitoring Results							
Station Number	**2017**	**2018**	**2019**	**2020**	**2021**	**Action Level (µSv/h)**	**Licence Limit (µSv/h)**
2	0.25					0.48	0.57
13	0.03					0.18	0.40
21	0.08					0.25	0.26

Fluctuations in the gamma results are expected given that the values are near background levels. No activities were conducted in 2017 which would have resulted in an increased gamma dose to the critical receptor.

Discharge to Air

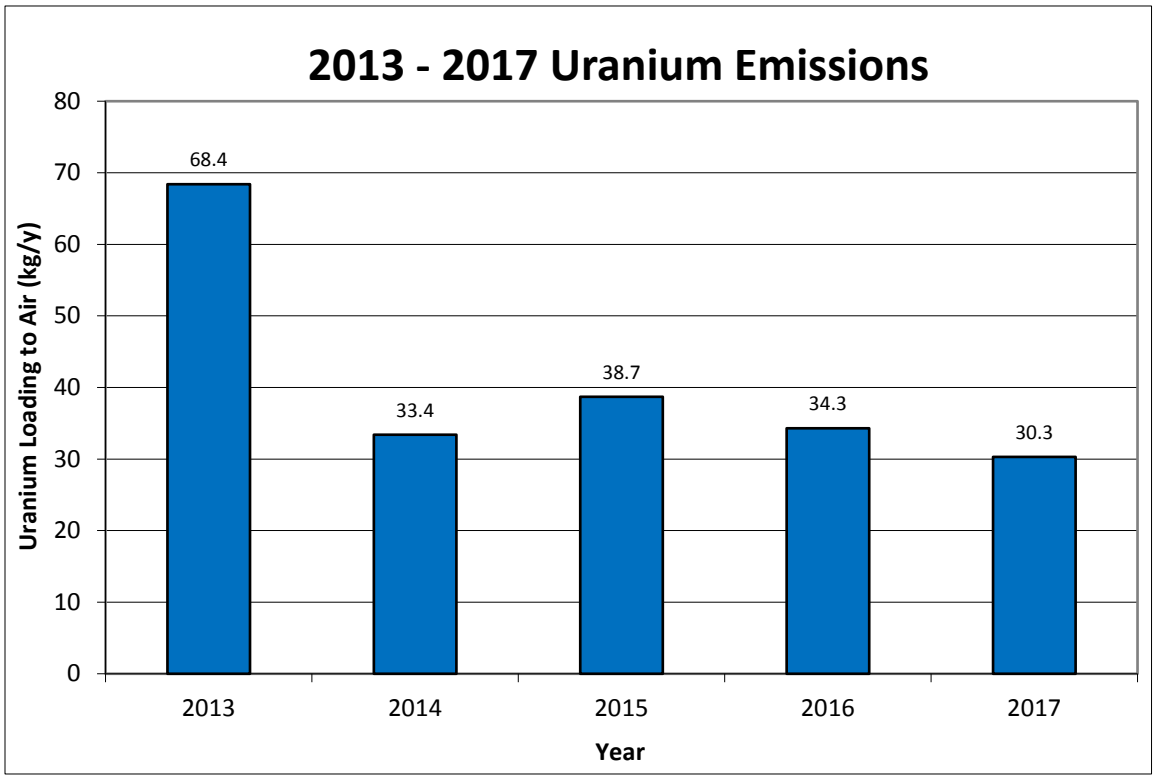
The air quality monitoring program at PHCF is divided into source air monitoring and ambient air monitoring. The source air monitoring program collects and analyzes daily samples from the main stacks on the UF_6 and UO_2 operating plants. Both of these stacks are continuously sampled for uranium.

The total uranium emissions to air from PHCF in 2017 were approximately 31.5 kgU. These uranium loadings include both the UF_6 and UO_2 main stacks, plant building ventilation and facility point sources. Table 23 and Figure 15 illustrates PHCF uranium loading to air for the period of 2013 to 2017. The PHCF uranium loading to air decreased significantly in 2014 from the UF_6 main stack due to the installation of a new tail gas Venturi scrubber in the first quarter of 2014. The decrease in emissions from 2016 and 2017 can be attributed to the UO_2 main stack demister pad upgrades completed in first quarter of 2017.

Table 23

Total Uranium Emissions (kgU)					
Emission	**2013**	**2014**	**2015**	**2016**	**2017**
Air	68.4	33.4	38.7	34.3	31.5

Figure 15



A stack monitoring program is used to determine the airborne uranium emission rates on a daily basis from the main stacks of the UF_6 and UO_2 plants. The licensed action level for the UF_6 plant main stack is 40 g U/h. The licensed action level for the UO_2 plant main stack is 7 g U/h.

No licensed action levels were exceeded for uranium emissions from the UF_6 plant main stack in 2017. The annual average and maximum uranium emissions in 2017 were comparable to 2014, 2015 and 2016 levels.

No licensed action levels were exceeded for uranium emissions from the UO_2 plant main stack in 2017. The annual average uranium emissions from the UO_2 plant main stack for 2017 is less than previous years due to the demister pad upgrade in the first quarter of 2017.

Fluoride emissions from the UF_6 main stack are sampled and analyzed on a continuous basis using an on-line analyzer and the data is collected on the plant computer system. The UO_2 main stack is also continuously sampled for ammonia to determine the ammonia emission rate from the UO_2 plant main stack.

The depleted circuit was operational in the UO_2 plant from February 8 to March 3, 2017. NOx emissions averaged 131 g NOx/h daily. The average and maximum results are below the licence limit of 78,000 g NOx/h based on a 24 hour averaging period.

All other stacks are sampled on an occasional or as requested basis. Source emission action levels and maximum limits are indicated in the appropriate Tables and Figures throughout this report.

The 2017 annual average and maximum stack emissions from the UF_6 plant main stack and the UO_2 main stack are presented in Table 24 and Figure 16 through to Figure 19.

Table 24

2013 - 2017 Daily Main Stack Emissions									
Plant	**Parameter**	**Licence Limit**	**Action Level**	**Value**	**2013**	**2014**	**2015**	**2016**	**2017**
UF_6	Uranium g U/h	280	40	Average	5.1	1.2	1.7	1.2	1.1
				Maximum	25.3	6.3	19.2	6.0	15.3
	Hydrogen Fluoride g HF/h	650	230	Average	19	13	17	10	21
				Maximum	143	99	146	122	209
UO_2	Uranium g U/h	240	7	Average	1.3	1.2	1.2	1.0	0.5
				Maximum	6.2	3.9	2.9	5.2	2.7
	Ammonia kg NH_3/h	58	13	Average	2.0	2.2	2.4	1.7	1.4
				Maximum	4.3	5.4	4.7	5.5	4.0

No regulatory action levels were exceeded for fluorides (as HF) for the UF_6 plant main stack in 2017. Air emissions observed in 2017 were comparable to levels observed in previous years. The total fluoride emissions to air (as HF) from the PHCF in 2017 were approximately 448 kg HF. These fluoride loadings include the UF_6 main stack, UF_6 plant building ventilation and facility point sources.

No regulatory action levels were exceeded for ammonia for the UO_2 plant main stack in 2017. The average annual ammonia emissions from the UO_2 plant main stack in 2017 are comparable to levels observed in previous years. The total ammonia emissions to air from PHCF in 2017 were approximately 43.7t NH_3. These ammonia loadings include the UO_2 plant main stack, the UO_2 plant point sources and facility point sources.

Figure 16

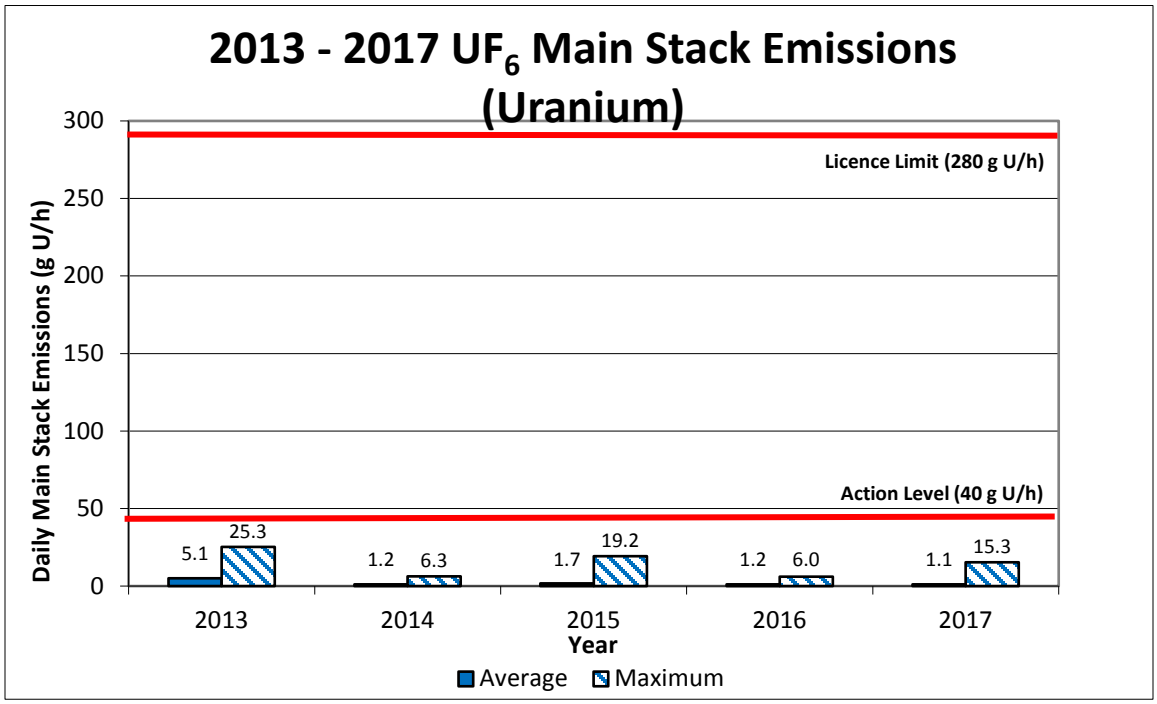


Figure 17

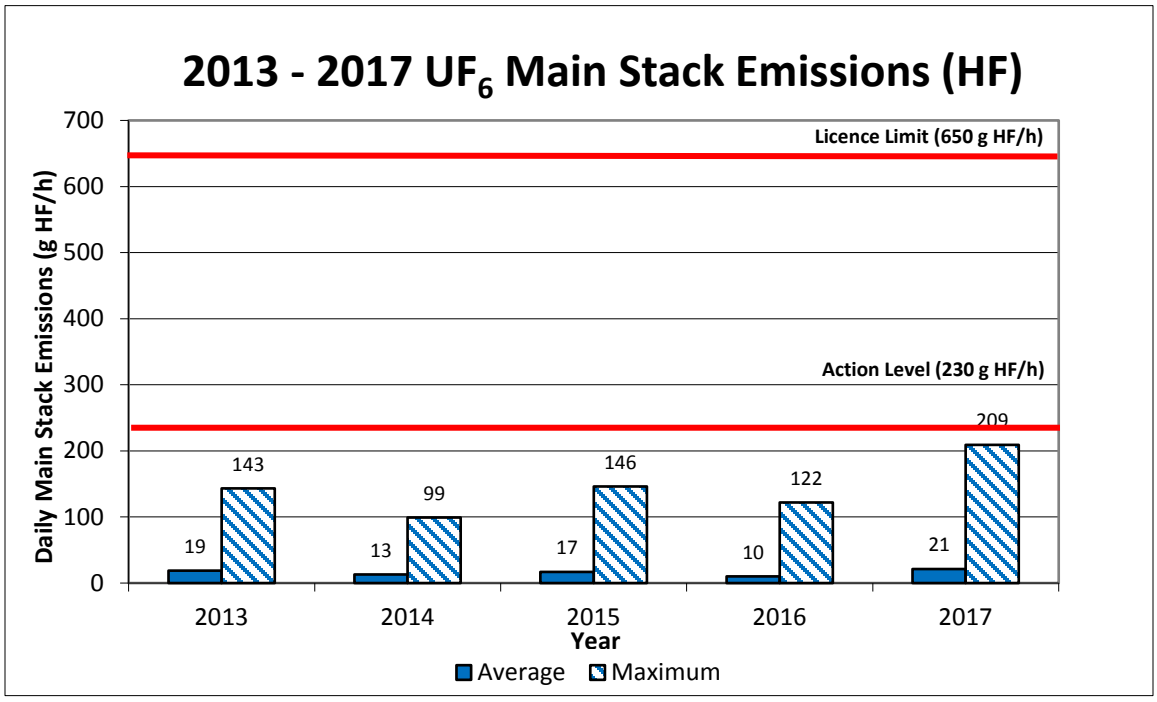


Figure 18

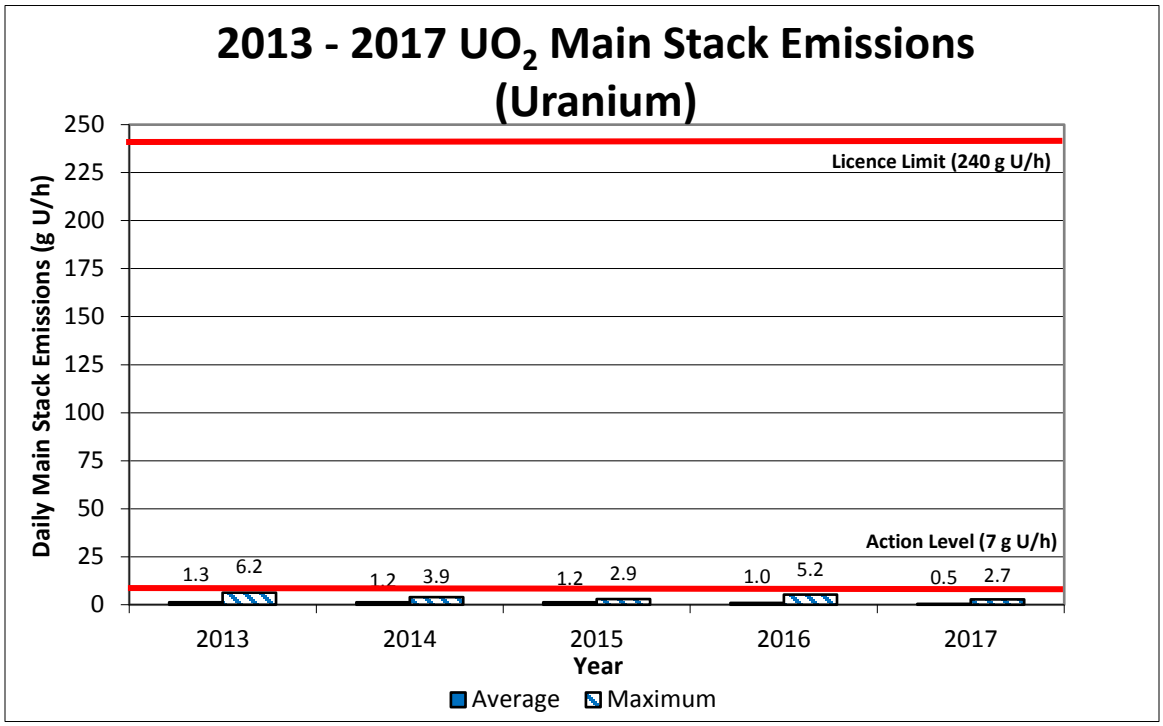
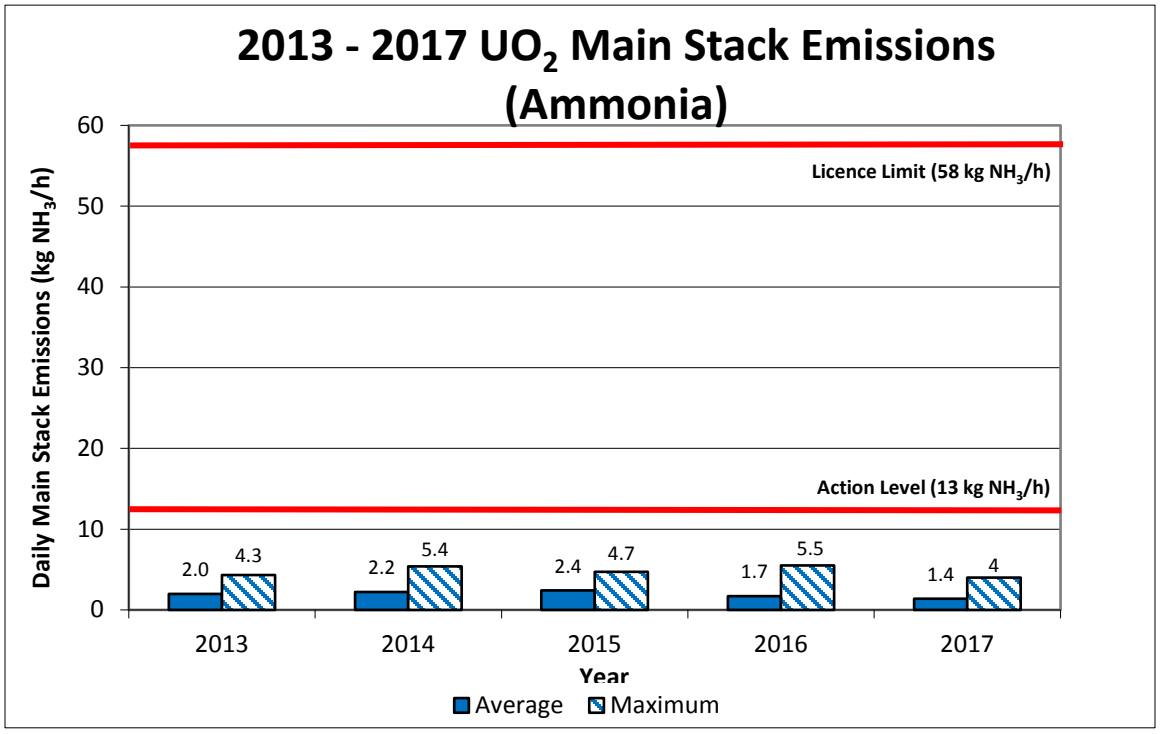


Figure 19



Ambient Air Monitoring

In support of the source sampling program, an ambient air program has been established to measure air quality near the PHCF. Samples from the site and the community are collected and analyzed for a variety of parameters. The facility's fluoride and uranium emissions have the greatest potential environmental impact and therefore are the primary focus of ambient air program.

Cameco monitors ambient uranium concentrations in the field using dustfall jars, high volume air samplers and soil samples. The results for these programs are provided below.

Dustfall monitoring is a measurement of deposition rate and is obtained by collecting particulate matter in a container, termed a dustfall jar. The particulate matter is collected over a one-month period, and analyzed to determine the uranium deposition rate. There is no regulated standard for uranium content in dustfall. Cameco has established an internal administrative screening level of 10 mg U/m^2/30 days that would be indicative of abnormal conditions.

No uranium dustfall results exceeded the internal administrative screening level in 2017. The facility uranium in dustfall results averaged < 0.1 mg U/m^2/30 days in 2017, which is comparable to levels detected in previous years. It should be noted that dustfall uranium results observed from 2013 to 2017 are near method detection levels.

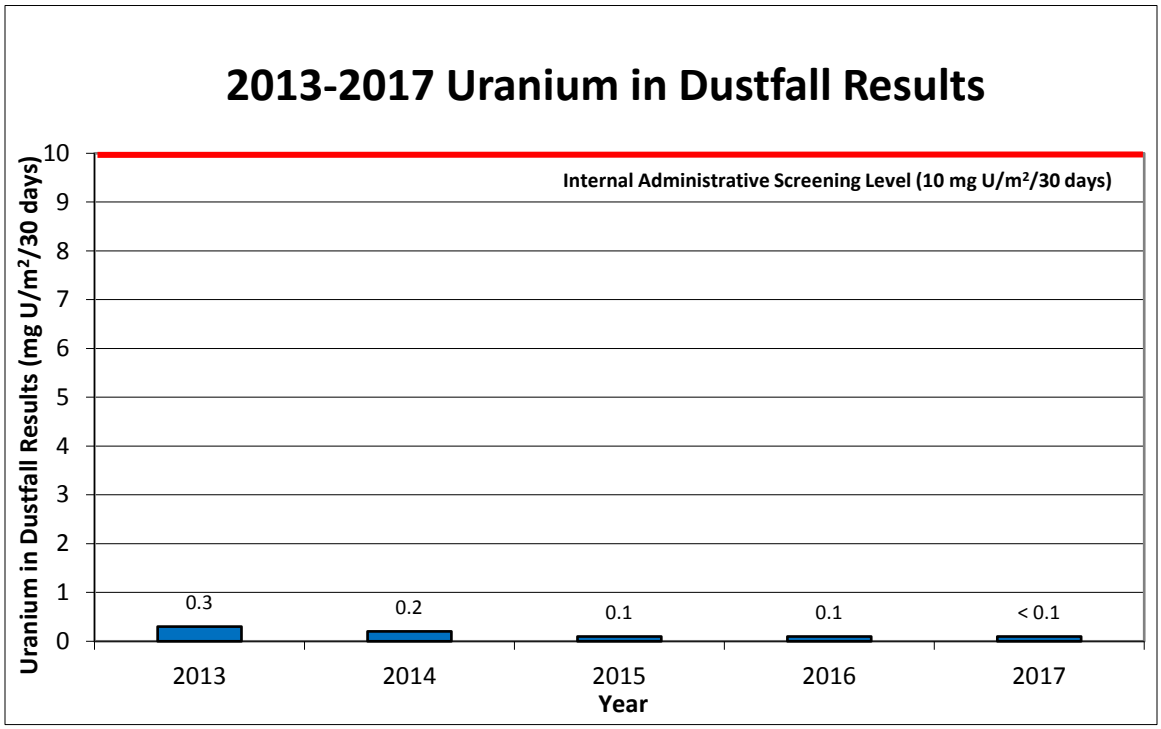
The annual all-station average uranium content in dustfall jars at and near the site in 2013 through 2017 is presented in Table 25.

Table 25

Comparison of Uranium in Dustfall Results (mg U/m^2/30 days)					
Period	**2013**	**2014**	**2015**	**2016**	**2017**
First Quarter	0.2	0.1	0.1	0.1	0.1
Second Quarter	0.2	0.4	0.2	0.1	0.1
Third Quarter	0.3	0.2	0.1	0.1	0.0
Fourth Quarter	0.4	0.2	0.1	0.1	0.0
Average	**0.3**	**0.2**	**0.1**	**0.1**	**< 0.1**
Cameco Internal Administrative Screening Level = 10 mg U/m^2/30 days					

Figure 20 shows the average uranium dustfall results from 2013 through 2017.

Figure 20



The high volume (hi-vol) air-sampling program monitors the concentration of uranium suspended in the air near the facility. There are four monitoring stations located at Marsh Street at the fence line just south of the UF_6 plant, east of the Port Hope Waterworks, Hayward Street and Shuter Street.

Approximately 40 cubic feet per minute of air is passed through and collects on a filter over a 24 hour period.

There is no regulated standard for uranium content in hi-vol monitoring. Cameco has established internal administrative screening levels of 1 µg U/m^3 24 h or 0.1 µg U/m^3 single station monthly average that would be indicative of abnormal conditions.

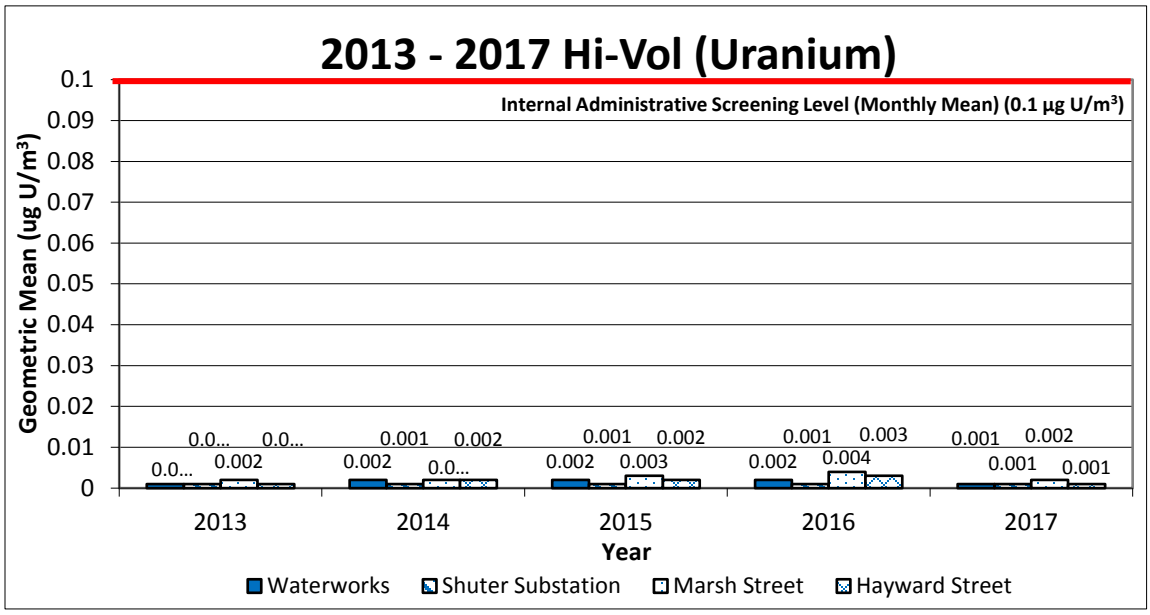
No uranium hi-vol exceeded the internal administrative screening level in 2017. Average hi-vol results for 2017 are comparable to levels observed in the previous four years. Annual average results from all stations remain well below the new MOECC annual average POI standard of 0.03 µg/m^3 (PM_{10}), which took effect July 1, 2016.

Table 26 and Figure 21 show the average uranium hi-vol results from 2013 through 2017.

Table 26

2013 – 2017 Annual Uranium-in-Air Concentration at Hi-Vol Stations					
Year	**Result**	**Waterworks**	**Shuter Substation**	**Marsh Street**	**Hayward Street**
2013	Average	0.001	0.001	0.002	0.001
	Maximum	0.035	0.012	0.100	0.017
2014	Average	0.002	0.001	0.002	0.002
	Maximum	0.033	0.016	0.024	0.019
2015	Average	0.002	0.001	0.003	0.002
	Maximum	0.011	0.004	0.018	0.009
2016	Average	0.002	0.001	0.004	0.003
	Maximum	0.082	0.005	0.119	0.121
2017	Average	0.001	0.001	0.002	0.001
	Maximum	0.015	0.007	0.009	0.007
Cameco Internal Administrative Screening Level = 1 µg U/m^3 24h or 0.1 µg U/m^3 single station monthly average					

Figure 21



The concentration of fluoride emissions from Cameco in the ambient environment are monitored in the field using dustfall, lime candle and vegetation sampling. The results from these programs are provided below.

In addition to the uranium analysis discussed above, the fluoride content of the collected dust provides information of fluoride in air near the facility. There is no regulated

standard for fluoride content in dustfall. However, Cameco has established an internal administrative screening level of 20 mg F/m^2/30 days that would be indicative of abnormal conditions.

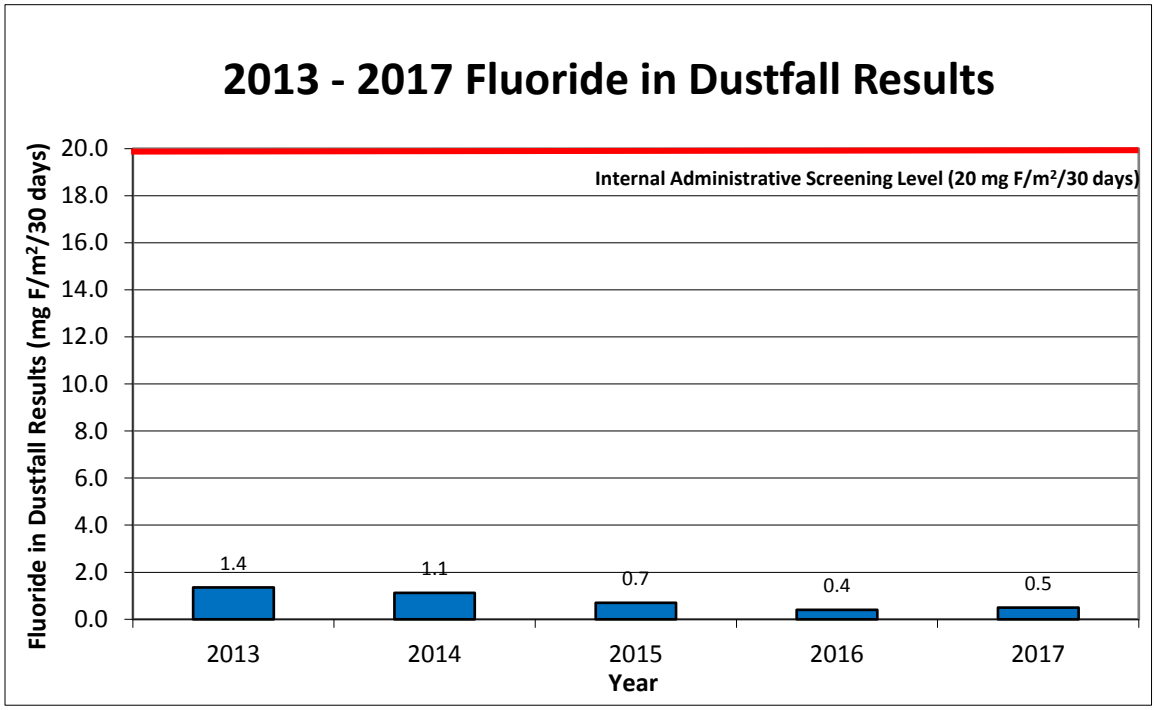
No fluoride dustfall exceeded the internal administrative screening level in 2017. The annual all-station average fluoride content in dustfall jars at and near the PHCF in 2013 through to 2017 is presented in Table 27. The dustfall fluoride levels observed are comparable to levels observed in 2013 through 2016 and are within acceptable data range variation.

Table 27

Comparison of Fluoride in Dustfall Results (mg F/m^2/30 days)					
Period	**2013**	**2014**	**2015**	**2016**	**2017**
First Quarter	1.9	0.5	0.4	0.4	0.2
Second Quarter	1.2	1.0	0.8	0.7	1.1
Third Quarter	1.0	1.2	1.0	0.4	0.4
Fourth Quarter	1.3	1.8	0.6	0.2	0.2
Average	**1.4**	**1.1**	**0.7**	**0.4**	**0.5**
Cameco Internal Administrative Screening Level = 20 mg F/m^2/30 days					

Figure 22 shows the average fluoride dustfall results from 2013 through 2017.

Figure 22



Fluorination rate is an indirect measurement of the gaseous fluoride concentration in the ambient air. An established method for measuring the fluoride concentration in ambient air is to expose lime coated filter papers, commonly called lime candles, for a fixed period of time. The fluoride reacts with the lime and the analysis of the lime candles provides a time-averaged fluoride concentration. Lime candles consist of a 10 cm x 10 cm filter paper that is soaked with a saturated calcium oxide (CaO) solution housed in a louvered shelter sampling station with a hinged top.

The lime candles are prepared, deployed and collected on a specified frequency and are analyzed. The period of time is normally 30 days; however, shorter terms of weekly periods are also used. These shorter-term results are used to assess impact in a timelier manner, and effect process changes to ensure that the monthly results are in compliance. Monthly and weekly lime candles are operated throughout the year. The MOECC Ambient Air Quality Criteria (AAQC) for fluoridation are 40 µg F/100 cm^2/30 days from April 1 to October 31 and 80 µg F/100 cm^2/30 days from November 1 to March 31. These criteria are based on the protection of foraging animals.

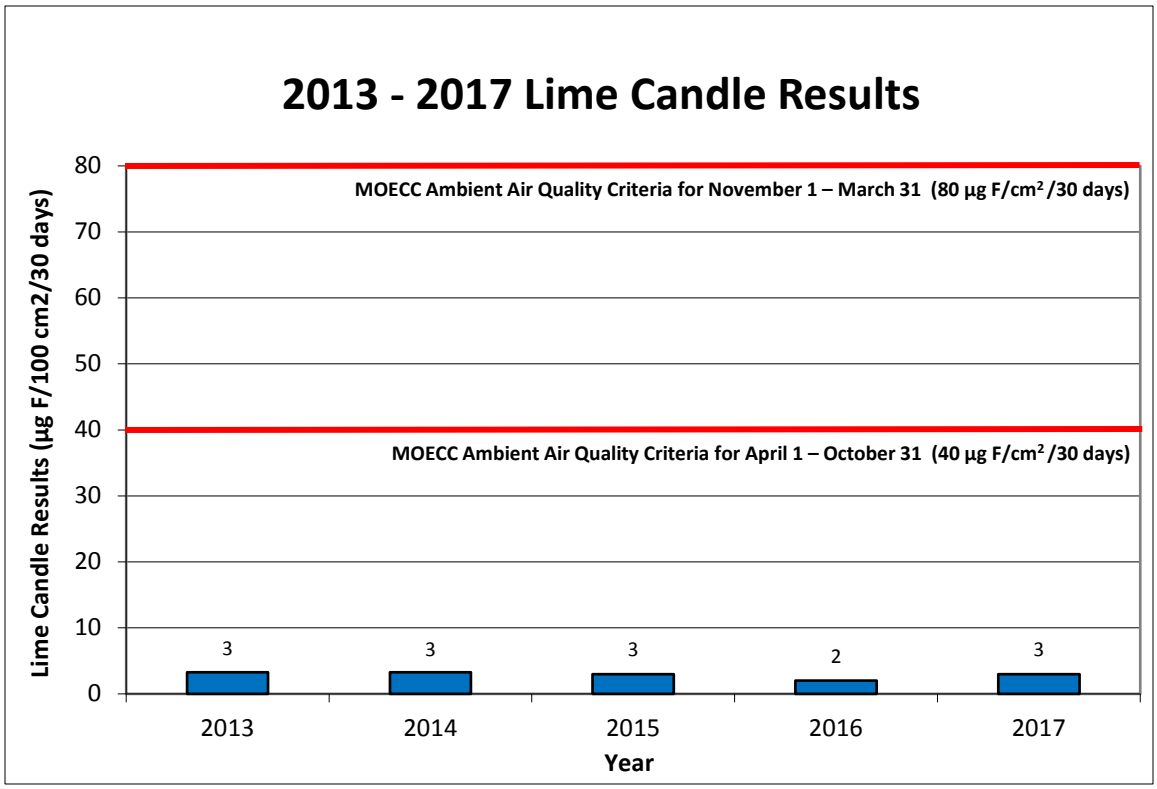
The quarterly average lime candle monitoring results are shown in Table 28 for 2013 through 2017. There were no lime candle results above the MOECC AAQC in 2017. The 2017 lime candle annual average is comparable to levels observed in previous years.

Table 28

Comparison of Monthly Lime Candle Results by Quarter (µg F/100 cm^2/30 days)					
Period	**2013**	**2014**	**2015**	**2016**	**2017**
First Quarter	4	3	3	2	3
Second Quarter	3	4	4	3	3
Third Quarter	4	3	3	3	3
Fourth Quarter	2	3	4	2	2
Average	**3**	**3**	**3**	**2**	**3**
The desirable ambient air quality criteria for lime candles are to protect forage crops consumed by livestock. During the summer growing season, the criteria is 40 µg F/100 cm^2/30 days, changing to 80 µg F/100 cm^2/30 days in winter.					

Figure 23 shows the average lime candle results from 2013 through 2017.

Figure 23



Soil Monitoring

The terrestrial sampling program, including soil and vegetation components, is carried out at frequencies specified in the individual procedures to supplement results from the PHCF air emissions monitoring programs and to monitor the long-term effects of facility air emissions, namely uranium and fluoride, in the areas surrounding the PHCF.

The soil monitoring program currently consists of five monitoring locations beyond the facility fence line. Three of these locations are within a 0 to 500 m radius zone from the facility, while the remaining two monitoring locations are within the 500 to 1000 m and 1000 to 1500 m radii. Only the clean fill soil plot data for the monitoring station located adjacent to the Port Hope Water Treatment Plant to the west of the facility is being reported herein.

The 2013 through 2017 uranium in soil in a clean fill soil plot data is provided in Table 29. The soil sampling approach was modified in 2015 to focus on the sampling of 15 cm cores and the collection of 0-5 cm, 5-10 cm and 10-15 cm core segments for compositing. Notwithstanding the above sampling approach updates, the five sampling locations were retained.

All individual sampling location values were below the Canadian Council of Ministers of the Environment (CCME) agricultural and residential/parkland land use soil quality guideline of 23 mg/kg (ppm). Moreover, clean fill soil plot results were below the MOECC Table 1 full depth background site condition uranium standard of 2.5 µg/g (ppm) for residential/parkland/institutional/industrial/commercial/community land use.

Table 29

Clean Fill Soil Plot						
Depth (cm)	**2013**	**2014**	**Depth (cm)**	**2015**	**2016**	**2017**
0-2 cm depth	1.0	1.4	0-5 cm depth	1.0	1.2	0.8
2-6 cm depth	0.9	1.2				
6-10 cm depth	1.0	1.1	5-10 cm depth	1.0	1.1	0.8
10-15 cm depth	1.0	1.1	10-15 cm depth	1.2	1.0	0.9
70 cm composite	1.5	1.4				

Vegetation Sampling

The focus of the vegetation monitoring program is foliar fluoride concentrations within the Municipality of Port Hope. Although the emissions control systems minimize the discharge of fluorides to the environment, the PHCF is an anthropogenic source of fluoride to the local environment.

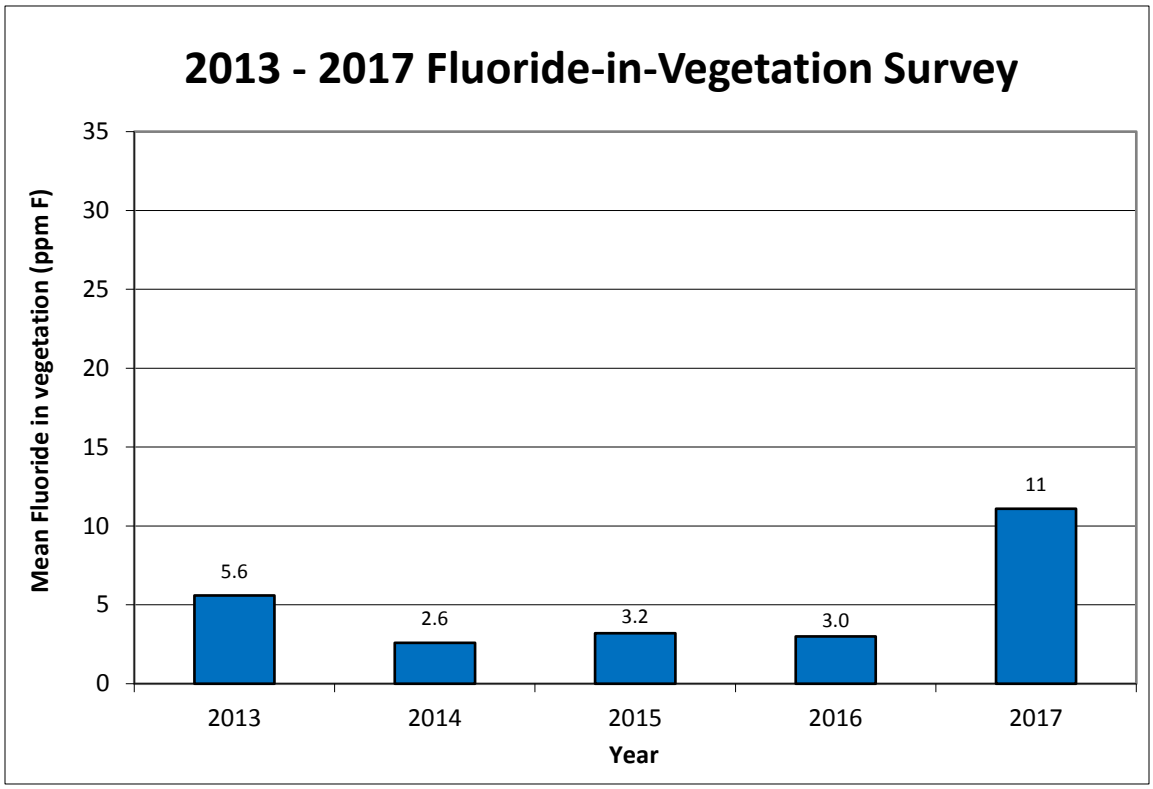
Samples of fluoride-sensitive vegetation are collected in late-August or early September for fluoride analysis and assessed for visible foliar damage. The monitoring program is completed in conjunction with the MOECC and samples are obtained from locations adjacent to PHCF and throughout the surrounding community. Program changes, where implemented, are primarily based on MOECC recommendations.

The vegetation sampling program was modified in 2017, including notable changes in the sampling approach as well as number and placement of monitoring locations. Sampling locations were standardized to Manitoba maple locations, clusters of trees were sampled as composite samples versus single location sampling, and locations were redistributed within the community based on Manitoba maple availability and placement.

The 2017 vegetation survey was completed on August 25. As typically observed, station fluoride results were well below the MOECC's Upper Limit of Normal (ULN) guideline of 35 ppm.

Figure 24 illustrates the mean vegetation survey results for 2013 through 2017. Note that the 2017 mean condition is not directly comparable to the 2013-2016 summary results due to the aforementioned monitoring program updates.

Figure 24



Discharge to Water

This section summarizes the PHCF liquid discharges and associated monitoring programs. Liquid discharge monitoring at the PHCF is divided into the following categories: Port Hope harbour water intake quality; liquid discharge monitoring; and sanitary sewage monitoring.

There are four types of point source discharges from the PHCF operations that are monitored on prescribed intervals: cooling water returns, sanitary sewage discharge, combined cooling water pre-treatment backwash (FBW) stream and storm sewer outlets.

The FBW stream consists of water use associated with travelling screen and downstream filter operations comprising the facility cooling water intake mechanical pre-treatment operations.

Most of the PHCF cooling water requirements are met by the facility cooling water intake, located at the entrance to the Port Hope harbour. The remaining cooling water requirements are met by municipal potable water. A once-through cooling water system is used. The cooling water system takings, operations and discharges are regulated by MOECC via a Permit to Take Water (PTTW) and an ECA.

The municipal sewage treatment plant processes the sanitary sewer discharges from PHCF, including numerous on-site and some off-site contributions. A portion of the sanitary sewage discharge from PHCF originates upstream of the facility, primarily from the municipal water treatment facility. The principal facility sources are standard domestic contributions from facility washrooms and showering facilities, as well as Powerhouse effluent such asboiler blowdown). All sanitary sewage sources merge into a common sanitary sewer line within PHCF prior to discharging to the municipal system.

A 2017 summary of select water quality data relating to the PHCF cooling water intake and discharges are shown in Table 30. The south cooling water intake (SCI), UF_6 plant + Building 2 cooling water return (UO_2N), and UO_2 plant cooling water return (UO_2S) have generally displayed consistent levels of uranium, fluoride, ammonia, nitrates and pH.

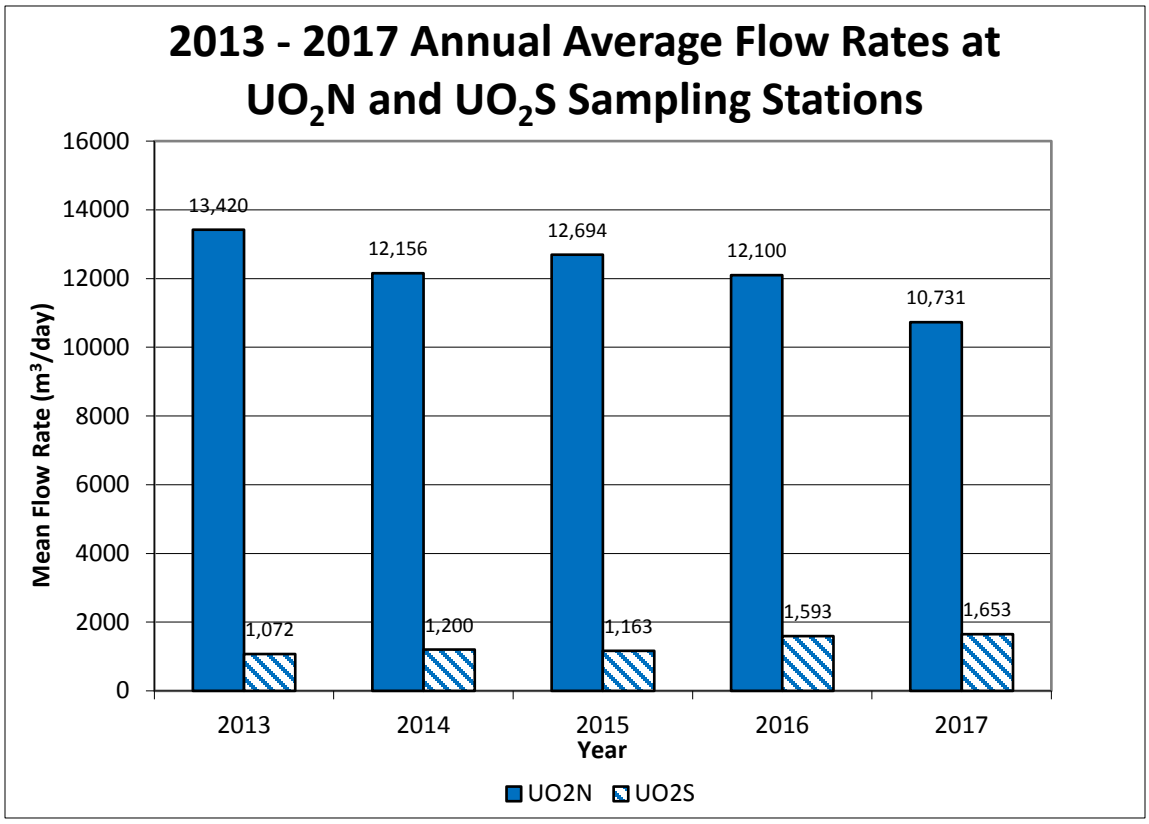
Table 30

Facility Water Quality Sampling Program										
Source	**Uranium (µg U/L)**		**Fluoride (mg F/L)**		**Ammonia + Ammonium (mg N/L)**		**Nitrate (mg N/L)**		**pH**	
	Avg	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Min**	**Max**
SCI	3.3	8.8	0.19	0.29	0.18	0.40	1.0	2.2	7.31	8.56
UO_2N	3.2	8.6	0.19	0.33	0.14	0.44	1.0	2.2	7.31	8.43
UO_2S	3.3	8.5	-	-	0.14	0.42	1.0	2.2	7.37	8.47
Note: Values are reported below the method detection limit, where applicable, to satisfy MOECC reporting requirements - indicates the parameter is not monitored										
SCI - Cooling Water Intake UO_2N – UF_6 plant + Building 2 Cooling Water Return UO_2S - UO_2 Plant Cooling Water Return										

Flow is monitored at both Port Hope harbour cooling water discharge points upstream of the respective discharges in accordance with MOECC MISA and ECA requirements. Flow rates observed at the UO_2N and UO_2S sampling points from 2013 through 2017 are presented in Figure 25.

In 2017, the average daily flow rates at the UO_2N and UO_2S sampling points were 10,731 m^3/day and 1,653 m^3/day respectively. Due to flow instrument operational issues experienced at UO_2N in the fourth quarter, UO_2N daily discharge volumes were estimated from early November through to the end of the calendar year from upstream flow instrument installation recordings. The instrument in question is targeted for replacement in 2018.

Figure 25



ECA 4998-9CKL7F requires specific sampling of the SCI, filtered cooling water supply (SCI-A), FBW and cooling water discharge points (UO_2N and UO_2S). The ECA requires the MISA cooling water sampling and flow monitoring requirements to be satisfied in addition to stipulating added sampling requirements.

Overviews of ECA monitoring results with comparison to cooling water quality objectives and limits, among other items, are compiled in a separate annual performance report to fulfill additional CofA requirements. Annual performance reports are submitted to the MOECC within 90 days of the end of each calendar year.

The combined PHCF sanitary sewer return is sampled on a continuous basis using daily composite sampling. Table 31 summarizes the annual average uranium concentration and uranium loadings to the Municipality of Port Hope's sanitary sewer system. Uranium loadings are also illustrated in Figure 26.

In 2016 and early 2017, as part of the relicensing process, a daily sanitary sewer discharge action level of 100 µg/L (24-hour composite sample) and a monthly mean release limit of 275 µg/L were developed and accepted. The sanitary sewer discharge action level was exceeded on multiple occasions between May and October 2017,

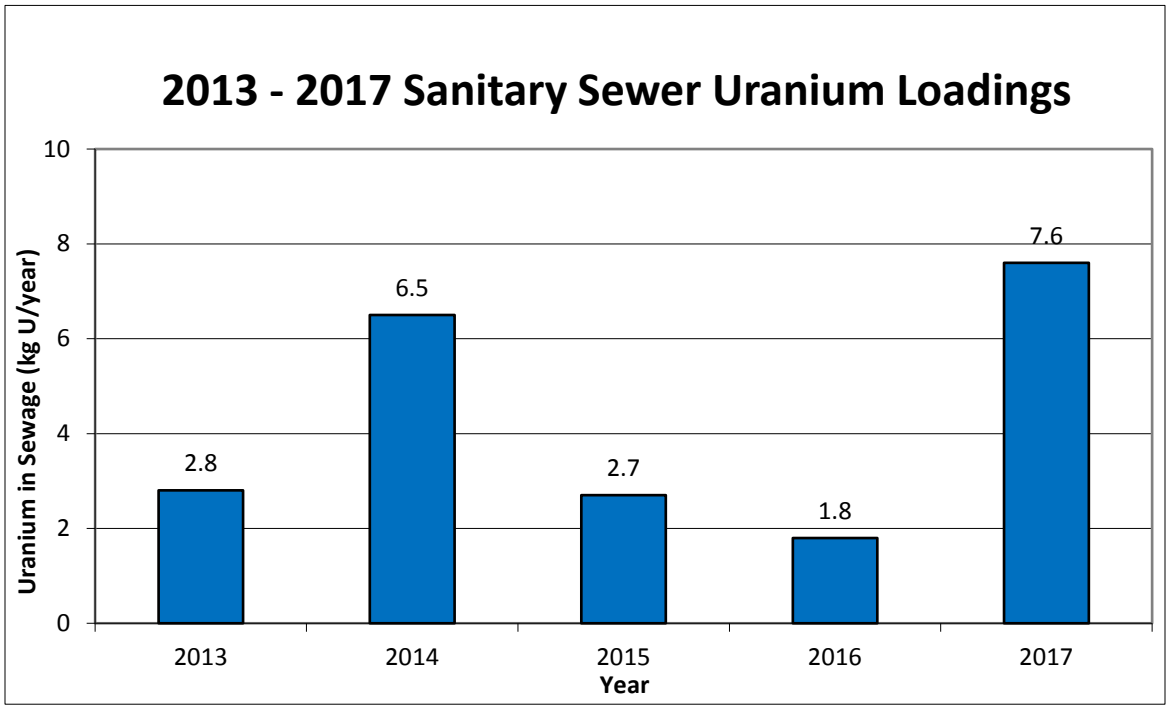
attributed to groundwater infiltration associated with elevated Lake Ontario levels and significant precipitation events. An exceedance of an action level does not pose a risk to people or the environment.

The mean sanitary sewer discharge rates observed between 2015 and 2017 decreased significantly from 2014. The offset in flow is directly attributable to the 2014 implementation of Powerhouse effluent pH control system that displaced the need for effluent dilution. The mean uranium concentration and uranium loadings increased significantly in 2017 in relation to unusually high Lake Ontario water elevations and associated groundwater infiltration to the sanitary sewer system.

Table 31

2013 – 2017 Sanitary Sewer Discharges			
Period	**Annual Average Flow (m^3/day)**	**Annual Average Uranium Concentration (µg/L)**	**Uranium Loadings (kg/year)**
2013	826	10	2.8
2014	1,020	17	6.5
2015	379	19	2.7
2016	298	17	1.8
2017	378	44	7.6

Figure 26



Harbour Water Supply Monitoring

The ambient water quality program is concerned with monitoring the potential impacts of aqueous discharges into the receiving waters. Discharges to the harbour are from the point discharges outlined previously as well as groundwater flow through the facility. Given its proximity to the harbour outlet, the cooling water intake provides a reasonable indication of the overall water quality in the Port Hope harbour.

Water quality in the Port Hope harbour is sampled on a continuous basis with the collection of daily composite samples from the facility's cooling water intake (SCI). Table 32 provides a summary of select water quality parameters results for the SCI. The 2017 harbour water quality results were generally comparable to 2013 through 2016 results and minor variations are typically attributable to seasonal variations in surface water quality.

Note that the 2014 maximum fluoride result should not be compared to the baseline monitoring data due to its association with the September 2014 UF_6 plant process effluent release to the Port Hope harbour. Moreover, the 2017 average and maximum fluoride results have increased over the previous five year period. Despite the average and maximum fluoride values exceeding the generic CCME water quality guideline of 0.12 mg/L, fluoride results were well below the CCME aquatic biota toxicity benchmark of 11.5 mg/L from which the generic guideline value is derived.

Table 32

2013 - 2017 Harbour Water Quality – Cooling Water Intake						
Parameter	**Value**	**2013**	**2014**	**2015**	**2016**	**2017**
Uranium (µg U/L)	Average	3.3	3.3	2.9	2.6	3.3
	Maximum	8.3	7.6	6.6	10	8.8
Fluoride (mg F/L)	Average	0.10	0.11	0.13	0.15	0.19
	Maximum	0.18	0.39	0.17	0.22	0.29
Nitrate (mg N/L)	Average	0.84	0.86	0.89	0.85	1.0
	Maximum	1.6	1.5	1.7	1.6	2.2
Ammonia +Ammonium (mg N/L)	Average	0.11	0.23	0.20	0.16	0.18
	Maximum	0.35	0.52	0.66	0.58	0.40
Note :Values reported below the method detection limit where applicable to satisfy MOECC reporting requirements						

The results of the harbour water quality for 2013 through 2017 are also illustrated in Figure 27 through to Figure 30. In accordance with the above feedback, the 2014

maximum fluoride result illustrated on Figure 28 should not be compared to the baseline monitoring data.

Figure 27

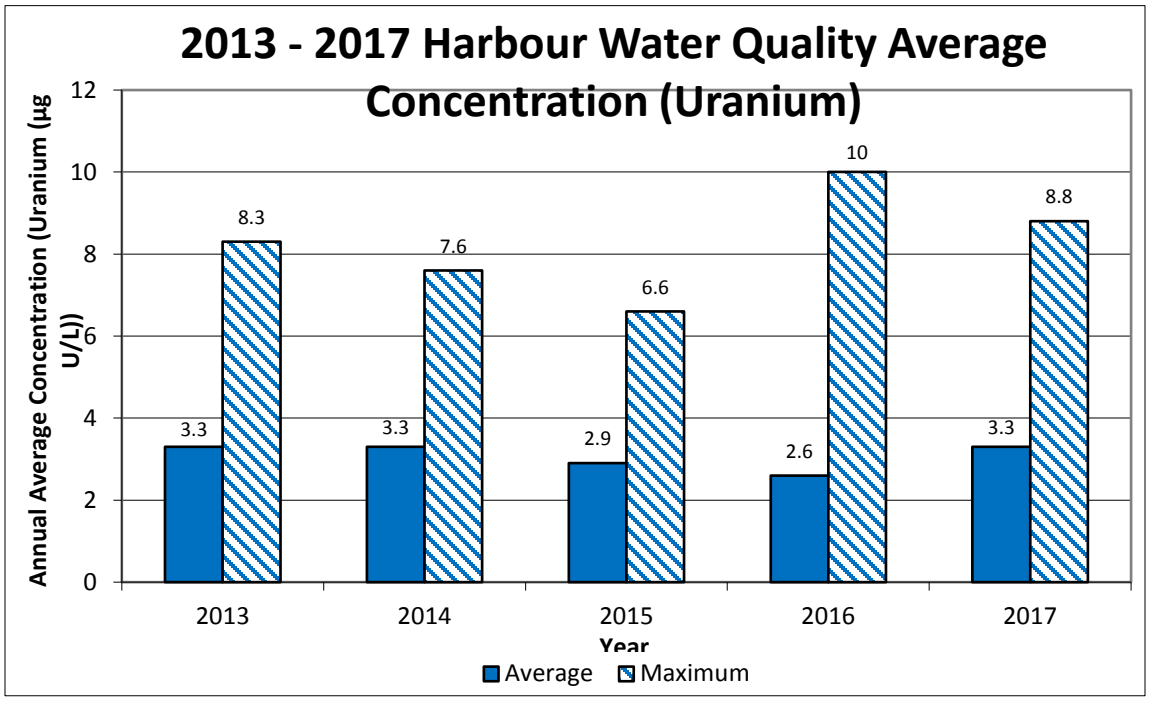


Figure 28

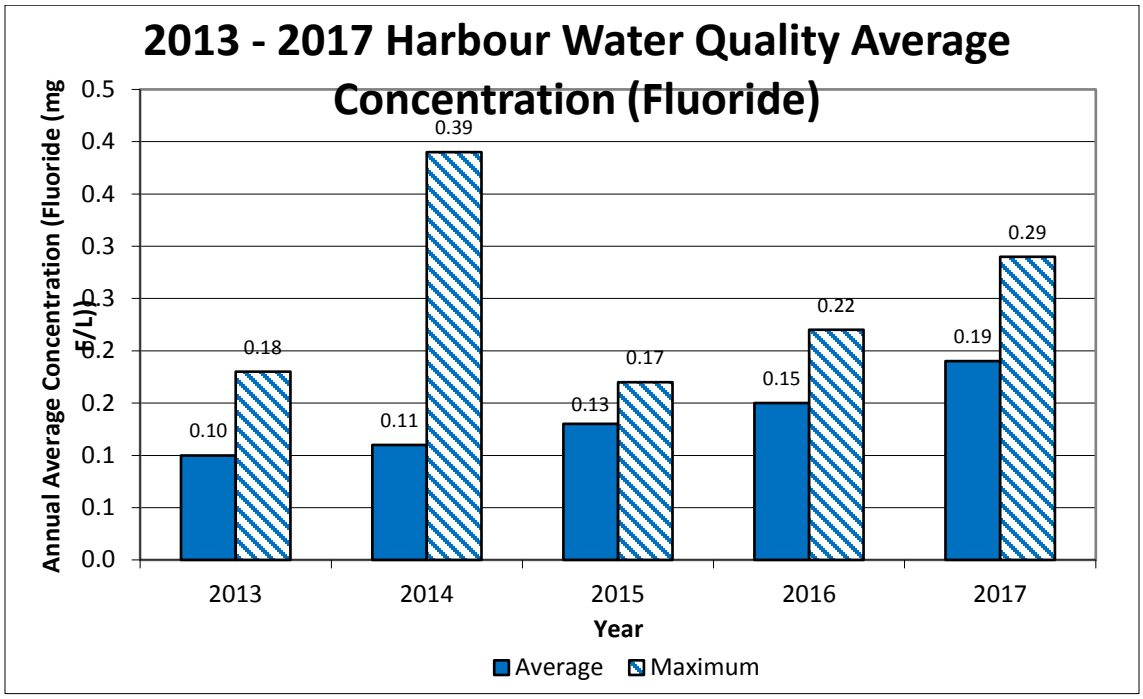


Figure 29

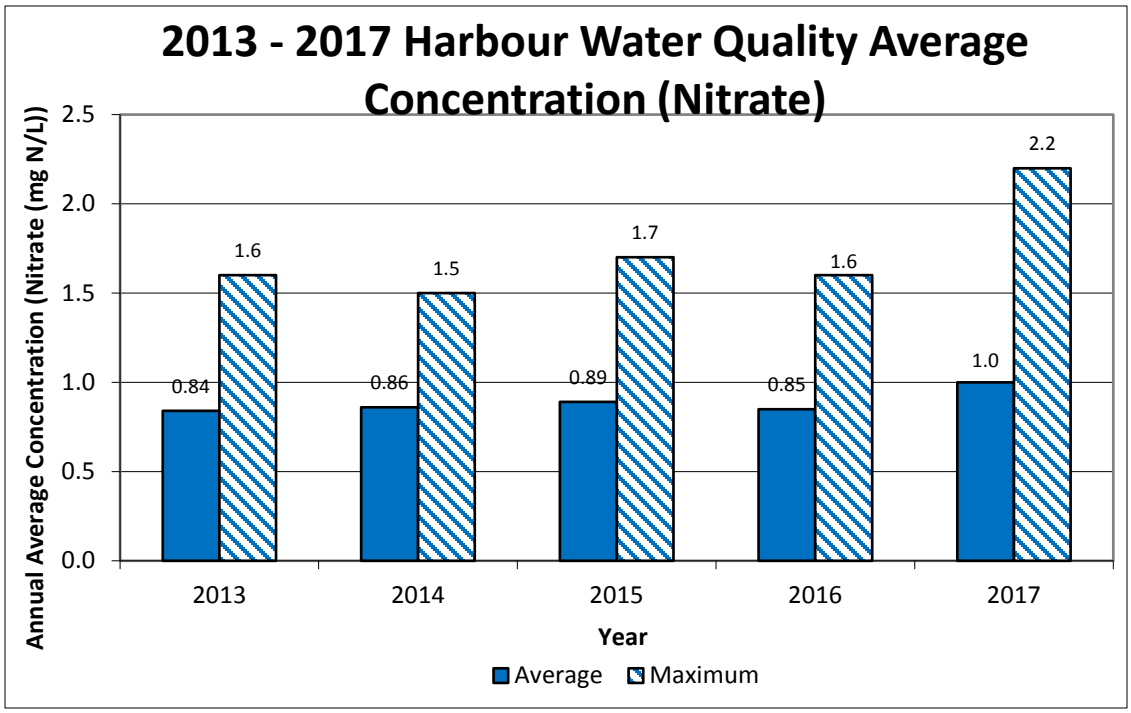
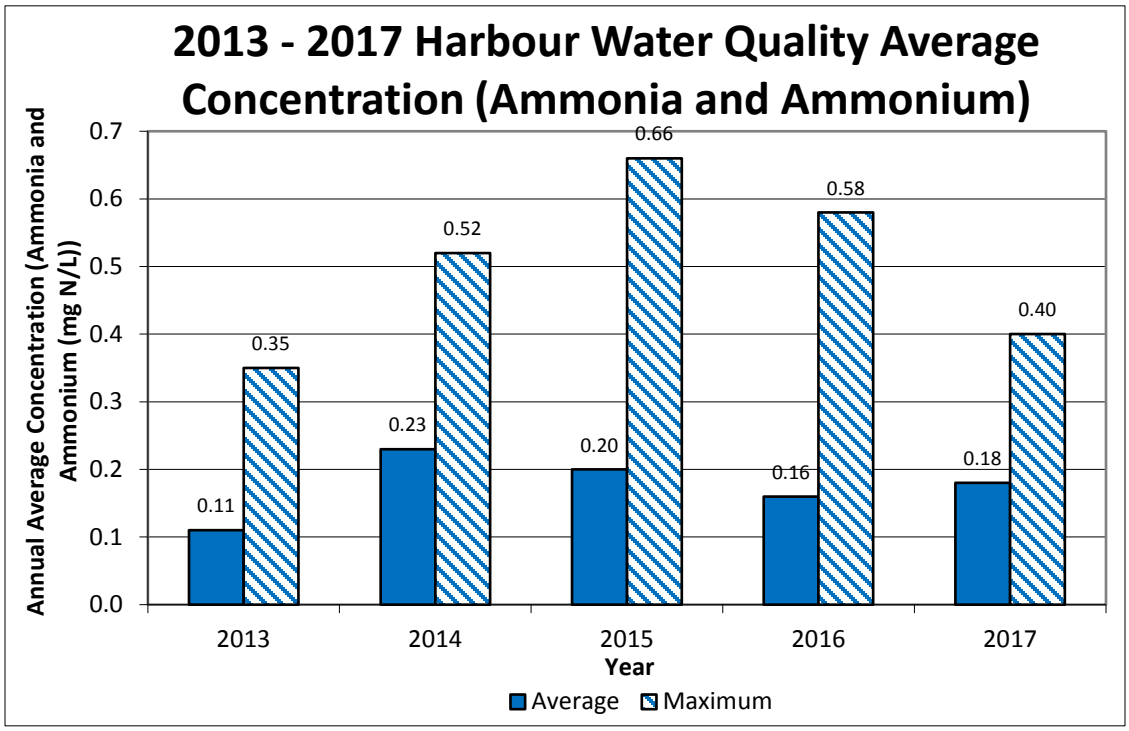


Figure 30



Storm Water Monitoring

A revised stormwater monitoring program was implemented in 2012. The stormwater monitoring program is carried out on a semi-annual schedule, targeted for the spring and fall seasons. Targeted precipitation events are 10+ mm forecasts, preceded by 48 hours of dry weather.

Grab samples are obtained from up to six storm sewer outlets immediately upstream of the harbour at catch basin/manhole access points, subject to availability of runoff (i.e. flowing conditions) and a lack of surface water influence (i.e. harbour water surging into the storm sewer works).

It is important to note that in the current storm sewer works operating condition, stormwater quality may be highly variable and influenced by factors such as precipitation event duration and intensity.

Table 33 provides a summary of stormwater quality parameters results for the 2017 calendar year. Outlet 8 is typically dry due to its catchment area comprising of granular cover. Note as well that at the time of the November sampling event, storm sewer outlet runoff was generally marginal.

Despite observation of large variances in stormwater quality for select parameters, all individual grab samples easily passed their respective *Daphnia magna* and rainbow trout acute lethality single concentrations tests (100% effluent).

Table 33

Sample Location	Date	Uranium	Fluoride	Ammonia + Ammonium	Nitrate	Arsenic	Acute lethality	
							Daphnia magna	Rainbow trout
		mg/L	mg/L	as N mg/L	as N mg/L	mg/L	% mortality	% mortality
Outlet 2	6-Apr-17	0.531	0.19	0.2	< 0.6	0.0424	0.0	0.0
	18-Nov-17	1.52	0.59	< 0.1	1.53	0.108	0.0	0.0
Outlet 6	6-Apr-17	0.0393	0.16	0.1	< 0.6	0.0010	0.0	0.0
	18-Nov-17	0.134	0.63	< 0.1	1.13	0.0017	0.0	0.0
Outlet 8	No samples - no flow during sampling events							
Outlet 11	6-Apr-17	0.0931	0.14	< 0.1	< 0.6	0.0028	0.0	0.0
	18-Nov-17	No sample - no flow during sampling event					0.0	0.0
Outlet 13	6-Apr-17	0.0785	0.11	0.2	< 0.6	0.0009	0.0	0.0
	18-Nov-17	0.835	0.30	0.2	1.91	0.0030	0.0	10
Outlet 15	6-Apr-17	0.0434	0.14	0.2	< 0.6	0.0047	0.0	0.0
	18-Nov-17	0.124	0.12	0.5	3.44	0.0016	0.0	10

Groundwater Monitoring

The PHCF long-term groundwater monitoring program includes groundwater level monitoring and groundwater sampling at select wells. Groundwater level monitoring is completed on a quarterly or annual basis.

Groundwater is sampled under three separate schedules: monthly sampling of the operating treatment wells; quarterly sampling of overburden wells; and annual sampling of bedrock wells. Areas of focus include the UF_6 plant area (east and south); the waste recovery building/warehouse areas; the former UF_6 plant area; and the UO_2 plant area.

Recovery of contaminated groundwater for treatment from the east and south sides of the UF_6 plant began in the first quarter 2008, while pumping well locations between the UF_6 plant and the harbour, as well as one pumping well to the east of the UO_2 plant (TW2A), were on-line as of the fourth quarter 2008.

Four additional pumping wells commenced operation during the fourth quarter of 2011. These installations are located to the east of the former UF_6 plant (TW27A and TW27B) and to the east/southeast of the UO_2 plant (TW2B and TW2C).

Twelve pumping wells were in operation in during the 2017 calendar year. Pumping well TW7 to the south of the UF_6 plant is no longer operated under baseline conditions.

Figure 31 illustrates the groundwater monitoring program well locations and associated general groundwater flow directions.

Figure 31 – Onsite Well Locations

2.3.4 Emergency Management and Response

This safety and control area covers emergency plans and emergency preparedness programs. These procedures must exist for emergencies and for non-routine conditions. This also includes the fire protection program and any results of emergency exercise participation.

The fire protection and security group has focused efforts to refine training to site specific chemicals, needs and responses for both emergency and medical requirements.

This activity and associated records are subject to various audits and are incorporated into the PHCF annual management review.

There were a number of internal drills and exercises conducted, which tested the effectiveness of the site and the emergency response organization. The following is a general list of the internal drills and activities in which the emergency response organization participated in 2017:

- Hazardous materials response drills, to include HF, PCB, ammonia, nitric acid and hydrogen fire response;
- Flood diversion drills;
- Fire alarm response drills;
- Medical assistance drills;
- Lockdown drills;
- Building evacuation drills; and,
- ERT recall drills.

All drills and exercises are documented and deficiencies are tracked to ensure that appropriate corrective actions are taken.

The emergency response and training assistance agreement between Cameco and the Municipality of Port Hope, continues to ensure that the two response organizations are provided the opportunity to train together in order 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 (PHFES) with the necessary equipment and training to effectively respond to emergencies at the PHCF.

Cameco and PHFES continue to find opportunities to bring the organizations together for training and other activities. Additionally, Cameco has supported the PHFES for responses in the municipality and for non-emergency related initiatives. An example of the interactions in 2017 included: On November 21 an ERT joint exercise was conducted with Port Hope Fire and Emergency Services to extinguish a mock 35,000 gallon grade 2 bunker fuel fire.

Emergency preparedness and response training is provided on an ongoing basis to ensure that responders have the knowledge and skills necessary to provide for an effective emergency response. In 2017, there were 2892 hours of ERT training conducted with 96.8% of responders successfully meeting the training criteria and 628 hours of medical training with 90.4% meeting the training criteria.

The PHCF Fire Protection program (FPP) has been designed to promote fire safety within the site and minimize the likelihood and frequency of fire as well as the potential impact on the health and safety of the employees, contractors, the public, the environment and Cameco's assets and continuity of operations. In order to confirm the effectiveness of the Fire Protection Program, the following third party verifications were conducted in 2017:

- Annual Facility Condition Inspection;
- Fire Hazard Analysis and Code Compliance Reviews for buildings other than the UO_2 and UF_6 plant;
- Annual Sprinkler Inspections Testing and Maintenance; and
- Annual Alarm Inspection and Verification.

The third party verifications listed above are documented and deficiencies are tracked to ensure that appropriate corrective actions are taken.

2.3.5 Waste and By-product Management

This safety and control area covers internal waste and by-product-related programs which form part of the facility's operations, up to the point where the waste is removed from the facility to a separate waste and by-product management facility. This also covers the ongoing decontamination and planning for decommissioning activities.

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

Wastes at the facility are segregated at the point of generation into contaminated and non-contaminated. Non-contaminated waste is either recycled or transferred to a suitable facility. Contaminated waste is stored in appropriate containers pending assessment of recycling or disposal options.

In 2017, a total of 59.1 tonnes of non-contaminated wastes were sent to a local landfill. A total of 54.1 tonnes of non-contaminated materials were sent to a recycling facility for recovery.

PHCF produces two by-products at the facility. These include ammonium nitrate which is sold to a local fertilizer company and fluoride product which is sent for uranium recovery at a licensed facility. The amount of ammonium nitrate recycled in 2017 was 2,075 m^3. A total of 2,316 drums (267,624 kg) of fluoride product were generated in 2017.

In 2017, PHCF generated 304 totes of contaminated combustible materials (CCM) and shipped the totes to BRR for incineration. During the same period a total of 59.6 tonnes of contaminated non-combustible materials (CNC) were generated.

PHCF recycled 98,820 kg of metal after decontamination to free release criteria.

2.3.6 Nuclear Security

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

PHCF maintains a comprehensive security program which meets the requirements of the General Nuclear Safety and Control Regulations, the Nuclear Security Regulations and other CNSC requirements.

The security plan provides the basis for security operations at the facility and identifies the systems and processes in place to meet security program objectives; accordingly, this document is considered prescribed information and is subject to the requirements of the General Nuclear Safety and Control Regulations.

PHCF ensures that security operations and procedures are reviewed (and revised as needed) in order to maintain compliance with General Nuclear Safety and Control Regulations, the Nuclear Security Regulations and other CNSC requirements.

2.3.7 Safeguards and Non-proliferation

This safety and control area covers the programs required for the successful implementation of the obligations arising from the Canada/IAEA Safeguards and Non-proliferation Agreement.

The PHCF participated in four Safeguard inspections/activities in 2017:

- A Design Information Verification (DIV) was completed April 24 to 28, 2017. During this activity four drums of material identified as cell sludge were found to be UF_4.
- A Short Notice Random Inspection was completed June 1 to 2, 2017.
- A Physical Inventory Verification (PIV) was held between September 18 and 29. All site inventory was verified and a number of DIV activities were carried out.
- A Short Notice Random Inspection was held between December 18 and 29.

2.3.8 Packaging and Transport of Nuclear Substances

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

Uranium dioxide (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 Japan, South Korea, Romania and Argentina. 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 CNSC *Packaging and Transport of Nuclear Substance Regulations*.

Uranium hexafluoride (UF_6) is produced and transported in Type H(M) and H(U) cylinders certified by the CNSC by road or marine from the PHCF to the USA or overseas, including but not limited to, the United Kingdom, France, Germany, Holland and Japan.

In addition to UO_2 and UF_6, uranium scraps and by-products are transported by road from the PHCF to Cameco's Key Lake operation or to the USA for uranium recovery.

There were no reportable transportation events that occurred at the PHCF in 2017.

3.0 OTHER MATTERS OF REGULATORY INTEREST

3.1.1 Public Information Program

In 2017, PHCF continued to meet the requirements of CNSC RD/GD 99.3, Public Information and Disclosure programs.

The communications team for Cameco's fuel services division is comprised of a director of public and government affairs, two communication specialists and a community relations liaison. The divisional communications team remains a part of Cameco's recently renamed corporate Sustainability and Stakeholder relations department.

Cameco has retained outside expertise for the past 14 years to measure public opinion in Port Hope to help determine the effectiveness of its public information program. The final report of the 2017 public opinion research conducted for Cameco by Fast Consulting was posted on Cameco's FSD website in July 2017. More than 400 Port Hope residents were randomly contacted by telephone and asked to respond to a series of questions about their perception of Cameco's operations in the community.

Among the key findings:

- The large majority (86%) of respondents support the continuation of Cameco's operations in Port Hope approximately one half (49%) who are 'strongly supportive'.
- Eight out of ten (85%) residents agree that Cameco does everything possible to protect people and the environment.
- The majority (70%) think Cameco makes information about its operations in Port Hope readily available.
- 87% of residents agree that Port Hope is a safe and healthy place to live.
- A large majority (87%) agree that the Cameco's Vision in Motion plan to renew, clean up and modernize the Port Hope conversion facility is a step in the right direction and a benefit for the community.

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. Results in most categories were consistent with surveys conducted over the past several years. The summary report can be found on our website.

Local media coverage of Cameco was light but generally positive in tone during 2017. Most media attention continues to focus on Cameco`s sponsorship of and employee participation in local community events as well as two business announcements.

Since establishing Cameco FSD's social media presence in 2013, use of both Facebook and Twitter have helped to augment Cameco's public information program and support efforts to engage youth, community members and employees. These channels are used to share information about community investments, upcoming events and activities, employee volunteer activities and other matters of potential public interest.

As social media outreach continues to mature. The number of "followers" who have "liked" the Cameco Ontario Facebook page increased 21% this year to 411 and our Twitter feed has grown by 26% in 2017 with 171 followers. With shares and retweets, several posts garnered larger audiences and resulted in over double the views and retweets of our posts.

Cameco also continued to closely monitor social media channels focused on Port Hope, especially Facebook pages dedicated to local political issues such as Port Hope Politics, Friends of the Port Hope East Beach, Restore the Port Hope West Beach. Within these pages, there was some focus on Cameco in 2017 and posts were dedicated to the cleanup of the conversion facility, the Centre Pier, and the proposed municipal roadway to the west and south of the conversion facility's property lines. These posts were more discussion-based and no questions were posed to Cameco.

Since 2006, Cameco's FSD has had its own dedicated website to supplement information found on the corporate website (www.cameco.com). On March 22, Cameco Fuel Services Division was excited to launch their new community website, camecofuel.com. The new community site aligns visually with Cameco Corporation's various other community websites and is more user-friendly with the ability to view on various devices such as smart phones, tablets and desktop computers. Information from camecoporthope.com was transferred over to the new website.

The camecofuel.com website continued to serve as a valuable tool to make information about the company easily accessible to members of the public. Quarterly environmental status reports, basic information about reportable incidents, articles on matters of public interest, external newsletter, news releases and announcements as well as presentations from community forums were posted to the new site.

Information regarding eight environmental or operational incidents were posted to the website in 2017. There were no follow-up inquiries from either members of the public or the media.

Total page views on our camecofuel.com website garnered 22,511 unique page views in 2017. The landing page for PHCF was the most frequently visited of the three FSD licensed facilities with more than 2,800 unique views; almost double compared to CFM and BRR.

Cameco values the effective working relationship it has built with the Municipality of Port Hope (MPH) over the past several years. Cameco provides summaries of our quarterly environmental reporting to the Port Hope Council and offers to appear at council meetings in order to respond to any questions that might emerge from the quarterly results of the environmental monitoring program.

Cameco held an open community forum in November of 2017. Public forums is one way Cameco reaches its external local stakeholders, and brings common information to interested parties. Question and answer sessions involving company representatives as well as guest speakers are a staple of the 11 year-old process. Participants have the opportunity to provide either written or oral questions.

Cameco promotes the forums in several ways. A database including more than 300 names has been developed. Individuals and organizations included in the database have specifically requested to be kept informed of Cameco's public events. Among those included are residents of Port Hope; municipal council members; local businesses and business organizations; special interest groups; non-governmental organizations; local and regional media; community service organizations; and other interested parties. Cameco also extends an invitation for every forum to the five First Nations bands in closest proximity to Port Hope. These are the Alderville First Nation, the Hiawatha First Nation, Mississaugas of Scugog Island, Mohawks of the Bay of Quinte and the Curve Lake First Nation. In addition, Cameco also sends a written invitation to the Metis Nation of Ontario.

To further encourage attendance at the forums, Cameco produces radio and print advertisements, posts an advisory on the FSD website and on its social media channels to ensure that as many people as possible are made aware of the event. Presentations made at the forums are posted on Cameco's community website after the forum has happened.

Since its inception in 2006, there has been a significant decline in attendance and interest at these forums despite polling results indicating that 76% of residents are aware these exist.

In 2017, Cameco hosted two media events to announce new contracts and educate people on Cameco's involvement in the world's supply of Coblat-60 to produce medical isotopes. These events were attended by Northumberland-Peterborough South Member of Parliament and Parliamentary Secretary to the Minister of Natural Resources, Kim Rudd; Member of Provincial Parliament, Lou Rinaldi as well as the Mayor of Cobourg, the Mayor of Port Hope, other dignitaries, and more than four media outlets including CHEX TV and Northumberland News.

In 2017 we had relatively few email and phone inquiries with the majority of them from individuals seeking either employment, requesting to do business with Cameco or related to community investment. Only two emails were received through our community website "Contact Us" page; one regarding the polling questions and the other related to street sweeper working in close proximity to the Cameco conversion facility fence line. Both emails were given a reply in a timely manner and no follow up was required.

Several hundred visitors were welcomed by more than 25 Cameco employees at the company's information booth at the 2017 Port Hope Fair. This was the eleventh year, Cameco had a presence at the fair. Cameco staffed a 10 x 20 booth inside the Fall Fair which included a kids table with colouring sheets, a charging station for cell phones, and two televisions. Of interest to the public who attended, Cameco's televisions played a recording of the Discovery Channel's television program "How it's Made" which was televised nationally in late 2016 and featured Cameco's processes. As well, Cameco used its booth to display nuclear and Cameco facts as well as updates on the Vision in Motion project and its scheduled activities. Employee volunteers were on hand to welcome fair-goers and address questions. Most questions received focused on general nuclear fuel/power.

In May, Cameco held its second annual career day, however for the first time the event was held at two local schools which Port Hope students attend - Port Hope High School and St. Mary's Catholic Secondary School. Approximately 25 employees holding a range of positions in the organization manned tables in the school's gymnasiums to speak with students about their own personal education, training and work experience. Students in grades nine to 12 attended.

Cameco provides tours of PHCF to a number of groups and individuals each year. Although most involve customers, nuclear industry representatives and regulators, some tours were provided to members of the public in 2017. They included:

- World Nuclear Fuel Cycle
- Canadian Nuclear Workers Council
- Grade nine students participating in "Take Your Kids to Work Day"
- Swedish politicians
- Professor from Royal Roads University
- Eastdale C.V.I. students

Cameco continued to develop partnerships with and provide financial and volunteer support to a number of events and organizations in Port Hope and the surrounding area.

Among the organizations that received from financial and/or volunteer support in 2017:

- Northumberland United Way;
- YMCA Northumberland's Swim to Survive Program;
- Habitat for Humanity Northumberland;
- Fare Share Food Bank;
- Towns of Cobourg and Port Hope through Canada Day celebrations
- Float Your Fanny Down the Ganny;
- Junior Achievement;
- Scientists in School;
- Northumberland Food for Thought;

Our employees remain our most trusted resource for information and we work to engage with the community as much as possible. In 2017, more than 300 Cameco employees volunteered at company-sponsored events in Northumberland County.

3.1.2 Site - Specific

The nuclear criticality safety program at the PHCF follows the criticality control principles as described in Radiation Protection Program Manual (section 8). In summary, processing of any amount of enriched material at the PHCF is governed by a criticality control committee (CCC) as described in the revised Nuclear Criticality Safety Program Manual. There were no processing activities of enriched material conducted on site in 2017.

Cameco has an accepted Preliminary Decommissioning Plan (PDP) and financial guarantee for the PHCF.

The PHCF met all other site-specific reporting requirements.

3.1.3 Improvement Plans and Future Outlook

The Vision in Motion project is a significant undertaking at PHCF with the key objective of transferring Cameco Decommissioning Waste to a long-term waste management facility (LTWMF) being constructed in Port Hope by the Port Hope Area Initiative. The materials to be transferred include buildings, equipment, contaminated soils, and stored wastes. The project will also implement building and infrastructure modifications needed to support the remediation effort.

The Vision in Motion project is being executed in accordance with standard Major Projects policies and procedures for project delivery. The project also conforms to PHCF site policies and procedures for activities carried out at PHCF.

In 2017 key activities included the initiation of detailed design; repackaging of stored wastes in preparation for transferring them to the LTWMF (executed using PHCF site resources during the Super CUP campaign); as well as asbestos abatement and electrical upgrades in the former UF_6 plant to prepare it for future equipment removal and demolition activities. The project was included in a safety audit carried out by Major Projects and resulting corrective actions have been implemented.

The 2017 Super CUP campaign in support of VIM was executed from July through September. The campaign resulted in the safe repackaging of accumulated wastes that are in storage in Building 43 at the Centre Pier and the first phase of activities in the tower of Building 27 to prepare it for future equipment removal. During the campaign over 4,200 drums of waste materials were repackaged into supersacs, which are being stored at the Centre Pier pending transfer to the LTWMF in 2018.

The Ontario Spills Action Centre (SAC) was contacted and the CNSC was notified six times during the Super CUP campaign (reference # 5214-AR6JW4) to report ambient station high volume air sampler exceedances of total suspended particulate (TSP), which is above the ECCC and MOECC 120 ug/m3 TSP dust criteria for visibility. PHCF operated seven hi-vols in total during the Super CUP campaign, including three that were set up specifically for the campaign. The uranium levels in the samples were not elevated indicating the particulate was due to dry conditions.

After the first administration level exceedance, dust cleanup activities to prevent future exceedances occurred including cleaning up excess road and sand debris that had accumulated on the curb adjacent to the West Fence hi-vol station. After the first action level exceedance, dust mitigation activities were increased to include suspension of all Super CUP transportation activities until further TSP results were assessed, watering and sweeping the roadway on site by gate 11, and watering and sweeping Eldorado Place. With additional TSP exceedances, pylons were placed in front of the West Fence

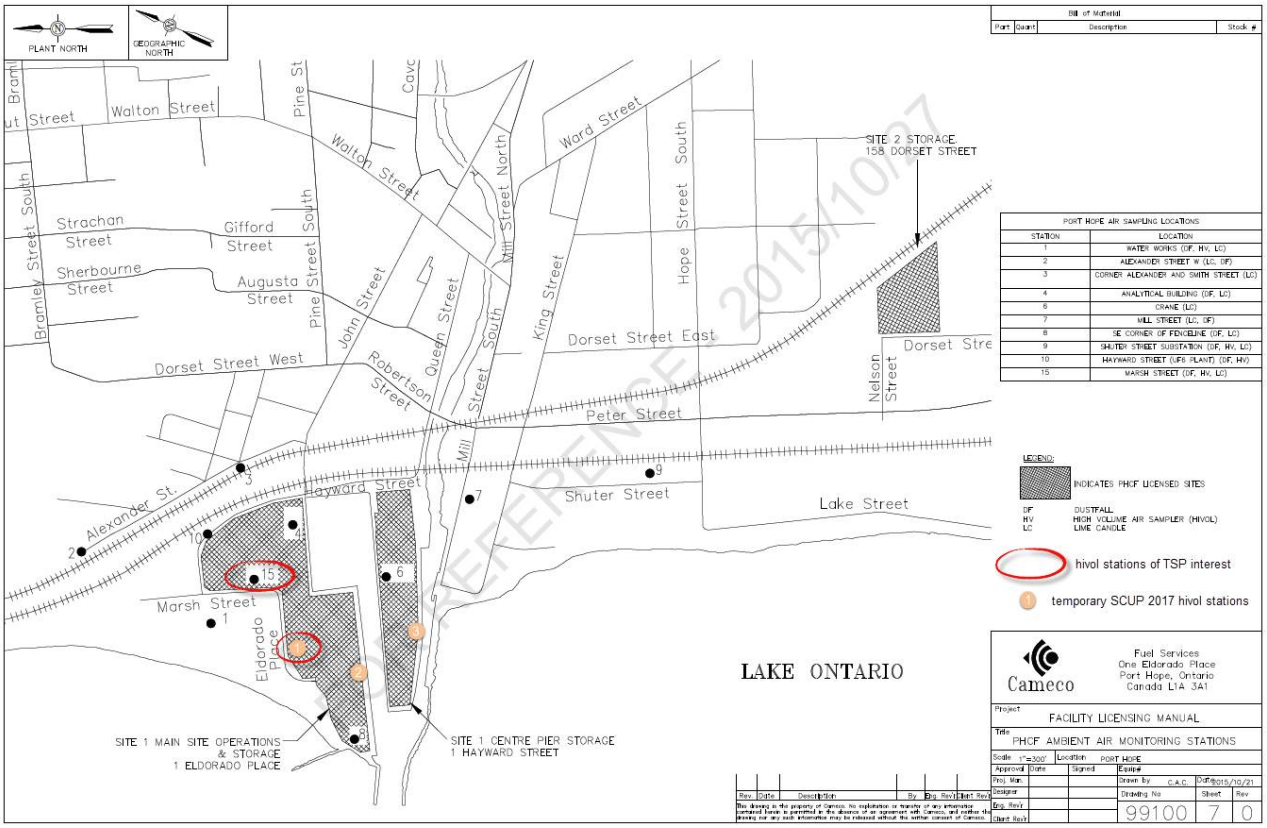
hi-vol station to prevent all vehicles from parking in front of the station to prevent stirring up dust when releasing breaks. The dry sweeping of Eldorado Place roadway was discontinued near the end of the quarter as it appeared it may have been stirring up more debris. Watering of Eldorado Place continued until the SuperCUP activities were complete.

Hi-vol results during the campaign, exceeding the PHCF administrative control level of 100 µg TSP/ m^3 are presented in Table 34. A map indicating the routine and temporary Super CUP ambient air monitoring stations, as well as the two hi-vol stations observing elevated results, is presented in Figure 32.

Table 34

Date	Hi-Vol Station (#)	TSP (>100 µg/m^3)	Reportable (>120 µg/m^3)
August 30, 2017	SCUP PHCF West (1)	112	
September 6, 2017	SCUP PHCF West (1)	101	
September 11, 2017	SCUP PHCF West (1)	134	Yes
September 12, 2017	SCUP PHCF West (1)	190	Yes
September 12, 2017	Marsh Street (15)	101	
September 14, 2017	SCUP PHCF West (1)	121	Yes
September 15, 2017	SCUP PHCF West (1)	204	Yes
September 16, 2017	SCUP PHCF West (1)	127	Yes
September 22, 2017	Marsh Street (15)	113	
September 23, 2017	SCUP PHCF West (1)	101	
September 25, 2017	Marsh Street (15)	151	Yes
September 26, 2017	Marsh Street (15)	103	

Figure 32



Vision in Motion detailed design activities continued through to the end of the year and will continue in 2018 as part of a rolling wave approach to detailing future work.

The Cameco/Canadian Nuclear Laboratories (CNL) working groups continued to coordinate future activities and detailed design work. The CNL schedule for the Long Term Waste Management Facility (LTWMF) to be ready to receive off-site wastes was delayed to approximately March 2018. Resulting adjustments required to the schedule for removal of the temporary storage site from the Centre Pier will drive a need for concurrent Cameco and CNL activities on the Centre Pier and a revision to the work island is being developed to mitigate delays. Cameco and CNL met with CNL contractors to begin co-ordination of waste transfers to the LTWMF. Legal agreements with CNL to support the temporary storage site removal work, waste acceptance criteria and shared work continue to be in-progress.

Per the Supplemental Environmental Monitoring Plan, proposed locations for the additional hi-vol stations were agreed to with the Municipality of Port Hope. Cameco

initiated design work for the agreed locations and an analysis of radionuclides in hi-vol dust samples was completed to provide a good environmental monitoring baseline.

In follow-up to written requests to the Municipality of Port Hope (MPH) to move forward with the design of the Choate Street extension per the Road Construction Agreement and an in-camera meeting with municipal council in August, in October MPH accepted the required design deposit and initiated preparation of a tender for the design and municipal environmental assessment. Purchase of the former waterworks property from MPH was completed in November.

Cameco is not planning any other major changes in 2018 that could require the Commission's approval.

3.1.4 Safety Performance Objectives for Following Year

There are no major changes planned in 2018 that could require Commission approval.

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

4.0 CONCLUDING REMARKS

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

In 2016, PHCF did not exceed any CNSC regulatory limits. As a result of the effective programs, plans and procedures in place, the PHCF was able to maintain individual radiation exposures well below all regulatory dose limits. In addition, environmental emissions continued to be controlled to levels that are a fraction of the regulatory limits, and public radiation exposures are also well below the regulatory limits.

Cameco's relationship with our neighboring communities remains strong and we are committed to maintaining these strong relationships.