2022 Annual Compliance Monitoring
&
Operational Performance Report

Reporting Period January 1 – December 31, 2022

Port Hope Conversion Facility
Operating Licence
FFOL-3631.00/2027

One Eldorado Place
Port Hope, Ontario
L1A 3A1

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

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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 350 workers. In 2022, the facility operated under fuel facility 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 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.

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

A wide range of mandatory legislative and other job specific training activities were also carried out in 2022. 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 2022 that negatively 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 2022, there were no significant changes to the Process and Design Change Control process.

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.

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 2022 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.

There were no significant changes to the Environmental Management Program in 2022.

PHCF maintained its emergency preparedness and response program while looking for opportunities to further improve. Activities and associated records are subject to various audits and are incorporated into the PHCF annual management review.

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 September 2022.

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 seven safeguard inspections/activities in 2022.

The scope of transportation activities at the PHCF includes the transport of Class 7 radioactive materials outlined in the *Transportation of Dangerous Goods Act*. There was one reportable transportation events related to the PHCF in 2022:

- On December 19, 2022, Cameco was informed that a transportation services truck carrying two flat racks each with full UF_6 cylinders was involved in an accident near Montreal, QC. There was no damage to the cargo.

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 2022 with the continuation of community outreach, 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 (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 radioactive waste issues in the Municipality of Port Hope. A separate

supplementary report specific to VIM will be submitted in conjunction with this report for 2022.

In conclusion, in 2022, 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 350 workers. In 2022, the facility operated under fuel facility operating licence FFOL-3631.00/2027 which is valid until February 28, 2027. There were no new licensed activities undertaken in 2022 requiring approval from the CNSC Commission.

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 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 was constructed by the PHAI on the site of the licensed Welcome Waste Management Facility.

In 2022, key activities included the following engineering, remediation, and construction activities:

- LTWMF was closed to all waste for more that half of 2022, however 61 dump trucks of eligible wastes, 477 super sacks, 857 drums and 546 other items were transferred to the LTWMF from the former PHCF including Dorset St.
- Building 27 equipment removal continued with the east and west baghouses safely size reduced and beginning interior blockwork wall removal.
- Began Building 27 tower hoarding in preparation for full demolition in 2023.

- The new liquid hydrogen plant was fully commissioned, and the old hydrogen station removed from site.
- The package for the deep excavation west of the harbour turning basin was returned to development, a new excavation methodology will be proposed at the start of 2023.

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 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 *REGDOC 3.1.2 Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*. This report describes the facility operations and provides a summary of the Safety and Control Areas for 2022 as listed in the Licence Conditions Handbook (LCH).

Laws, regulations, and international agreements applicable to the PHCF are referenced in site documentation including the LCH. Some of these are listed below:

- *Nuclear Safety and Control Act (NSCA) and its Regulations*
- *Canadian Environmental Protection Act*
- *Transportation of Dangerous Goods Act*
- *Access to Information Act*
- *Canada/IAEA Safeguards Agreement*
- *Canada Labour Code, Part II*

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

In addition to the CNSC, the PHCF is regulated by other federal and provincial regulators, such as the Ontario MECP, 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
CNL	Canadian Nuclear Laboratories
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

DRD	Direct Reading Dosimeter
ECCC	Environment and Climate Change Canada
ECA	Environmental Compliance Approval
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
HIRAC	Hazard Identification, Risk Assessment and Control
I&E	Impingement and Entrainment
IAEA	International Atomic Energy Agency
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
MECP	Ontario Ministry of the Environment, Conservation and Parks

mSv	Millisievert
NEW	Nuclear Energy Worker
NO_x	Nitrogen Oxides
NO_2	Nitrogen Dioxide
NO_3	Nitrate
NSCA	Nuclear Safety Control Act
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
SHEQ	Safety Health Environment and Quality
SPOC	Single Point of Contact
SSC	Systems Structures and Components
TC	Transport Canada
UF_6	Uranium Hexafluoride

µgU/L	Micrograms of Uranium per Litre
UO_2	Uranium Dioxide
UO_2N	UF_6 plant + Building 2 cooling water return
UO_2S	UO_2 plant cooling water return
UO_3	Uranium Trioxide
µR/h	Microroentgen per Hour
µSv	Microsievert
WSIB	Workplace Safety and Insurance Board

1.2 Facility Operation

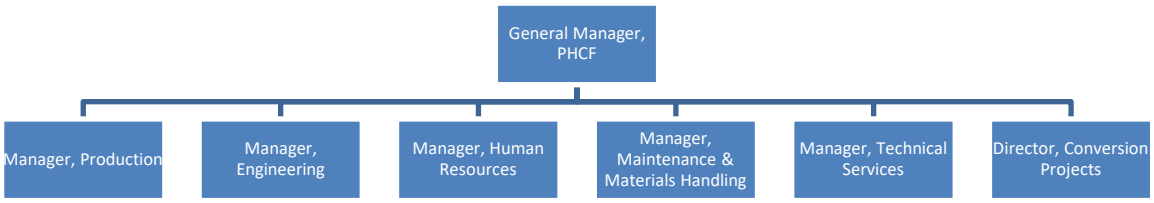
Cameco continues to strive for operational excellence at all its facilities through consistent application of management systems across its operations to ensure that they operate in a safe, clean, and reliable manner. Corporate policies and programs, including that for safety, health, environment, and 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.

There were no significant organizational changes in 2022.

An organizational chart for PHCF for 2022 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 Sr. Coordinator, Safety and Quality. 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 management systems program has been designed to meet *REGDOC-2.1.1, Management System* and *CSA N286-12 Management system requirements for nuclear facilities*. 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, corporate conducts audits as per a three-year schedule 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 2022, there were no significant changes to the Process and Design Change Control process.

The UF_6 plant ran uninterrupted for the first and second quarters of 2022. The plant shut down on July 22nd for the annual maintenance outage. The outage was completed, and the plant was restarted on August 22nd. After that, the plant operated uninterrupted for the remainder of the year including through the holiday period and into 2023.

The UO_2 plant restarted after the holiday break on January 4, 2022. The first two weeks of operation in 2022 was to blend depleted UO_2 lots. The plant operated the remainder of the quarter and through the second quarter without interruption. The plant shut down on

July 22nd for a longer duration outage. The outage included the annual maintenance outage as well as equipment/piping removal in building 2. The UO_2 plant restarted September 26th and personnel worked through commissioning the closed loop cooling water system. The plant operated through to December 22nd and then was shut down for the holiday period. The plant restarted January 4, 2023.

The PHCF experienced the following reportable events in 2022:

- Sanitary sewer action levels
- Environmental particulate limit
- UF_6 plant stack uranium action level exceedance
- Potable water spills from UF_6 plant sprinkler system
- UF_6 plant stack fluoride action level exceedance
- Potable water spill from UO_2 plant sprinkler system
- Water main break (potable water spill)

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 regulatory 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 2022 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 Facility Modification

There were no modifications affecting the safety analysis of the licensed facility made in 2022 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 2022:

- CQP-1201 Fire Safety Plan
- Fire Protection Program
- Radiation Protection Program Manual
- Occupational Health and Safety Program Management Manual
- Preliminary Decommissioning Plan
- Emergency Response Plan
- TSSA Pressure Boundary Quality Control Manual
- SOG019 Emergency Response Team Minimum Staffing
- Port Hope Conversion Facility Main Site Layout Drawing
- Safety Analysis Report

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 Management Systems Program Manual was last updated in 2021 to address items noted in the CNSC management systems inspection conducted in June 2021.

The annual site management review meeting was held March 1, 2023, to review the suitability, adequacy, and effectiveness of the SHEQ policy during 2022. The site management systems, which cover all site programs, were reviewed and sufficient information was provided to demonstrate effectiveness. All safety and control areas ere assessed as part of the 2022 Annual Management Review.

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 audits completed in 2022 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 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.
- An annual facility condition inspection was conducted in 2022.
- Fire Hazard Assessments were completed for all buildings except buildings 24 and 50.
- A containment standard audit was completed by Corporate SHEQ in 2022.
- An ISO14001 audit was completed in 2022.

There were no significant issues identified during the internal or external audits completed in 2022. 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 2022, the PHCF maintained its Management Systems Program Manual in compliance with *CSA N286-12 Management System requirements for nuclear facilities*. There were no significant changes to the Management Systems Program in 2022.

PHCF follows a systematic evaluation method for its safety culture self-assessments which are generally completed every five years. Cameco uses these assessments to shape the safety program improvements at each site. The last safety culture self-assessment completed for the PHCF was done in 2021.

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.

PHCF operations continued to ensure that all training requirements were met for all personnel. In 2022, the site completed the year with 97.8% compliance which is up 1.1% from 2021. The site target for training compliance was 95% in 2022. Training activity included mandatory, legislative and job specific training. The goal at the PHCF is to ensure employees are competent and qualified to perform the duties of their position safely. A well-trained employee is also a safe employee. A systematic approach to training (the process in use at the PHCF) ensures that all required knowledge, skill, and safety-related attributes have been attained, through a process of performance-based assessment and evaluation.

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 operator training in 2022 involved training for new and existing UF_6 chemical operators as well as standard maintenance of training material. No issues were noted for UF_6 operator and supervisor training in 2022.

UO_2 operator training in 2022 involved a re-alignment of training material to updated procedures. No issues were noted for UO_2 operator and supervisor internal qualification requirements in 2022.

In 2022, 14,256 hours of training time were spent on in-class learning and computer-based training. 22,292 hours of on-the-job training were documented.

Throughout 2022, training continued to adapt to changes resulting from the COVID-19 pandemic. This included shifting training delivery to a virtual format where appropriate, and smaller in-person classes resulting from social distancing and smaller room capacity. COVID-19 protocols from 2021 continued into 2022.

Cameco has a range of programs in place to ensure that employees are fit for duty. These programs and procedures cover human resource matters such as a program for alcohol and substance abuse, violence in the workplace, respectful workplace as well as

addressing more general health matters such as routine medical surveillance and radiation protection monitoring.

During 2022, the PHCF maintained a sufficient number of production personnel to ensure that operating production areas and the site were adequately staffed to run safely. In cases where staffing became an issue, production areas were safely shut down until sufficient personnel were available.

In 2022, the following changes occurred with respect to certified or licensed employees:

- 1 NDE technician retired and was replaced with an external qualified NDE technician.
- 1 welder retired; 1 welder resigned and 1 shift welder/steamfitter/ERT resigned. 1 welding position was filled internally with qualified a welder that previously bid out. Currently recruiting a welder and the shift welder/steamfitter/ERT.
- 1 reliability engineer resigned and was replaced with an external intermediate reliability engineer.
- 1 laboratory technician transferred to Blind River and was replaced with an external laboratory technician.
- 1 occupational health nurse is on leave and was replaced with 2 external part-time registered nurses.
- 1 shift instrument technician/electrician/ERT was recruited to fill a vacancy of instrumentation technician from 2021.

2.1.3 Operating Performance

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

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

The UF_6 plant ran uninterrupted for the first and second quarters of 2022. The plant shut down on July 22nd for the annual maintenance outage. The outage was completed, and the plant was restarted on August 22nd. After that, the plant operated uninterrupted for the remainder of the year including through the holiday period and into 2023.

The UO_2 plant restarted after the holiday break on January 4, 2022. The first two weeks of operation in 2022 was to blend depleted UO_2 lots. The plant operated the remainder of the quarter and through the second quarter without interruption. The plant shut down on July 22nd for a longer duration outage. The outage included the annual maintenance outage as well as equipment/piping removal in building 2. The UO_2 plant restarted September 26th and personnel worked through commissioning the closed loop cooling water system. The plant operated through to December 22nd and then was shut down for the holiday period. The plant restarted January 4, 2023.

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.

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.

During 2022, 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 March 17, 18, 21, 22, 24 - 29, April 2, June 21, September 22, 28, 29, the daily composite sample uranium result from the combined facility discharge was reported above the daily action level of 100 µg/L. Groundwater infiltration was the suspected primary causal factor. Powerhouse use and associated discharges of impacted harbour water to the sanitary sewer system may have also contributed to elevated uranium in sanitary sewage recordings in 2022.

On March 23, 2022, the ambient station high volume air sampler (hi-vol) at two locations exceeded the 120 µg/m^3 dust criteria for total suspended particulate (TSP) at 139 µg/m^3 and 142 µg/m^3 respectively. Both samplers are close to roadways and the cause was determined to be residual winter sand resuspended due to vehicle traffic.

On June 28, 2022, the daily average for the UF_6 plant main stack exceeded the action level of 40 gU/h at a value of 45 gU/h.

On August 18, 2022, approximately 600L of potable water (town water) from the UF_6 plant sprinkler system discharged through the alarm line into a storm sewer basin connected to the harbour. The PHCF potable water system is supplied by the Municipality of Port Hope.

On August 31, 2022, the daily fluoride emission average for the UF_6 main plant stack exceeded the action level of 230 g HF/h, at a value of 236 g HF/h.

On November 18, 2022, approximately 480 L of potable water (i.e., municipal water) from the UO_2 plant sprinkler system discharged to the ground from the sprinkler room and into a storm sewer basin connected to the harbour.

On December 23, 2022, approximately 40,000 L of potable water (i.e., municipal water) from a water main break was released into a storm sewer basin connected to the harbour.

On December 24, 2022, approximately 200 gallons of potable water (i.e., municipal water) was released to the ground from the UF_6 plant sprinkler system some of which was able to enter a nearby catch basin.

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.

There were no modifications made in 2022 that negatively 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.

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 considering 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 2022.

There were no significant changes to the Process and Design Change Control process.

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 2022 to progress in all areas of the Operational Reliability program. The site Operational Excellence scorecard established a variety of objectives and targets for 2022 as part of the 5-year Operational Excellence Master Plan. There were 24 targets/objectives captured in the annual 2022 Operational Excellence scorecard.

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 (KPI's). Program effectiveness is defined by upward trends of these indicators to reach world class standards for chemical manufacturing industries. 2022 continued to be impacted by significantly higher absenteeism due to the site's stringent protocols to screen out any employees or contractors that may be a risk from a COVID-19 perspective.

Highlights of selected KPI's by focus area include:

- Work Management
    - Schedule load, which represents the planned work each week versus the available resource hours, was 87% versus a target of 90%.
    - Schedule compliance was flat year over year with 71% of work being executed in the week it was scheduled, impacted by the aforementioned absenteeism as well as other challenges with work execution.
- Materials Management
    - Inventory management continued to provide challenges in 2022 due to logistics and transportation issues for many of our maintenance materials due to global challenges. The site continued to implement countermeasures and changes to our inventory control program to ensure materials were available when needed.
- Reliability Engineering
    - Condition based monitoring of equipment continues to be a focus with additional improvements being made on all inspection types: thermography, ultrasonic bearing inspections, ultrasonic steam trap

inspections, ultrasonic compressed air leak inspections, vibration, and oil analysis.
    - Pilot projects were in place by the end of 2022 for real time condition monitoring for high priority assets with bearing condition for rotational assets and vibration monitoring. A third type of condition monitoring, for steam traps, was installed but waiting on the delivery of a functional data hub.
    - 'Bad Actor' assets continue to be identified in the Production Loss Elimination Process (PLEP), for both downtime and high costs. Reliability engineers facilitated Reliability Centered maintenance workshops to review failures/costs with key stakeholders and assessed existing asset maintenance strategies for opportunities to improve.
- Operations Improvement
    - Overall Equipment Effectiveness (OEE) for the UF_6 and UO_2 plants were below target. The UF_6 plant set an all-time record for production and we continue to apply best practices to achieve even higher levels of safe production.

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 several 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.

There were no significant changes to the Asset Management and Reliability program in 2022.

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
- 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 2022 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:

- 3 new iCAMs in UF_6 have been brought into service.
- The PHCF Radiation Protection Program (PHF-MAN-RAD, Version 16) was updated with the interim monthly and quarterly administrative and regulatory levels for the lens of the eye. The Interim action levels pending the completion of eye dose studies to derive more accurate algorithm from OSLD dose and it's acceptance by the CNSC staff.
- Two Alpha/Beta counting systems (Tennelec) were purchased in 2022.
- The site Safety meeting for the month of June 2022 was focused on the Lung Counting Program.
- The PHCF site nurses are now all trained on how to do a CWT measurement.
- In August of 2022, a new Web-remote program to remotely access all whole body and hand and foot monitors was installed to replace Canberra CRemote.

Safety Improvements:

- New photosensor light installed above main door of lung counter. Light fixture is more efficient, "permanent" and should not need to be removed before transportation to and from BRR. Use of ladder no longer required unless maintenance to the fixture is needed.
- The lung counter lift gate was painted. This will prolong the life of the lift platform as the air conditioner drain releases water on edge of platform. New paint also increased traction to prevent slips and falls.
- The new body size sensors in the WBM are designed to easily detect all body types. This new upgrade will eliminate the need of getting to close and/or touching (face) the detectors.

Procedural Improvements

- CAP:RAD:16 Check For Loose Contamination Using Swipe Check Method
- CAP:RAD:21 Internal Dosimetry – In-Vitro – Urinalysis Monitoring
- CAP:RAD:22 Internal Dosimetry – In-Vivo-Lung Counting Program
- CAP:RAD:30 Monitoring Procedures for Vehicles Leaving the Property
- CAP:RAD:31 Monitoring Procedures for yard areas
- CAP:RAD:33 Procedures for Control of Radioactive Spills
- CAP:RAD:37 Fenceline Radiation Monitoring
- CAP:RAD:40 Routine Lung Count Data Acquisition
- CAP:RAD:45 Use of Contamination Survey Meters
- CAP:RAD:52 Validation of Radioactive Source Standards
- CAP:RAD:56 Apex In-Vivo Quality Assurance Calibration Check

PHCF's performance in 2022 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 4.1 mSv in 2022 was received by a UF_6 operator.
    - The 36 mSv for external skin dose was met. The maximum dose of 12.0 mSv was received by a UF_6 operator.
    - The 1 mSv for internal dose – urine analysis was met. The maximum dose of 0.53 mSv was received by a maintenance employee.
    - The 4 mSv for internal dose – lung counting was met. The maximum dose of 3.3 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 98.5% compliance to scheduled urine sample submissions.
- Continued to support 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 2023 ALARA targets are as follows:

- Dose targets: Whole body dose < 5 mSv
- Skin dose < 36 mSv

- Urine analysis dose < 1 mSv
- Eye dose < 36 mSv
- Lung dose < 4 mSv

Radiation protection initiatives planned for 2022 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.
- Continue to support the production team to develop and implement a plan for improved engineering and administrative controls for the 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, skin, and eye 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 2022, PHCF did not exceed any CNSC licensed limits 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. In 2022, PHCF recorded 100% 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 2022 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 2022 external whole-body dose are shown in Table 2 and Figure 4. More than 97% of the whole-body exposures were below 1 mSv with a total of 13 workers receiving a whole-body dose greater than 2 mSv.

Table 2

2022 Whole Body Dose Distribution	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 1	97.1
1 – 2	1.7
2 – 3	0.7
3 – 4	0.4
4 – 5	0.1
> 5	0.0

Figure 4

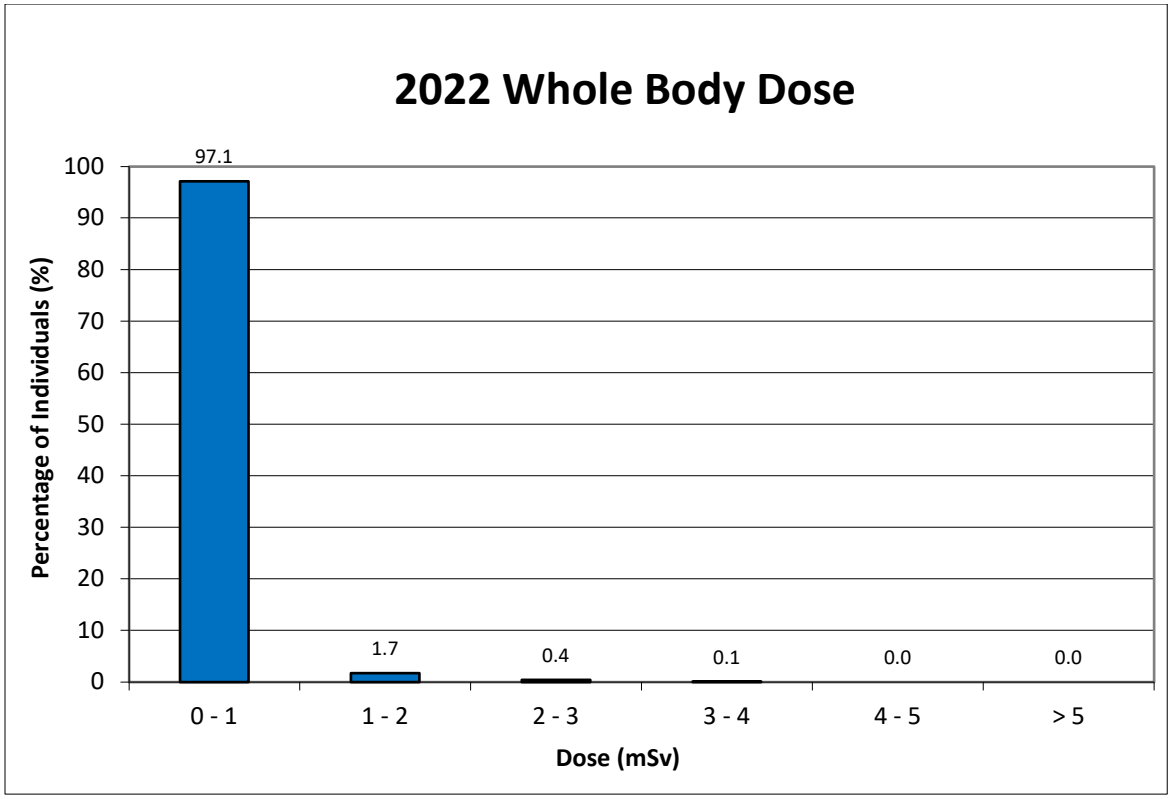
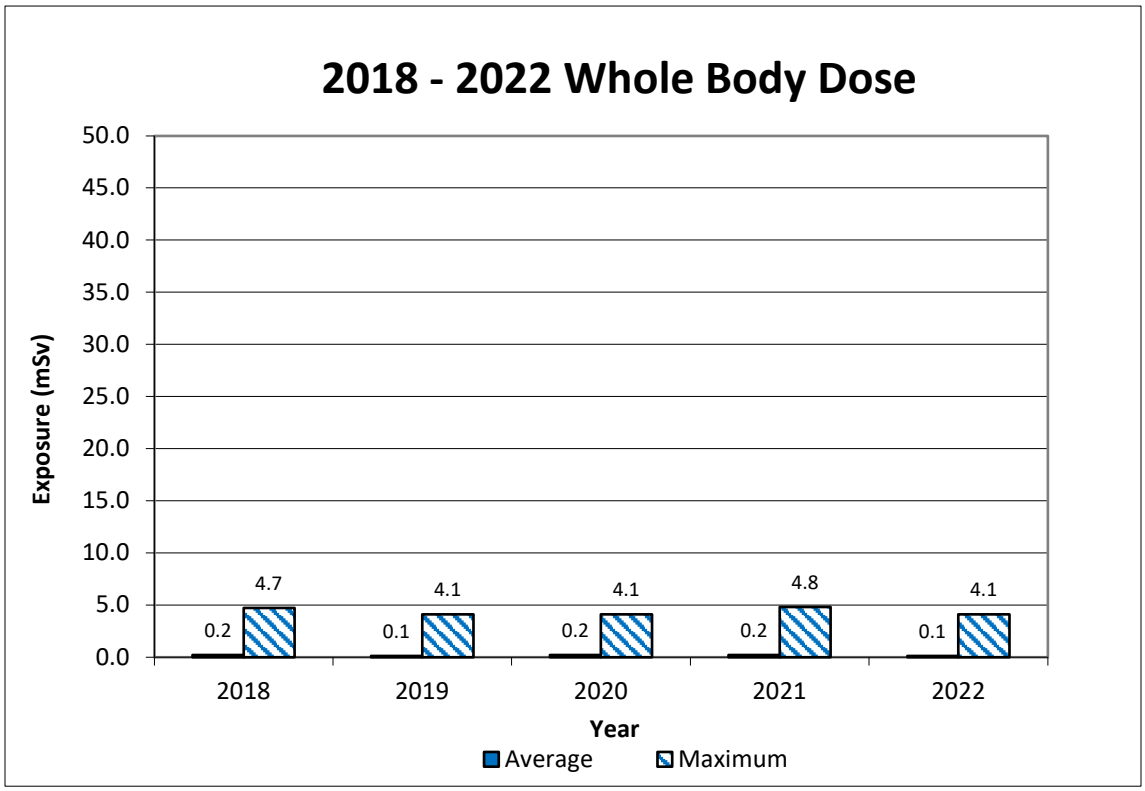


Table 3 and Figure 5 show the employee average and maximum individual external whole-body dose for the five-year period from 2018 – 2022. This data includes contractors with NEW status. The average dose in 2022 was relatively the same compared to the average dose from 2018 through 2021. The maximum individual external whole-body dose was 4.10 mSv received by a UF_6 operator.

Table 3

2018 – 2022 Whole Body Dose				
Year	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum (mSv)**
2018	933	0.2	0.0	4.7
2019	1,099	0.1	0.0	4.1
2020	946	0.2	0.0	4.1
2021	874	0.2	0.0	4.8
2022	1,110	0.1	0.0	4.1

Figure 5



Skin Dose

Distributions of 2022 external skin doses are shown in Table 4 and Figure 6. Over 99% of the external skin doses were below 10 mSv.

Table 4

2022 Skin Dose Distribution	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 10	99.8
10 – 20	0.2
20 – 30	0.0
30 – 40	0.0
40 – 50	0.0
> 50	0.0

Figure 6

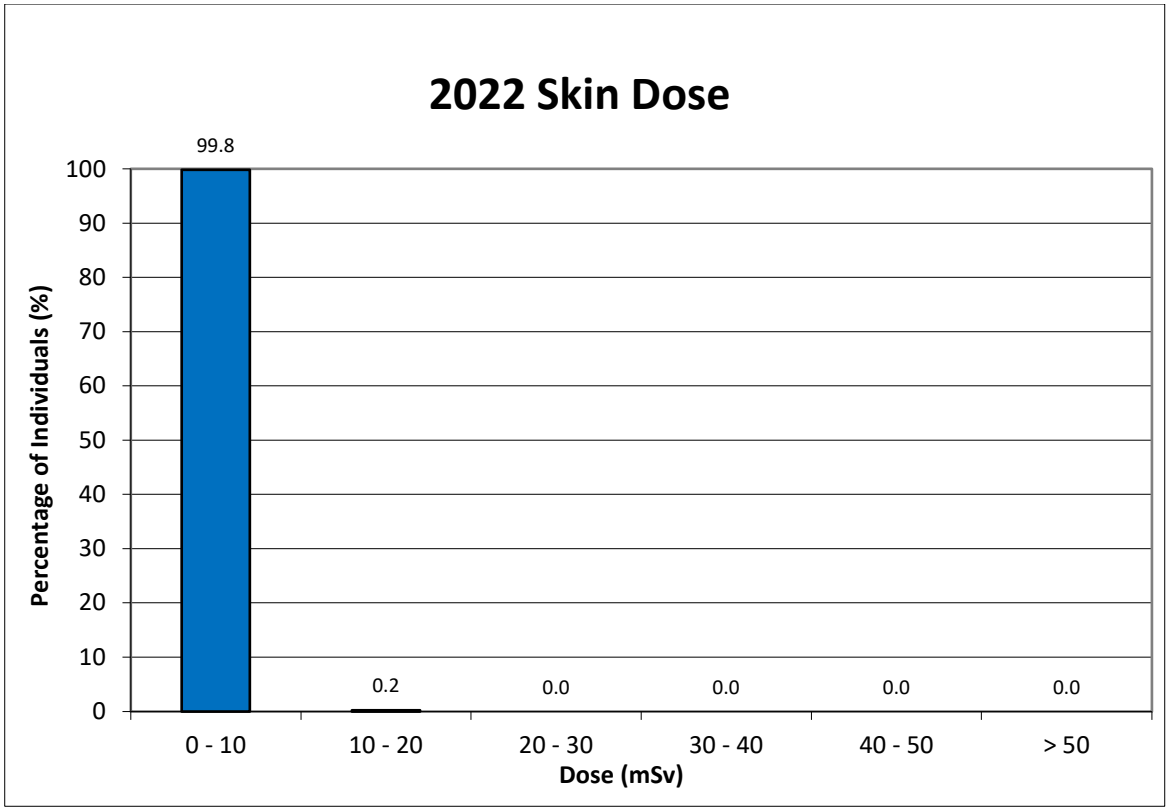
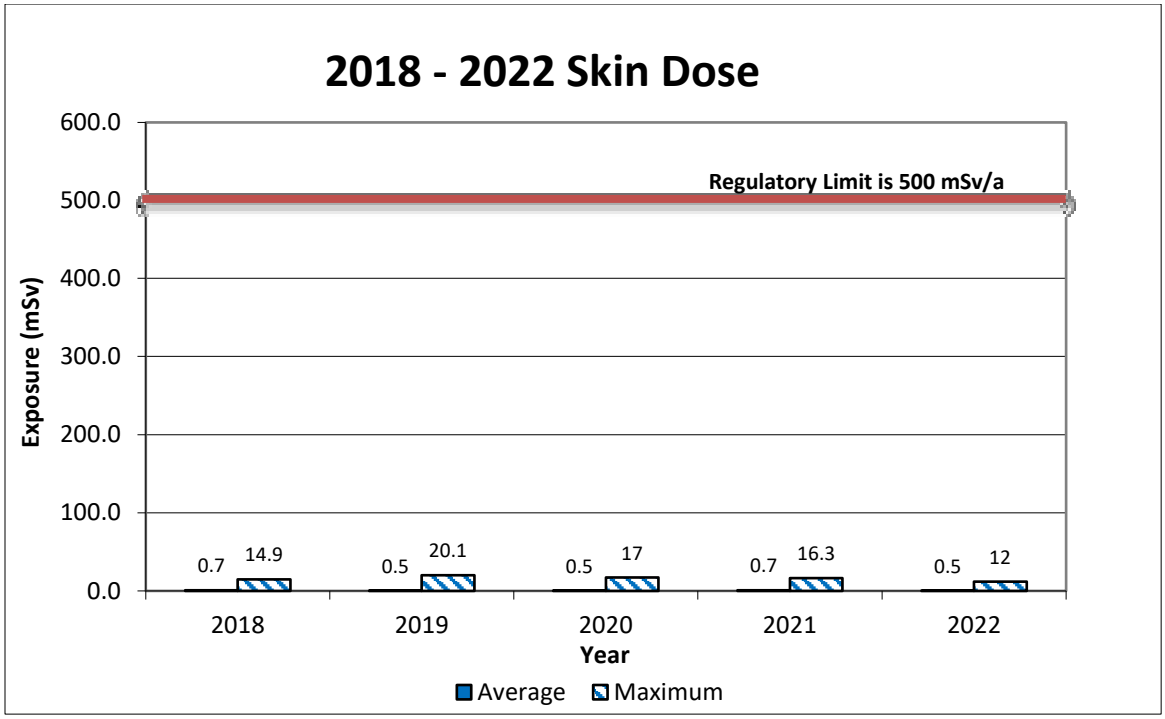


Table 5 and Figure 7 show the employee average and maximum individual skin dose for the five-year period from 2018 – 2022 including contractors (NEW). Average dose remained very close over the period if not slightly lower. The maximum individual skin dose was lower than the previous year. The maximum individual dose in 2022 was 12.0 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

2018 – 2022 Skin Dose				
Year	**Number of Individuals**	**Average**	**Minimum**	**Maximum**
2018	933	0.7	0.0	14.9
2019	1,099	0.5	0.0	20.1
2020	946	0.5	0.0	17.0
2021	874	0.7	0.0	16.3
2022	1,110	0.5	0.0	12.0

Figure 7



Site visitors and non-NEW contractors are also issued dosimeter badges. The average and maximum whole-body results for these individuals were 0.00 mSv and 0.02 mSv, respectively. The average and maximum non-NEW contractor/visitor skin dose results were 0.00 mSv and 0.02 mSv, respectively.

Eye Dose

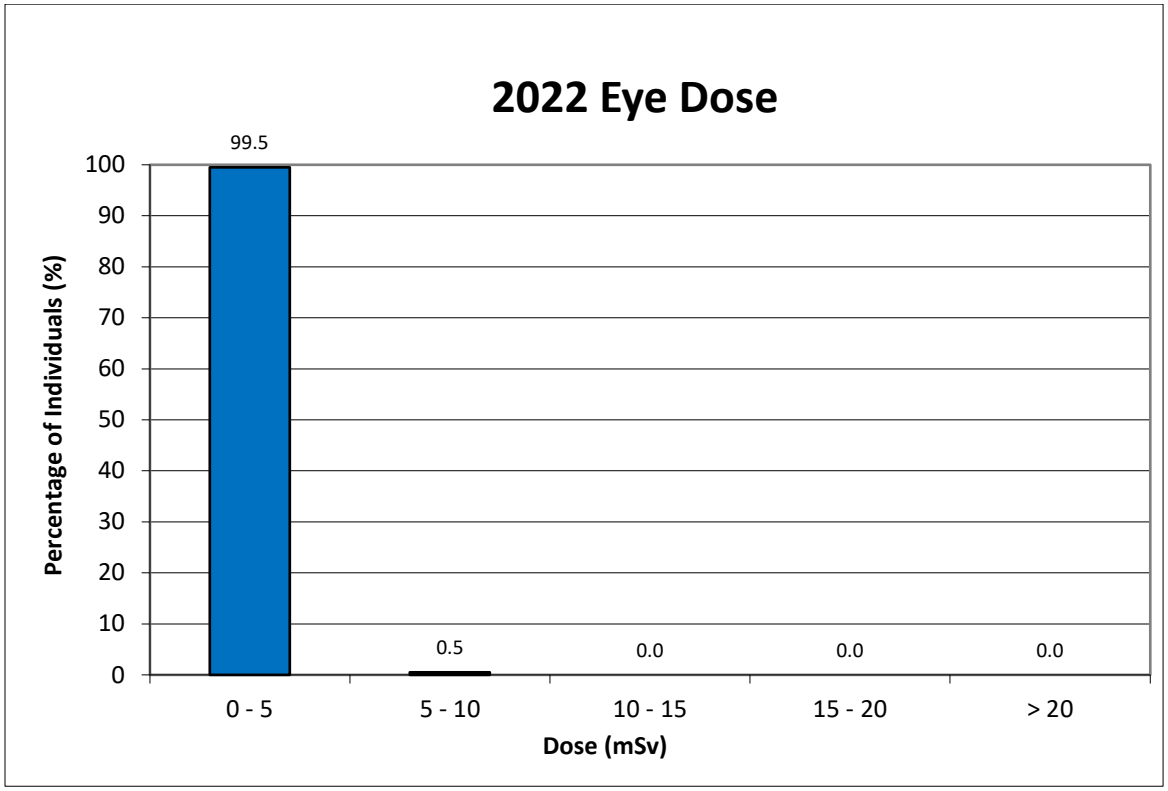
The CNSC regulatory dose limit to the lens of the eye for NEW's is 50 mSv per year. The current interim action level for eye dose is 6 mSv/month and 12 mSv/Quarter.

Table 6 and Figure 8 display the distribution, in 5 mSv increments, of the calculated dose to the eye for all NEWs in 2022. The calculated eye dose for the majority of NEWs was below 5 mSv (99.5%) with no employees above 20 mSv.

Table 6

2022 Eye Dose Distribution	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 5	99.5
5 – 10	0.5
10 – 15	0.0
15 – 20	0.0
> 20	0.0

Figure 8



The highest eye doses are from the operations work group, consisting of production and maintenance personnel. In 2022, the average eye dose for all NEWs was 0.3 mSv and the maximum annual eye dose was 7.35 mSv.

Changes to the radiation protection regulations prompted the PHCF to initiate tracking and analysis of eye dose to employees and contractors in 2021. Table 7 and Figure 9

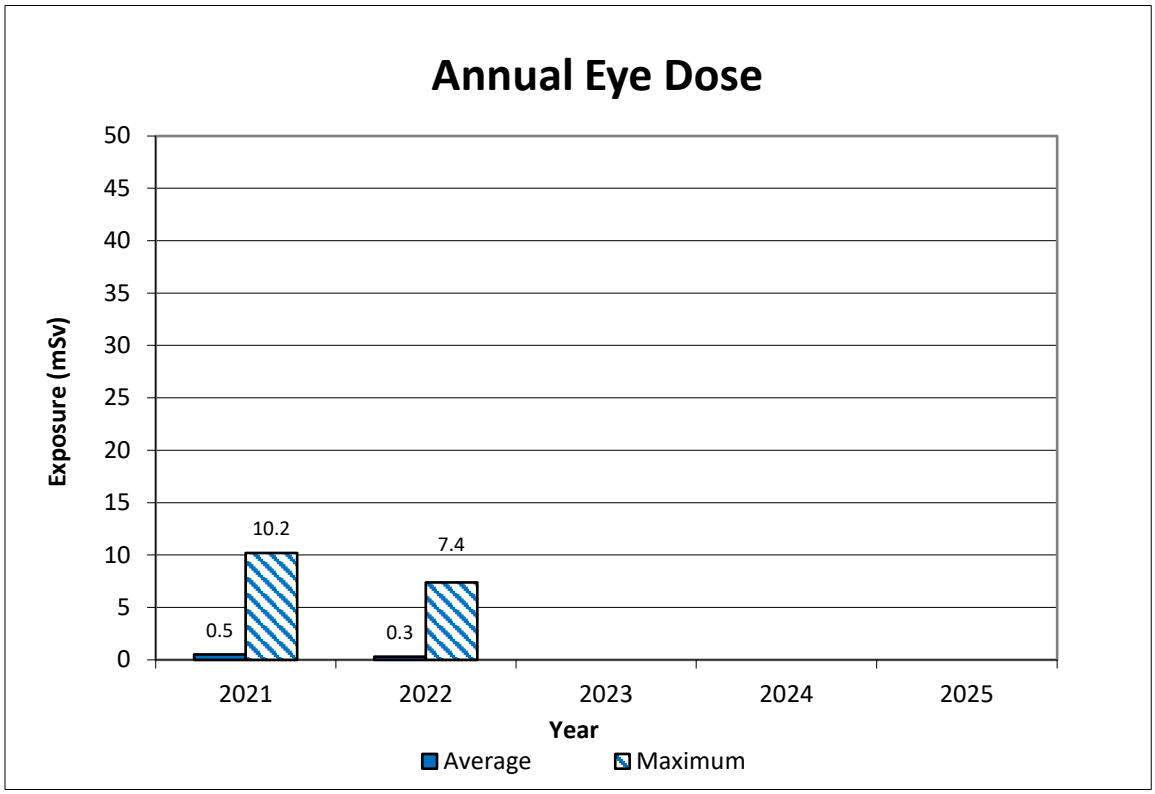
presents the employee average, minimum and maximum eye dose for the 2022 period. This table and figure will include year by year comparison in future reports as data is collected.

The chart illustrates that the maximum annual dose received by an individual is below the regulatory limit. In 2022, the individual with the highest dose was a UF_6 employee this individual also had the maximum skin dose.

Table 7

2021 - 2022 Eye Dose				
Year	**Number of Individuals**	**Average Dose (mSv)**	**Minimum Dose (mSv)**	**Maximum Dose (mSv)**
2021	873	0.5	0.0	10.2
2022	1,110	0.3	0.0	7.4

Figure 9



Urine Analysis

Table 8 shows the distribution of urine results for 2022. A total of 46,531 urine samples were collected and analyzed for uranium and/or fluorides during 2022. The majority of uranium in urine results (> 98.5%) were less than 5 µg U/L in 2022.

Table 8

2022 Urine Analysis Results	
Distribution of Results	**2022**
Number of Samples ≤ 5 µg U/l	45,853
Number of Samples >5 to ≤ 25 µg U/l	645
Number of Samples >25 to ≤ 50 µg U/l	26
Number of Samples > 50 µg U/l	7
Number of Uranium in Urine Samples Analyzed	46,531
Number of Samples above the Action Level	0
Maximum Routine Sample Result (µg U/L)	18
Maximum Non-Routine Sample Result (µg U/L)	82

The distribution of 2022 internal urine dose for employees is shown in Table 9 and Figure 9. Approximately 97.1% of the individual assigned doses were below 0.2 mSv.

Table 9

2022 Internal Dose Distribution (Urine Analysis)	
Dose Range (mSv)	**Percentage of Individuals (%)**
0.0 – 0.2	97.1
0.2 – 0.4	2.6
0.4 – 0.6	0.4
0.6 – 0.8	0.0
0.8 – 1.0	0.0
> 1.0	0.0

Figure 9

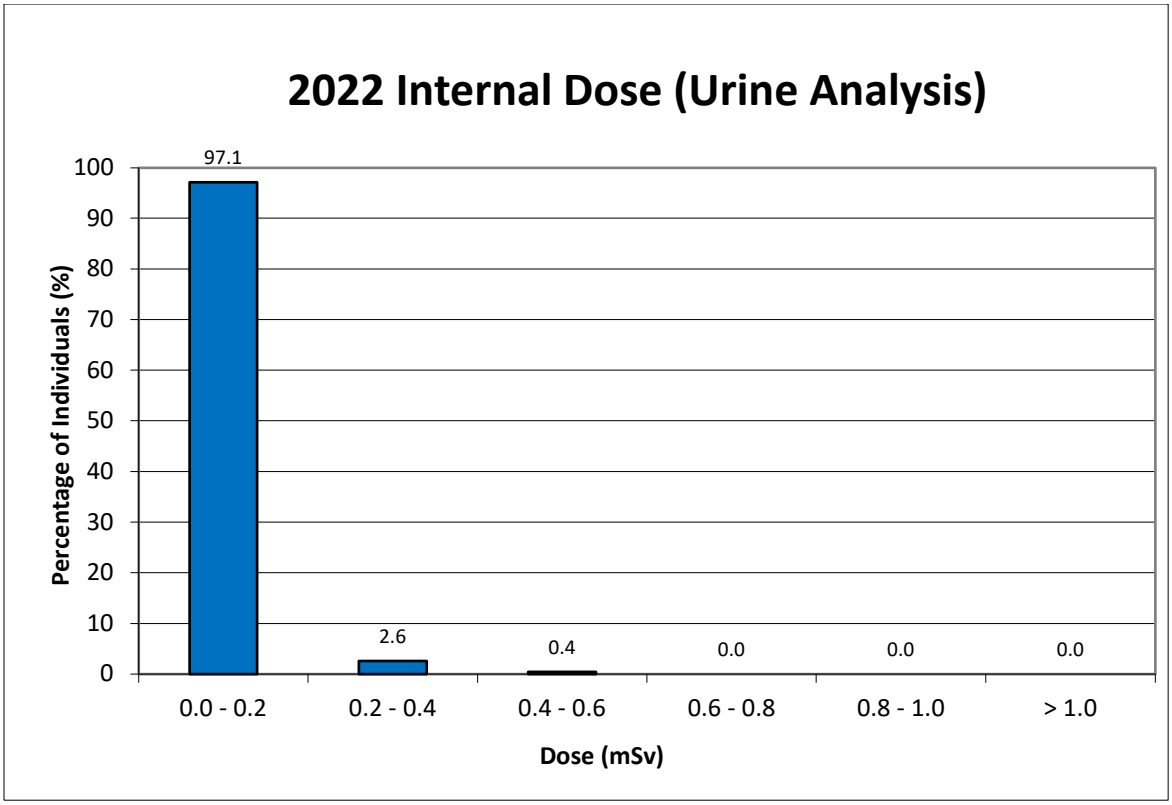


Table 10 and Figure 10 present the average and maximum internal urine analysis doses for the 2018 through 2022 period. A total of 860 employees, contractors and visitors were monitored by the urine analysis program during 2022. The average and maximum internal urine analysis doses in 2022 (including contractors) were 0.03 mSv and 0.53 mSv respectively which were lower to previous years. The maximum dose of 0.53 mSv was received by a Maintenance employee.

The annual ALARA target for internal urine analysis exposure of 1 mSv was not exceeded in 2022.

Table 10

2018 – 2022 Internal Dose (Urine Analysis)				
Year	**Number of Individuals (Includes Contractors)**	**Average Dose (mSv)**	**Minimum Dose (mSv)**	**Maximum Dose (mSv)**
2018	735	0.04	0.00	0.59
2019	905	0.04	0.00	0.75
2020	755	0.04	0.00	0.63
2021	674	0.03	0.00	0.70
2022	860	0.03	0.00	0.53

Figure 10

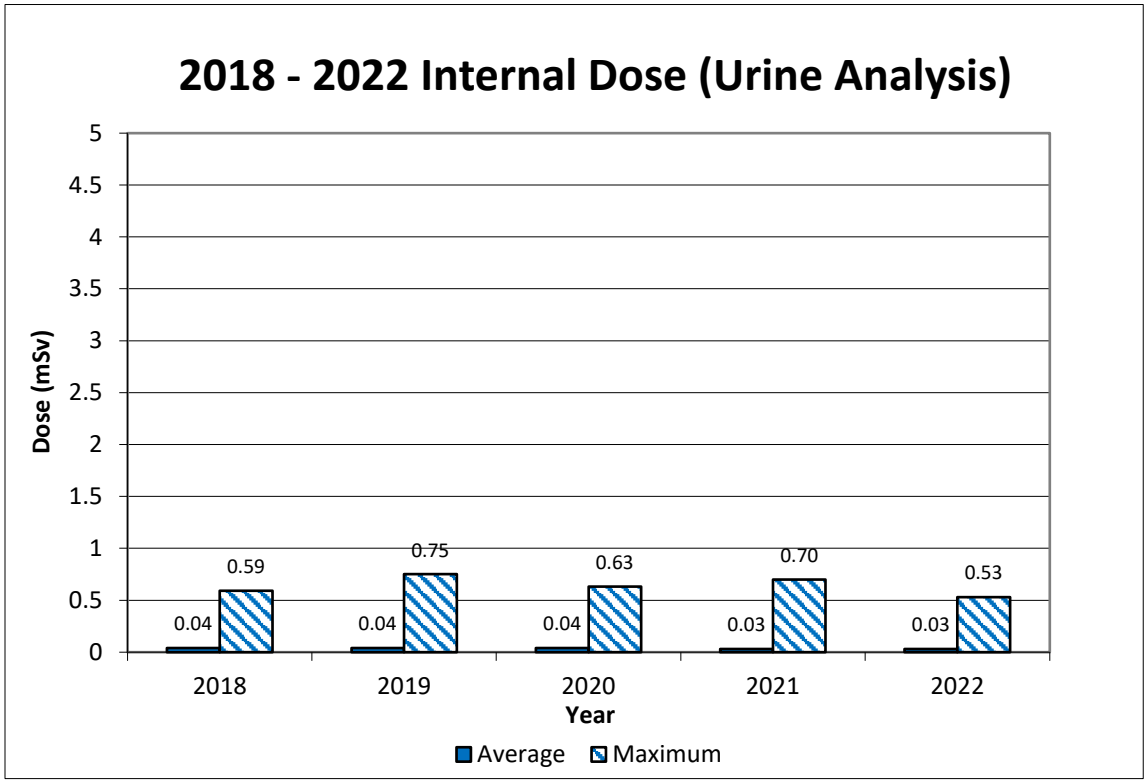


Table 11 shows a comparison of the annual exposure results for whole body dose, skin dose, eye dose and urine analysis broken down by work group. The highest doses are from the operations work group, consisting of production, materials handling, waste management and maintenance personnel.

Table 11

2022 Annual Exposure Results by Work Group												
Work Group	**Whole Body (mSv)**			**Skin Exposure (mSv)**			**Eye Dose (mSv)**			**Urine Analysis (mSv)**		
	Avg	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**
UF_6 Plant	0.63	0.00	4.10	1.97	0.00	11.97	1.31	0.00	7.35	0.10	0.00	0.47
UO_2 Plant	0.31	0.00	0.95	1.02	0.01	3.28	0.69	0.01	2.06	0.02	0.00	0.09
Maintenance	0.32	0.00	1.73	1.92	0.00	9.46	1.10	0.00	5.29	0.08	0.00	0.53
Technical Support [1]	0.06	0.00	3.81	0.20	0.00	4.73	0.13	0.00	3.83	0.01	0.00	0.33
Administration	0.01	0.00	0.16	0.01	0.00	0.36	0.01	0.00	0.24	0.00	0.00	0.02
Total	**0.14**	**0.00**	**4.10**	**0.49**	**0.00**	**11.97**	**0.31**	**0.00**	**7.35**	**0.03**	**0.00**	**0.53**
[1] Includes contractors (NEWs)												

Fluoride in Urine

A total of 31,221 urine samples were analyzed for fluoride in 2022, with summary results provided in Table 12. There were 19 samples above the internal administrative investigation level of 4 mg F/L during the year. 14 of these were determined to be non-occupational related to tea drinking, 3 were determined to be related to respirator use and 2 were investigated with no cause able to be determined.

Table 12

2022 Fluoride in Urine Analysis Results			
Type of Fluoride Samples	**Number of Samples**	**Minimum Concentration (mg F/L)**	**Maximum Concentration (mg F/L)**
All fluoride samples	31,221	0.1	7.2
Routine post-shift fluoride samples >= 7 mg F/L	1	-	-
Routine pre-shift fluoride samples >= 4 mg F/L	4	-	-
Non-routine fluoride samples	1,896	0.1	4.9
Samples analyzed for U, insufficient volume (< 30mL) for F analysis	124	-	-

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 1,130 internal lung count doses were assigned at the PHCF in 2022. There were no investigations triggered by the lung counting program during the year and no regulatory action level was exceeded for lung count measurements. Intercomparisons (independent tests) were conducted by Health Canada in 2022 to validate, test, and certify the lung counting system. This testing was completed July 27th.

The estimates of 2022 internal exposures, based on the lung counting program, were assigned for 259 employees and the prorated actuals of 2022 internal exposures were calculated for 713 contractors (NEW) and administrative employees. The 2022 average internal lung counting dose assigned was 0.3 mSv. The maximum dose of 3.3 mSv, received by a maintenance employee was in line with the previous year. The annual ALARA target for lung counting of 4 mSv was achieved in 2022. Note that the action level is 5 mSv.

Taking into consideration counting statistics and the minimum detectable activity (MDA) of the lung counter, six basic dosimetry groups are in place with a greater number of workers in each to increase the accuracy of group-based dose assessment. These dosimetry groups are:

- UF_6 plant
- UO_2 plant
- Maintenance
- Technical support
- Administration
- NEW Contractors.

The technical support dosimetry group includes materials handling, environmental and radiation safety personnel, and engineering work groups.

Table 13 and Figure 11 show the distribution of assigned lung counting doses. All assigned lung doses were below 4 mSv.

Table 13

2022 Internal Dose Distribution (Lung)	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 1	86.2
1 – 2	13.0
2 – 3	0.7
3 – 4	0.1
4 – 5	0.0
> 5	0.0

Figure 11

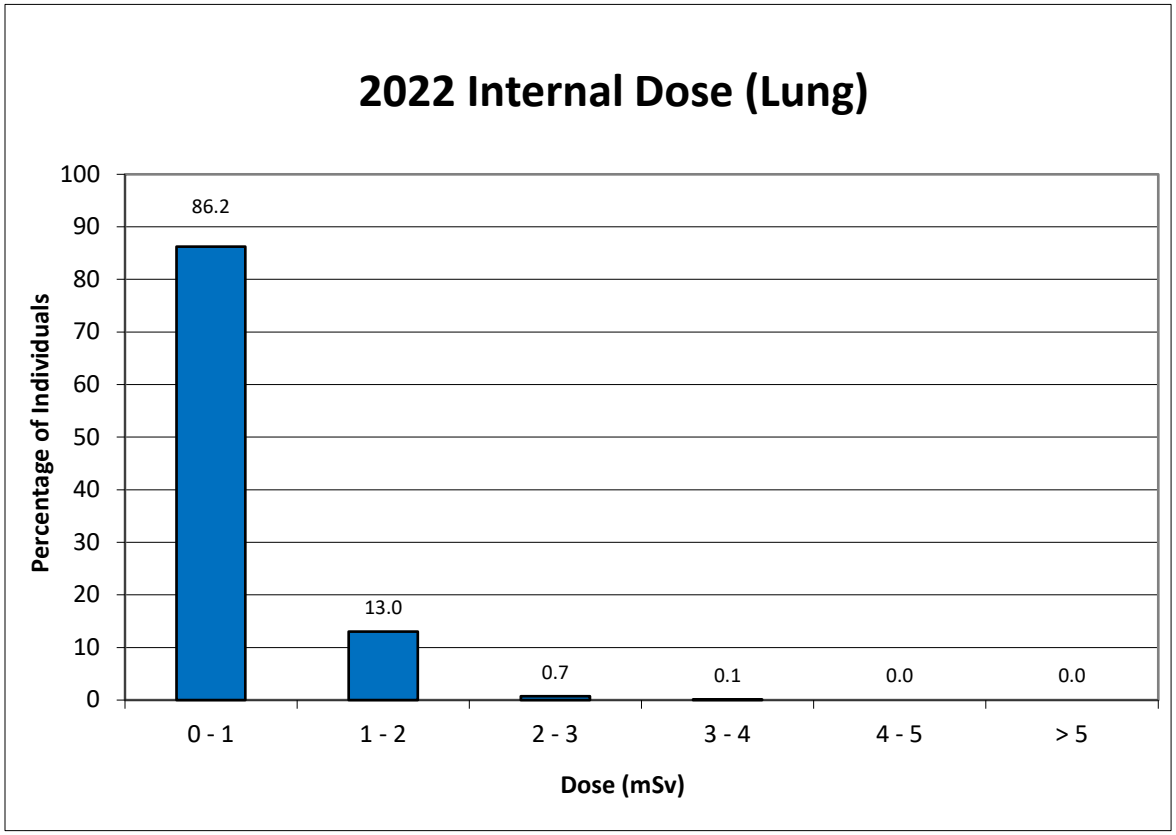


Table 14 presents the internal lung counting dose indicators for 2018-2022 period.

Table 14

Internal Lung Count Exposures 2018 – 2022				
Year	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum[1] (mSv)**
2018	1,021	0.4	0.0	2.1
2019	1,173	0.2	0.0	2.3
2020	979	0.3	0.0	1.7
2021	898	0.5	0.0	3.4
2022	1,130	0.3	0.0	3.3
[1]Maximum annual dose to an individual				

Table 15 shows the assigned internal lung count doses for 2022.

Table 15

Assigned Internal Lung Count Doses 2022				
Dosimetry Group	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum[1] (mSv)**
UF_6 Plant	107	1.2	0.0	2.3
UO_2 Plant	27	0.8	0.0	1.3
Maintenance	76	0.5	0.0	3.3
Technical Support[2 3]	820	0.2	0.0	1.5
Administration[2]	100	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)				

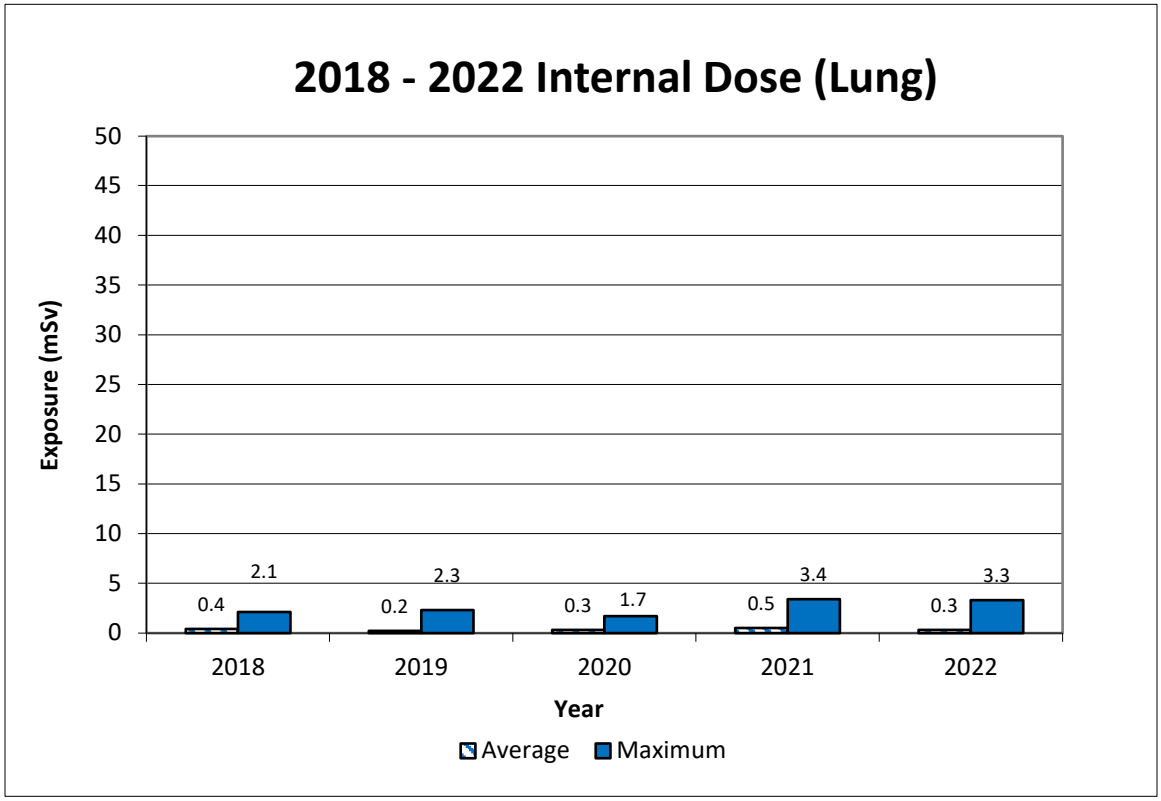
In 2022, no lung count measurements exceeded the Decision Level (DL) of the lung counter; therefore, lung doses for all individuals were based and assigned on group averages. Differences in individual lung doses within the same group are due to different fractions of the group average being applied to the individual's annual dose, based on the dates the individual's lung counts occurred.

Differences in individual lung doses from year to year are due to correction factors. The current methodology assigns the dose from a lung count to the next lung count, hence the lung doses for 2022 are estimates only, projecting the exposure from the last lung count in 2022 until the end of the year to be the same as the one between the last two lung

counts. Once the lung counts are completed in 2023, the actual lung doses for 2022 can be calculated. The difference between the actual and estimated lung doses is applied to the next year estimates (becoming corrected estimates).

Figure 12 shows the average and maximum internal lung dose for PHCF employees for the 2018 through 2022 period, including the outside contractors work group (NEWs).

Figure 12



Total Effective Dose

The total effective dose (TED) was assessed for 1150 employees and 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 2022 were 0.48 mSv and 5.86 mSv, respectively.

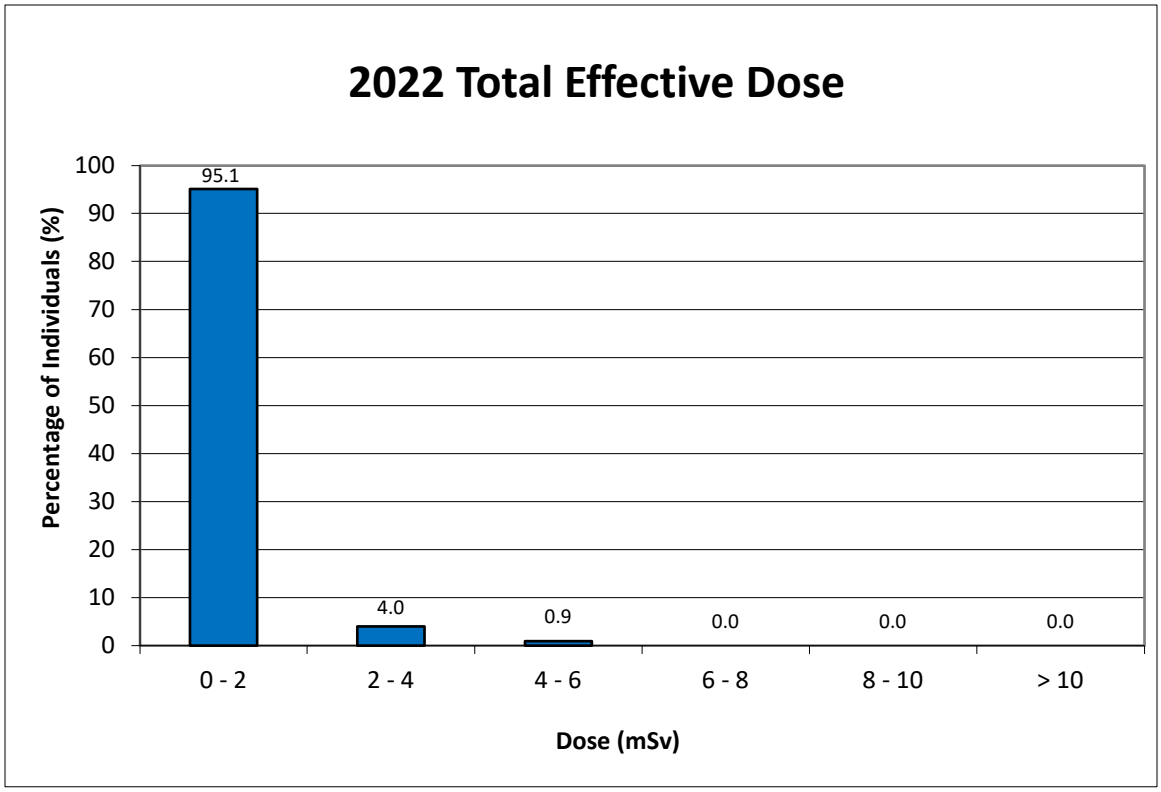
In 2022, there were 666 contractor NEWs. The maximum TED for a contractor NEW was 2.52 mSv.

Table 16 and Figure 13 show the breakdown of the total effective dose for employees in 2021. 99.1% of employees or contractors (NEWs) had an effective dose of 4 mSv or less.

Table 16

2021 Total Effective Dose Distribution	
Dose Range (mSv)	**Percentage of Individuals (%)**
0 – 2	95.1
2 – 4	4.0
4 – 6	0.9
6 – 8	0.0
8 – 10	0.0
> 10	0.0

Figure 13



The average employee effective dose in 2022 is consistent with the average effective dose recorded over the past five-year period.

Table 17 and Figure 14 present the total effective dose for employees during the 2018 - 2022 period.

The five-year regulatory limits established in the *Radiation Protection Regulations* apply to unique five-year periods of time. The current period extends from January 1, 2021, to December 31, 2025. The maximum individual effective dose for the current five-year dosimetry period is 6.6 mSv which is well below the regulatory limits of 50 mSv/year and 100 mSv/5 years.

Table 17

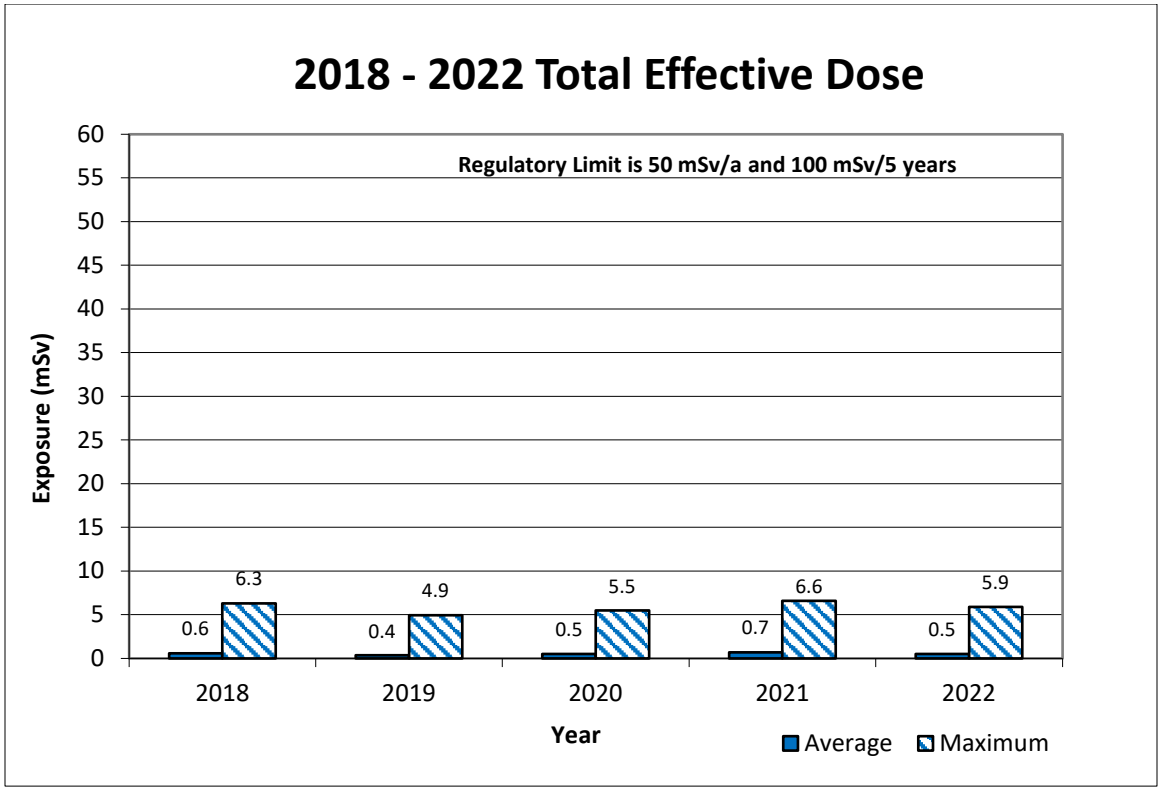
Total Effective Dose 2018 - 2022				
Year	**Number of Individuals**	**Average (mSv)**	**Minimum (mSv)**	**Maximum[1] (mSv)**
2018	1,025	0.6	0.0	6.3
2019	1,177	0.4	0.0	4.9
2020	994	0.5	0.0	5.5
2021	908	0.7	0.0	6.6
2022	1,150	0.5	0.0	5.9
[1]Maximum annual dose to an individual				

Cameco measures and assigns dose to all workers with a potential to receive dose and designates workers as NEWs on this potential. Average results are reported using an assignment of a zero dose when the dose was too small to be measured. A measured dose of zero is a legitimate dose and reflects the radiation exposure controls in place at the facility. Table 18 shows the annual NEW total effective dose results for measurable doses (removal of zero doses). The average total effective dose for all measurable doses (zero doses removed) for a NEW in 2022 was 0.7 mSv.

Table 18

Total Effective Dose (All Measurable Doses – Zero Dose Removed)				
Year	**Number of Individuals**	**Average[2] (mSv)**	**Minimum (mSv)**	**Maximum[1] (mSv)**
2020	556	0.8	0.1	5.5
2021	473	1.4	0.1	6.6
2022	579	0.7	0.1	5.9
[1]Maximum annual dose to an individual [2]PHCF began reporting non-zero average total effective dose in 2020				

Figure 14



The average total effective dose five-year trend from 2018 through to the end of 2022, remains stable, with a maximum average of 0.70 mSv in 2021 and a minimum average of 0.35 mSv in 2019.

Table 19 shows the total effective dose broken down into urine analysis dose, lung count dose and external whole-body dose for 2022.

Table 19

Dose Components & Total Effective Dose 2021												
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	1.23	0.00	2.31	0.63	0.00	4.10	1.94	0.00	5.86
UO_2 Plant	0.02	0.00	0.09	0.75	0.00	1.25	0.31	0.00	0.95	1.06	0.00	2.00
Maintenance	0.08	0.00	0.53	0.50	0.00	3.32	0.32	0.00	1.73	0.90	0.00	4.79
Technical Support	0.01	0.00	0.05	0.74	0.00	1.32	0.06	0.00	0.37	0.81	0.00	1.63
Administration	0.00	0.00	0.01	0.00	0.00	0.13	0.01	0.00	0.16	0.01	0.00	0.16
PHCF Average	**0.03**	**0.00**	**0.53**	**0.34**	**0.00**	**3.32**	**0.14**	**0.00**	**4.10**	**0.48**	**0.00**	**5.86**
[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 20, the individuals with the highest effective doses at the PHCF include operators in the UF_6 plant and Material handling employees.

Table 20

2022 Five Highest Effective Dose Individuals				
Occupation	**Urine Dose (mSv)**	**Lung Dose (mSv)**	**External Whole-Body Dose (mSv)**	**Effective Dose (mSv)**
UF_6 Operator	0.37	1.4	4.1	5.9
UF_6 Operator	0.34	2.3	3.2	5.8
UF_6 Operator	0.29	1.5	3.8	5.5
UF_6 Operator	0.17	1.4	3.5	5.1
Material Handling	0.00	1.1	3.8	4.9

Collective dose for each dose component with all assigned doses is provided in Table 21 for 2020 through 2022.

Table 21

Collective Dose (2020 – 2022)				
Year	**Whole Body (mSv)**	**Skin (mSv)**	**Internal Dose (mSv)**	**Effective Dose (mSv)**
2020	140.4	502.6	331.0	471.4
2021	183.7	613.0	465.0	648.7
2022	150.1	543.7	407.1	557.2

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. 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 22

Summary of PHCF Internal Administration Levels and Events in 2022				
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	3,097
Zone 2	0.4	3.7	149	46,089

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 99 permanent monitoring stations across PHCF. 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 23 shows the average annual derived air concentration per work area for the 2018 through 2022 period.

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 $\mu gU/m^3$ and 100 $\mu gU/m^3$ for the UF_6 and UO_2 plants, respectively. PHCF is taking a conservative approach by using the 100 $\mu gU/m^3$ 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 23

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]
2018	0.08	168	0.03	1	0.02	5	0.05	1
2019	0.09	196	0.02	1	0.02	1	0.01	0
2020	0.09	253	0.03	2	0.02	0	0.02	2
2021	0.09	231	0.03	3	0.01	0	0.01	0
2022	0.08	120	0.02	1	0.02	0	0.01	0
[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 24 summarizes the results taken in each area in 2022.

The general processes and operations at the PHCF are well defined and stable, and the external gamma radiation levels were fairly constant in 2022. 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 24

Summary of Plant Gamma Readings by Area (µSv/h)				
Building Number	**Location**	**Average**	**Minimum**	**Maximum**
2	1st Floor	0.82	0.19	2.82
	2nd Floor	0.58	0.43	0.82
	3rd Floor	0.35	0.03	0.78
5B	1st Floor	0.12	0.04	0.3
5C	1st Floor	0.67	0.24	1.23
7	1st Floor	0.9	0.4	1.45
12	1st Floor	11.6	0.12	30.0
24	1st Floor	2.48	0.25	6.89
	2nd Floor	1.14	0.10	3.82
	3rd Floor	0.56	0.26	1.12
	4th Floor	2.68	1.28	5.19
50	1st Floor Flame Reactor Area	115.7	55.0	254.0
	1st Floor Tote Bin Area	5.79	4.25	7.33
	1st Floor Cylinder Filling Area	21.3	21.3	21.3
	1st Floor Effluent Area	4.14	1.67	6.61
	2nd Floor Tower	2.05	0.03	4.51
	2nd Floor Flame Reactor Area	74.14	7.03	112
	3rd Floor Tower	5.53	2.4	10.3
	3rd Floor Flame Reactor Area	39.85	18.1	51.5
	3rd Floor Cold Trap Area	0.74	0.74	0.74
	4th Floor Tower	3.82	2.5	4.71
	4th Floor Flame Reactor Area	7.29	4.74	9.48
	5th Floor Tower	3.0	2.24	3.46
	5th Floor Flame Reactor Area	4.74	3.55	5.83
	6th Floor Tower	2.97	0.26	6.35
	7th Floor Tower	3.30	0.18	6.99
	8th Floor Tower	2.40	0.95	4.85
	9th Floor Tower	0.97	0.17	1.70

2.3.2 Conventional Health and Safety

This safety and control area covers the implementation of a program to manage conventional 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 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.
- 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, safety performance, safety program performance, internal responsibility system, safety related projects, and joint union/management OH&S issues that may arise from time to time. The CSSC meets 2 days per month to improve safety performance on site and creating a sustainable safety culture. Each employee representative of the CSSC dedicates an additional day a month for safety dedicated duties.

The Canada Labour Code requirement is nine meetings per year. The CSSC is active in promoting continuous safety improvement and is effectively meeting the expectations of its mandate. In 2022, the CSSC met for nine regulatory meetings and eight regular meetings. There was a total of 10 inspections completed which covered all areas of the site.

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. 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
- 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 performance. This data is reviewed by site and divisional management in effort to 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 2021. Cameco uses these assessments to shape the safety program improvements at each site.

Table 25 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 and exhibited variation year over year. Reviews of the safety incidents have been

evaluated several different ways and preceding annual objectives are designed to combat and reduce risk and injury in these areas.

There were no lost time injuries recorded in 2022. Site Total Recordable Injury Rate (TRIR) increased slightly from 0.52 in 2021 to 1.32 in 2022.

Table 25

2018 – 2022 Safety Statistics					
Year / Parameter	**2018**	**2019**	**2020**	**2021**	**2022**
First Aid Injuries	64	70	41	34	46
Medical Diagnostic Procedures	10	9	3	2	7
Medical Treatment Injuries	12	11	8	2	4
Other – Recordable	0	0	1	0	0
Lost Time Injuries	2	0	0	0	0
Lost Time Injury Frequency	0.49	0.00	0.00	0.00	0.00
Lost Time Injury Severity	7.58	0.00	0.00	0.00	0.00
Site TRIR	4.16	2.46	2.21	0.52	1.32

All reported Occupational Health and Safety incidents are registered in CIRS for tracking and management. Incidents captured by the Canada Labour Code (Part II) definition of hazardous occurrences fall under categories III-V of the CIRS system.

The medical diagnostic procedures were:

- Standard threshold shift (hearing) (3 events)
- Minor electrical shock (2 events)
- Strain to elbow/bicep
- Splash of ammonium hydroxide to eyes

The medical treatment injuries were:

- Irritation to eye
- Pain to elbow
- Pain to palm of hand
- Pain to back

The site OH&S program continued to be effective in 2022 with new initiatives being introduced when possible.

- CSSC meetings were performed virtually to support social distancing but were executed to meet the required regulatory requirements of a minimum of 9 per year.

- Safety announcements continued to be utilized on internal TV monitors. This included regulatory changes and highlighting safety procedure edits.
- The site cutting tool committee executed a 'collect and return' for specific knife styles to minimize risk in the first quarter. Safer and ergonomic friendly knives were sourced. Prizes were awarded to promote the collection campaign.
- A "Caught Working Safely" activity was executed. Employees were able to recognize each other for safe working activities and enter to win a variety of prizes.
- The CSSC continued the partnership with site management resulting in sponsorship of safety awareness activities and the CSSC actively leading or participating in at least one event in each fiscal quarter.
- A vendor show was held in the fourth quarter. Employees were able to meet with a variety of vendors related to PPE, tools/equipment, and health related services.
- Site recorded 86 Safety Wins (employee lead actions implemented to improve safety, prior to and not because of an injury or incident).
- The site Total Recordable Incident Rate was finalized at 1.32 up a bit from 0.52 in the previous year.
- The site reached 3,476,968 hours worked (4 years) without a Lost Time Injury in September.
- COVID-19 protocols continued to be managed, created, and revised until June 2022 when most protocols were suspended following provincial guidelines. Site vaccination requirements remain in effect.
- Continued deployment of the site industrial hygiene program including a welding fume sampling study, site mould assessment, nitric acid study in the UO_2 plant and asbestos sampling/remediation activities.
- Continued management of personal fluorine monitors and relevant troubleshooting.
- Completed internal Safety, Health, Environment and Quality self-assessments.
- Increased digital and electronic management of safety forms and processes.

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
- 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 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 2022.

Program Improvements included:

- Waste management projects implemented portions of the long-term waste management plan to dispose of contaminated materials at appropriately licensed hazardous waste facilities.

Procedural updates included:

- PHF-SRA PHCF Spill Risk Assessment
- CQP-115 Response to On-site Events – Spills, Incidents, Occurrences and Loss of Primary Containment
- CAP ENV 29 Stormwater Monitoring Program
- CQP-511 Quality Review of Environmental Data for Regulatory Compliance Reporting
- CAP ENV 1 The Determination of Particulate Emissions by TSI Isokinetic Dust Sampling
- CAP ENV 3 Determination of Uranium and Particulate in Air by the High-Volume Method
- CAP ENV 17 Groundwater Monitoring Program for the Port Hope Conversion Facility
- PHF-PLAN-SPC Spill Prevention and Contingency Plan for the PHCF
- PHF-PLAN-EE1 Environmental Emergency Plan for the PHCF
- CAP ENV 31 Sanitary Sewage Monitoring Program
- CAP ENV 16 Vegetation Sampling
- CAP ENV 15 Collection and Measurement of Lime Candles
- CAP ENV 28 Soil Monitoring Program

The following environmental targets were in place for 2022:

- For all water discharged from an approved discharge point, maintain performance within regulatory limits and action levels. (This target was not met due to the sanitary sewer action level exceedances in 2022.)
- Satisfy historical benchmarks for groundwater discharge. (Target met)

The environmental initiatives planned for 2023 include the following:

- Continue improvements to the PHCF sanitary sewer system.
- Continue to implement portions of the FSD waste management plan.
- Continue implementation of Vision in Motion to remove legacy wastes and contamination from the site.

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

The annual dose from Site 1 and Site 2 are based on monitoring results for each dose component as shown in Table 26. This table illustrates the individual contributions from air, water, and gamma as well as the total public dose from each site.

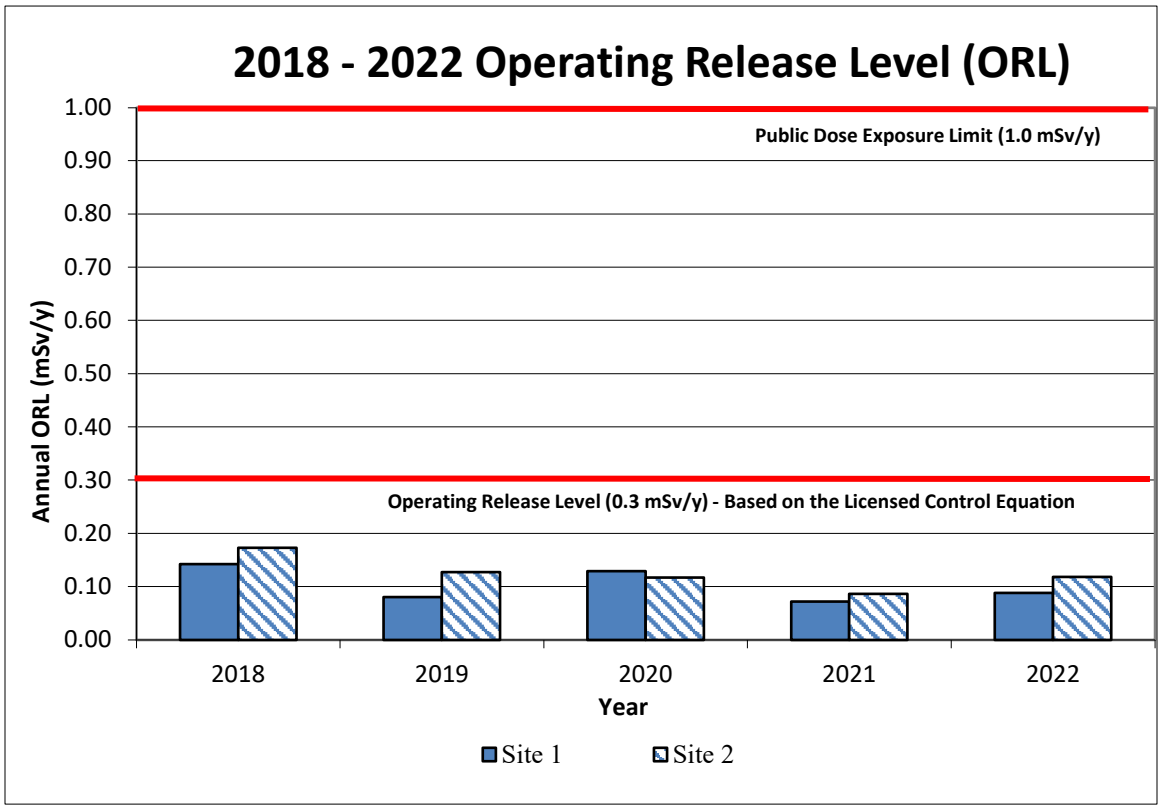
Note that as of July 1, 2019, TLD 13 has been replaced by TLD 10 in the gamma dose calculation for Site 1 due to the removal of the Centre Pier from the licensed property.

The ORL contributions are also shown graphically in Figure 15.

Table 26

Annual Dose (mSv/year)					
ORL Component	**2018**	**2019**	**2020**	**2021**	**2022**
Air	0.001	0.001	0.001	0.001	0.001
Water	0.001	0.001	0.001	0.001	0.001
Gamma – Site 1	0.141	0.078	0.128	0.071	0.087
Gamma – Site 2	0.172	0.125	0.115	0.085	0.116
Annual Dose – Site 1	0.142	0.080	0.129	0.072	0.088
Annual Dose – Site 2	0.173	0.127	0.117	0.086	0.118

Figure 15



Gamma Monitoring

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 then converted into a dose rate in µSv/h. Fourteen locations at Site 1 and six locations at Site 2 have been selected around the fenced perimeter to cover all potential receptors in the public. Note that the number of locations at Site 1 decreased at the end of the second quarter 2019 from 18 to 14, with the removal of Centre Pier from the Site 1 property.

As per the 2016 ORL, dose to the public critical receptor is calculated for both sites 1 and 2 using specific gamma fenceline monitoring locations. The results at stations 2 and 10 are used for Site 1 public dose calculations after July 1, 2019. The results at stations 2 and 21 are used for Site 2 public dose calculations. The results at these locations for this year are summarized and compared with regulatory action levels in Tables 27 and 28.

Table 27

2022 Monthly Public Dose Gamma Monitoring Results (µSv/h)			
Month	**Station**		
	2	**10**	**21**
January	0.16	0.00	0.00
February	0.18	0.00	0.01
March	0.23	0.01	0.06
April	0.14	0.00	0.01
May	0.19	0.00	0.02
June	0.17	0.00	0.04
July	0.18	0.00	0.00
August	0.22	0.01	0.04
September	0.13	0.00	0.00
October	0.18	0.00	0.04
November	0.18	0.00	0.04
December	0.14	0.01	0.02
Action Level (µSv/h)	**0.40**	**0.40**	**0.25**
Licence Limit (µSv/h)	**0.57**	**0.61**	**0.26**

Table 28

Maximum Monthly Public Dose Gamma Monitoring Results							
Station Number	**2018**	**2019**	**2020**	**2021**	**2022**	**Action Level (µSv/h)**	**Licence Limit (µSv/h)**
2	0.26	0.20	0.20	0.21	0.23	0.40	0.57
13*/10	0.07*	0.00*/0.05	0.11	0.02	0.01	0.10*/0.40	0.40*/0.61
21	0.07	0.06	0.09	0.03	0.06	0.25	0.26
*Denotes values for station number 13							

Some fluctuations in the gamma results are expected for stations 13 and 21 given that the values are near background levels of 0.08 µSv/h. Historical waste material stored at Centre Pier buildings was removed in 2018 (station 13). Some of the material was used as shielding inside building 40. Temporary shielding in the form of sea containers was installed to minimize the impact on fence line gamma while activities were carried out in building 40. Buildings 40, 41 and 42 were demolished and Center Pier was handed over

to CNL in July 2019. Waste inspection/characterization and removal activities were carried out at Site 2, Dorset Street property, with no significant impact to public dose.

Discharge to Air

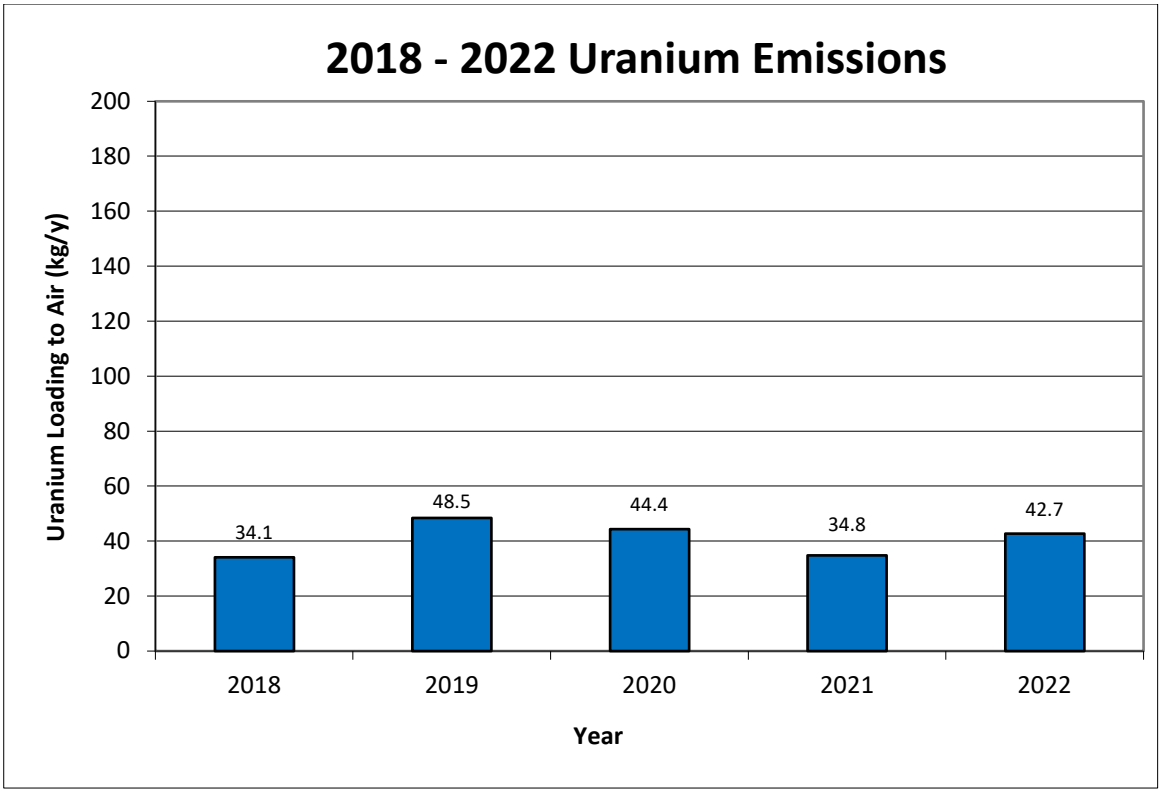
The air quality monitoring program at PHCF is divided into source air monitoring and ambient air monitoring. The source air monitoring program collects and analyzes daily samples from the main stacks on the UF_6 and UO_2 operating plants. Both stacks are continuously sampled for uranium.

The total uranium emissions to air from PHCF in 2022 were approximately 42.7 kg U. These uranium loadings include both the UF_6 and UO_2 main stacks, plant building ventilation and facility point sources. Table 29 and Figure 16 illustrates PHCF uranium loading to air for the period of 2018 to 2022. The PHCF uranium loading to air was slightly increased compared to previous years based on production days and volumes.

Table 29

Total Uranium Emissions (kg U)					
Emission	**2018**	**2019**	**2020**	**2021**	**2022**
Air	34.1	48.5	44.4	39.0	42.7

Figure 16



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 10 g U/h.

One action level was exceeded for uranium emissions from the UF_6 plant main stack in 2022. The UF_6 plant main stack daily average for June 28 was available on June 29, and it showed an elevated result of 45 gU/h for the main stack. While well below the limit of 280 gU/h, it was above the action level of 40 gU/h. The annual daily average uranium emission in 2022 remained comparable to the previous year based on production days and volumes.

No licensed action levels were exceeded for uranium emissions from the UO_2 plant main stack in 2022. The annual daily average uranium emissions in 2022 remained comparable to the previous year based on production days and volumes.

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. One action level was exceeded for fluoride emissions from the UF_6 plant in 2022. The

daily fluoride emission average for the UF_6 main plant stack exceeded the action level of 230 g HF/h for August 31, 2022, at a value of 236 g HF/h. Facility emissions remained well below the regulatory limit of 650 g HF/h. The annual daily average HF emissions in 2022 remained comparable to the previous year based on production days and volumes. The total fluoride emissions to air (as HF) from the PHCF in 2021 were approximately 548 kg HF. These fluoride loadings include the UF_6 main stack, UF_6 plant building ventilation and facility point sources.

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 in the UO_2 plant was operated in the last quarter of 2021. UO_2 depleted lots were blended in the first two weeks of operation in the year 2022

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 2022 annual average and maximum stack emissions from the UF_6 plant main stack and the UO_2 main stack are presented in Table 30 and Figure 17 through to Figure 20.

Table 30

2018 - 2022 Main Stack Emissions									
Plant	**Parameter**	**Licence Limit**	**Action Level**	**Value**	**2018**	**2019**	**2020**	**2021**	**2022**
UF_6	Uranium g U/h	280	40	Annual Daily Average	1.4	2.7	2.5	2.2	2.5
				Annual Daily Maximum	8.7	13.3	8.2	6.7	44.7
	Hydrogen Fluoride g HF/h	650	230	Annual Daily Average	30	18	28	29	20
				Annual Daily Maximum	229	266	273	191	236
UO_2	Uranium g U/h	240	10	Annual Daily Average	0.7	0.8	0.6	0.5	0.5
				Annual Daily Maximum	2.2	2.9	2.5	2.3	1.4
	Ammonia kg NH_3/h	58	10	Annual Daily Average	1.7	2.1	2.0	2.0	2.4
				Annual Daily Maximum	3.9	4.8	4.9	5.1	7.7

* Note that the daily emission data is available to CNSC during site inspections.

No regulatory action levels were exceeded for ammonia for the UO_2 plant main stack in 2022. The average annual ammonia emissions from the UO_2 plant main stack in 2022 are comparable to levels observed in previous years. The total ammonia emissions to air from PHCF in 2022 were approximately 38t NH_3. These ammonia loadings include the UO_2 plant main stack, the UO_2 plant point sources and facility point sources.

Figure 17

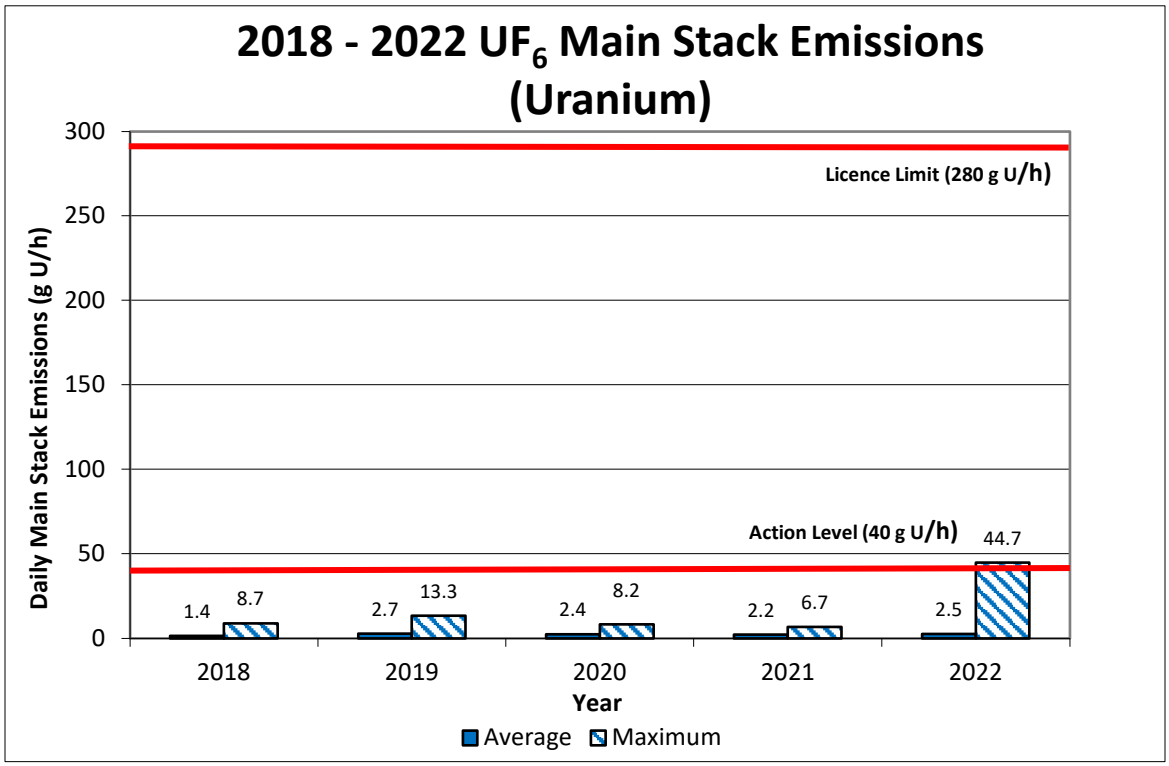

2018 - 2022 UF6 Main Stack Emissions (Uranium)
Daily Main Stack Emissions (g U/h)
300
250
200
150
100
50
0
Licence Limit (280 g U/h)
Action Level (40 g U/h)
1.4
8.7
2.7
13.3
2.4
8.2
2.2
6.7
2.5
44.7
2018
2019
2020
2021
2022
Year
Average
Maximum

Figure 18

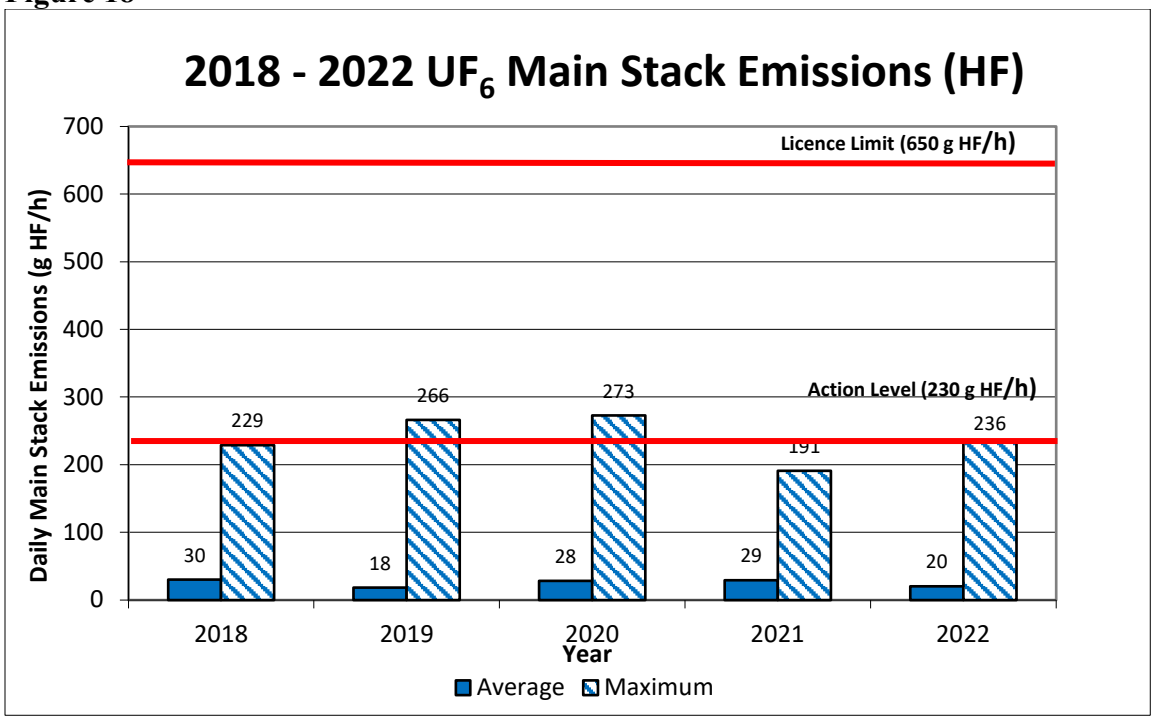


Figure 19

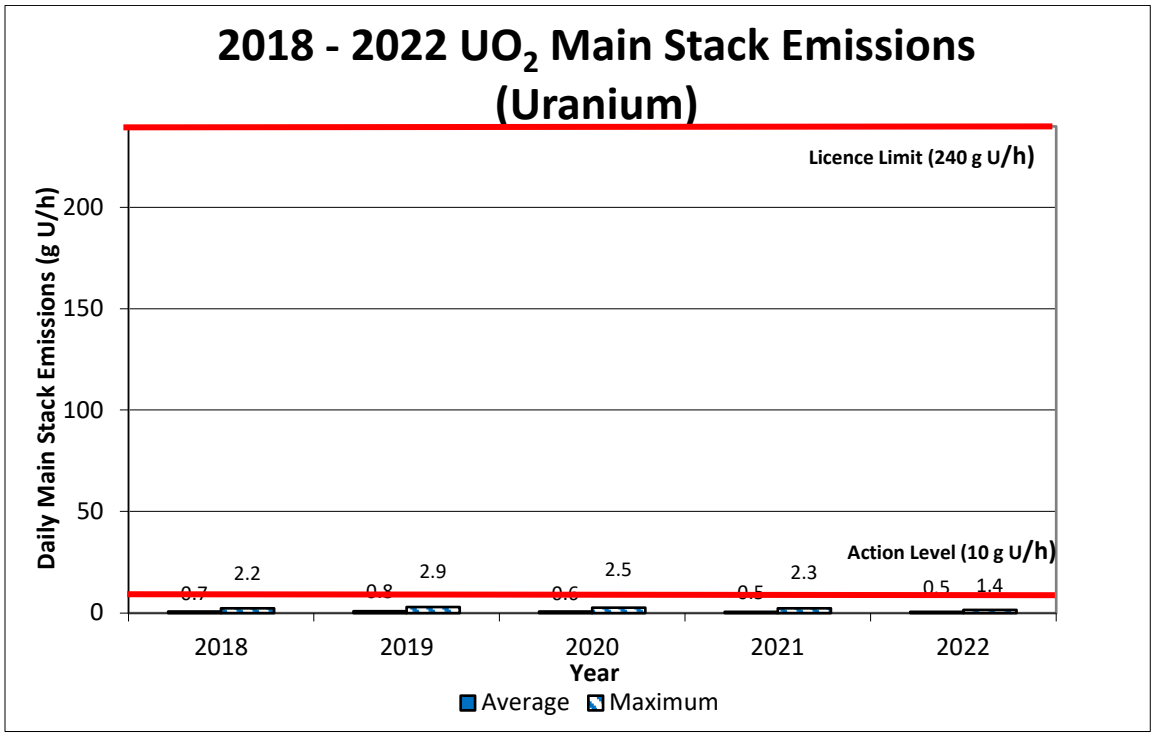
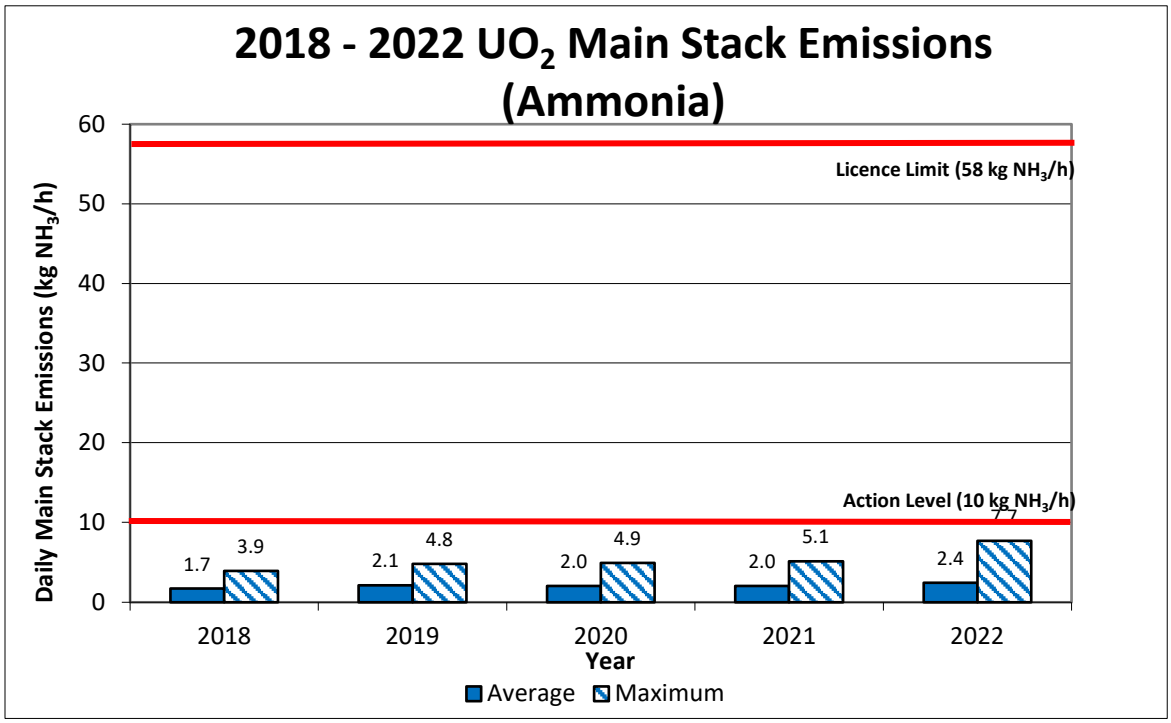


Figure 20

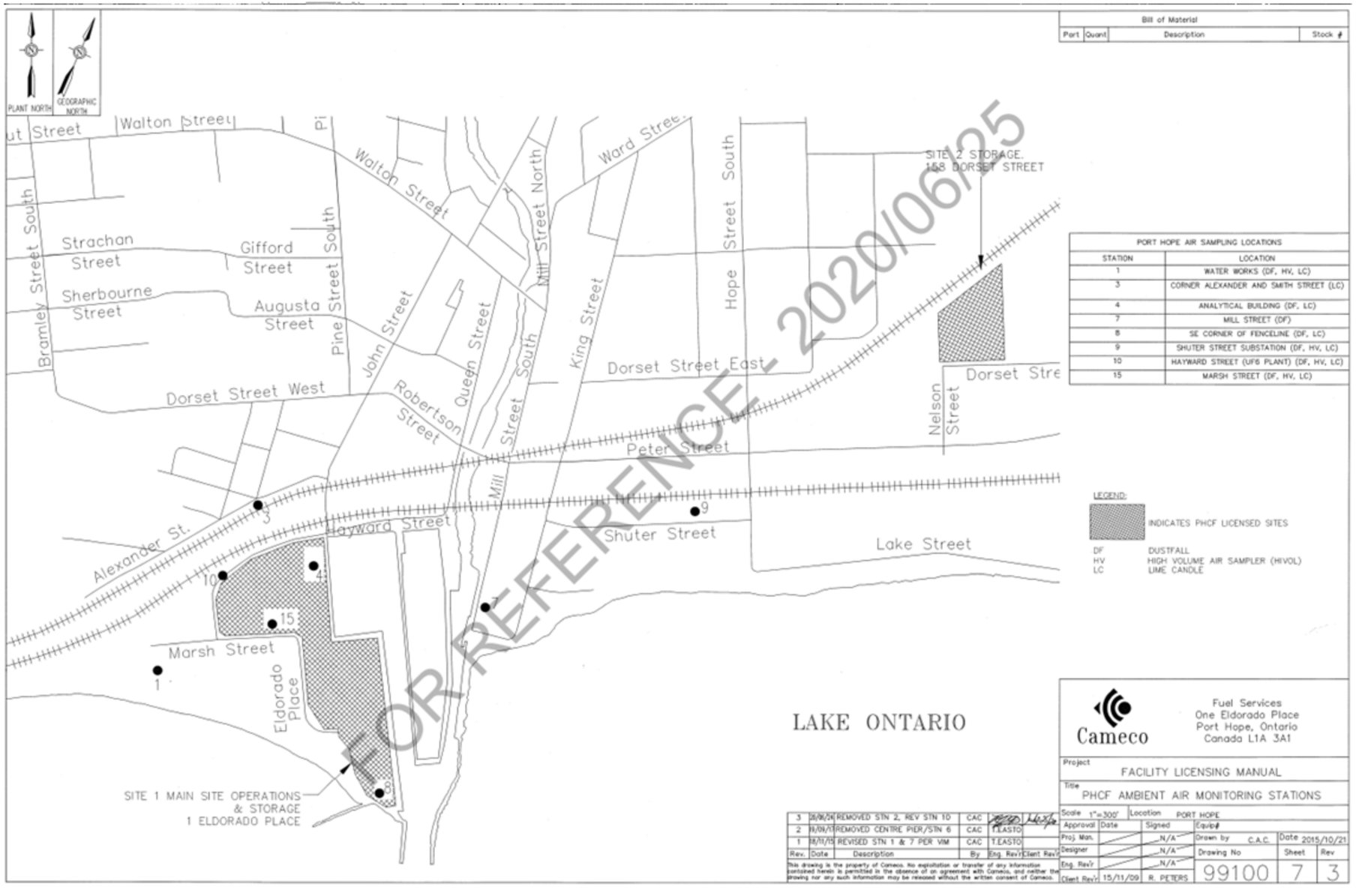


Ambient Air Monitoring

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.

PHCF ambient air monitoring station locations for dustfalls, lime candles and high-volume air samplers are shown on Figure 21.

Figure 21


PLANT NORTH
GEOGRAPHIC NORTH
Walton Street
Strachan Street
Gifford Street
Sherbourne Street
Augusta Street
Bramley Street South
Pine Street South
John Street
Queen Street
Mill Street North
Mill Street South
King Street
Ward Street
Hope Street South
Dorset Street West
Dorset Street East
Robertson Street
Peter Street
Nelson Street
Alexander St.
Hayward Street
Shuter Street
Lake Street
Marsh Street
Eldorado Place
SITE 2 STORAGE.
188 DORSET STREET
SITE 1 MAIN SITE OPERATIONS
& STORAGE
1 ELDORADO PLACE
LAKE ONTARIO
FOR REFERENCE ONLY - 2020/06/25
Bill of Material
Part | Quant | Description | Stock #
PORT HOPE AIR SAMPLING LOCATIONS
STATION | LOCATION
1 | WATER WORKS (DF, HV, LC)
3 | CORNER ALEXANDER AND SMITH STREET (LC)
4 | ANALYTICAL BUILDING (DF, LC)
7 | MILL STREET (DF)
8 | SE CORNER OF FENCELINE (DF, LC)
9 | SHUTER STREET SUBSTATION (DF, HV, LC)
10 | HAYWARD STREET (UF6 PLANT) (DF, HV, LC)
15 | MARSH STREET (DF, HV, LC)
LEGEND:
INDICATES PHCF LICENSED SITES
DF DUSTFALL
HV HIGH VOLUME AIR SAMPLER (HIVOL)
LC LIME CANDLE
Cameco
Fuel Services
One Eldorado Place
Port Hope, Ontario
Canada L1A 3A1
Project
FACILITY LICENSING MANUAL
Title
PHCF AMBIENT AIR MONITORING STATIONS
Scale 1"=300'
Location PORT HOPE
Approval | Date | Signed | Equip#
Proj. Man. N/A
Designer N/A
Eng. Rev'r N/A
Client Rev'r 15/11/09 R. PETERS
Drawn by C.A.C.
Date 2015/10/21
Drawing No 99100
Sheet 7
Rev 3
3 26/06/24 REMOVED STN 2, REV STN 10 CAC T.EASTO
2 19/09/17 REMOVED CENTRE PIER/STN 6 CAC T.EASTO
1 28/11/15 REVISED STN 1 & 7 PER VIM CAC T.EASTO
Rev. | Date | Description | By | Eng. Rev'r | Client Rev'r
This drawing is the property of Cameco. No exploitation or transfer of any information contained herein is permitted in the absence of an agreement with Cameco, and neither the drawing nor any such information may be released without the written consent of Cameco.

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 2022. The facility uranium in dustfall results averaged less than 0.1 mg U/m^2/30 days in 2022, which is comparable to levels detected in previous years. It should be noted that dustfall uranium results observed from 2018 to 2022 are near method detection levels.

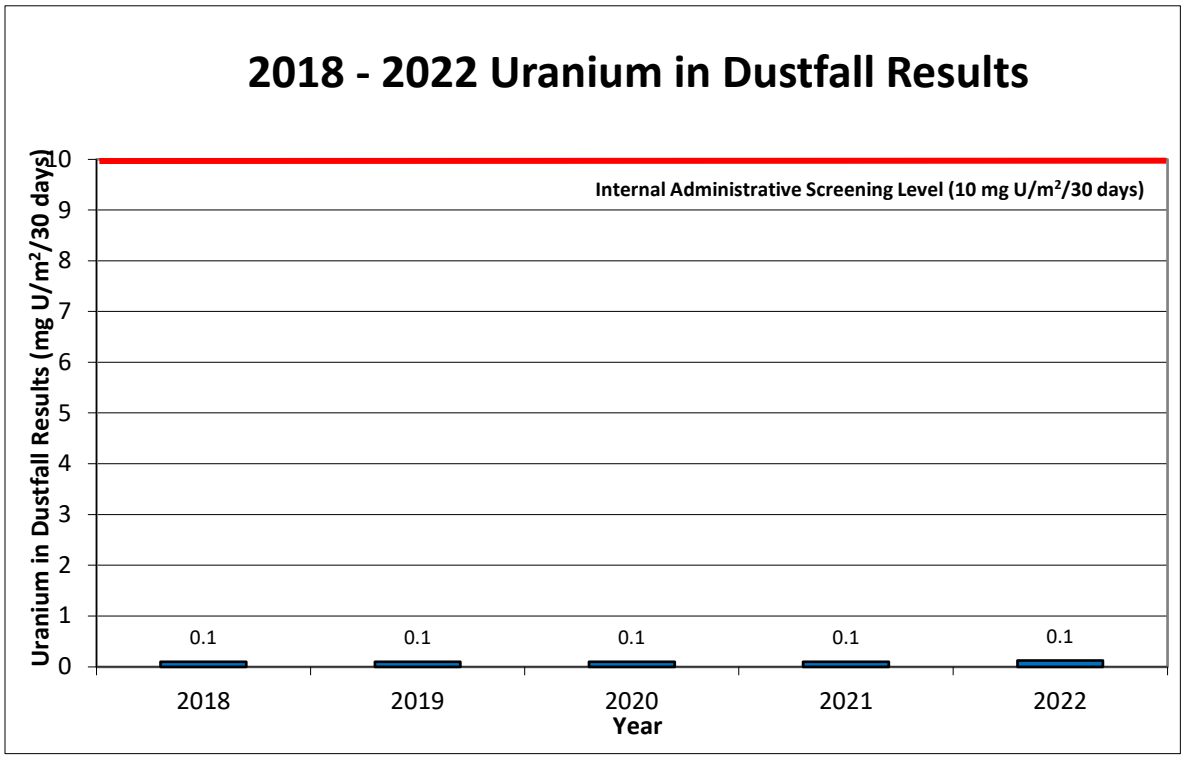
The annual all-station average uranium content in dustfall jars at and near the site in 2018 through 2022 is presented in Table 31.

Table 31

Comparison of Uranium in Dustfall Results (mg U/m^2/30 days)					
Period	**2018**	**2019**	**2020**	**2021**	**2022**
First Quarter	0.1	0.1	0.0	0.0	0.0
Second Quarter	0.1	0.1	0.1	0.0	0.1
Third Quarter	0.1	0.1	0.1	0.1	0.2
Fourth Quarter	0.1	0.1	0.1	0.1	0.2
Average	**0.1**	**0.1**	**0.1**	**< 0.1**	**0.1**
Cameco Internal Administrative Screening Level = 10 mg U/m^2/30 days					

Figure 22 shows the average uranium dustfall results from 2018 through 2022.

Figure 22



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. The regulatory criteria for uranium content in ambient air varies by period and particulate size. Cameco uses TSP (total suspended particulates) hivols at the PHCF. The Ambient Air Quality Criteria (AAQC) for U in TSP are 0.3 µg U TSP/m^3 (24 hr) and 0.06 µg U in TSP/m^3 (annual). These U in TSP criteria are compared against the maximum and average PHCF hivol U in TSP results, respectively.

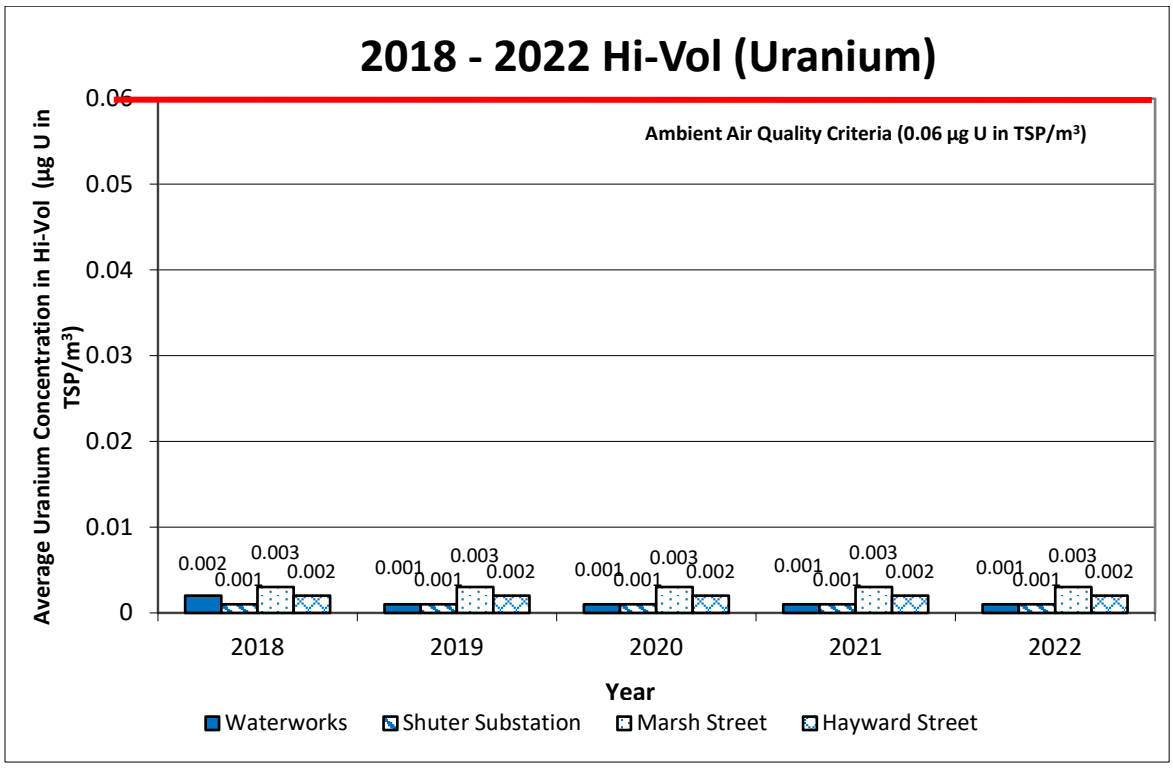
Table 32 shows the average and maximum uranium hi-vol results from 2018 through 2022. Average and maximum results are comparable to levels observed in the previous years.

Figure 23 shows the average uranium hi-vol results from 2018 through 2022.

Table 32

2018 – 2022 Annual Uranium-in-Air Concentration at Hi-Vol Stations (µg U in TSP/m³)					
Year	**Result**	**Waterworks**	**Shuter Substation**	**Marsh Street**	**Hayward Street**
2018	Average	0.002	0.001	0.003	0.002
	Maximum	0.044	0.007	0.049	0.019
2019	Average	0.001	0.001	0.003	0.002
	Maximum	0.011	0.009	0.016	0.033
2020	Average	0.001	0.001	0.003	0.002
	Maximum	0.007	0.009	0.221	0.010
2021	Average	0.001	0.001	0.003	0.002
	Maximum	0.025	0.011	0.071	0.011
2022	Average	0.001	0.001	0.003	0.002
	Maximum	0.017	0.036	0.031	0.015
Average <0.06 µg U in TSP/m³ (annual) AAQC Maximum <0.3 µg U in TSP/m³ (24 hr) AAQC					

Figure 23



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.

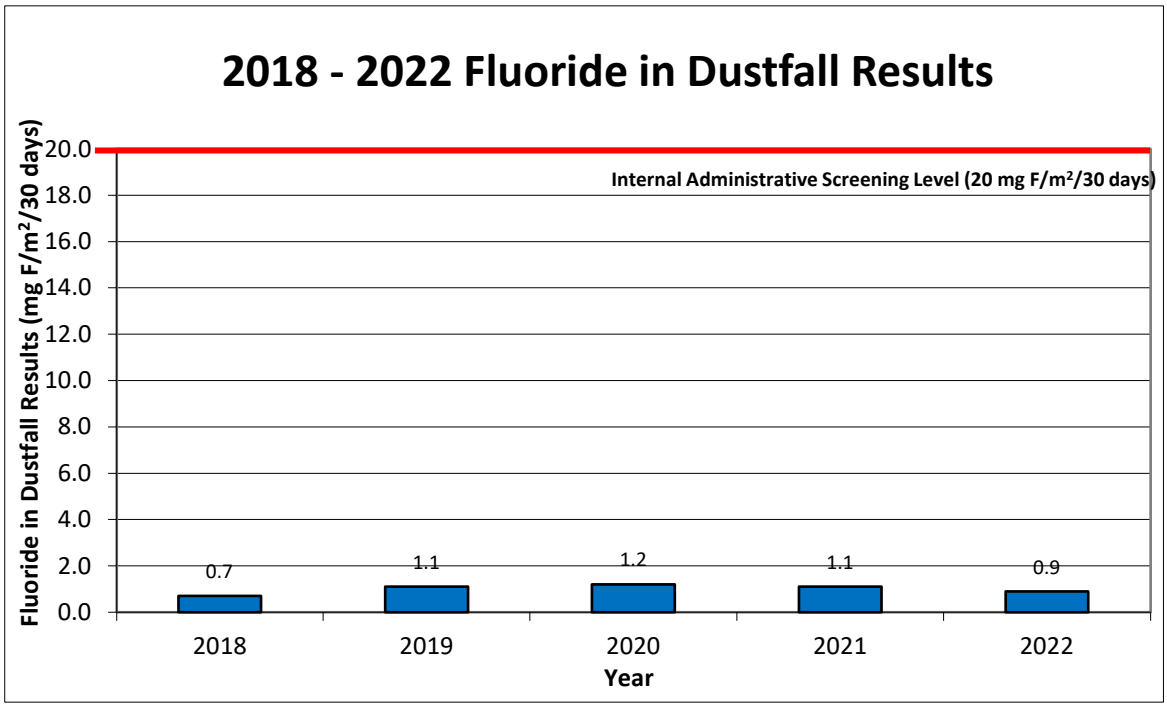
No fluoride dustfall exceeded the internal administrative screening level in 2022. The annual all-station average fluoride content in dustfall jars at and near the PHCF in 2018 through to 2022 is presented in Table 33. The dustfall fluoride levels observed in 2022 are comparable to levels observed in the previous year when production was operational and are within acceptable data range variation.

Table 33

Comparison of Fluoride in Dustfall Results (mg F/m^2/30 days)					
Period	**2018**	**2019**	**2020**	**2021**	**2022**
First Quarter	0.7	0.8	1.1	1.3	0.9
Second Quarter	1.0	1.2	1.1	1.2	1.5
Third Quarter	0.5	1.0	1.1	0.6	0.4
Fourth Quarter	0.6	1.4	1.4	1.1	0.8
Average	**0.7**	**1.1**	**1.2**	**1.1**	**0.9**
Cameco Internal Administrative Screening Level = 20 mg F/m^2/30 days					

Figure 24 shows the average fluoride dustfall results from 2018 through 2022.

Figure 24



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 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 MECP 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.

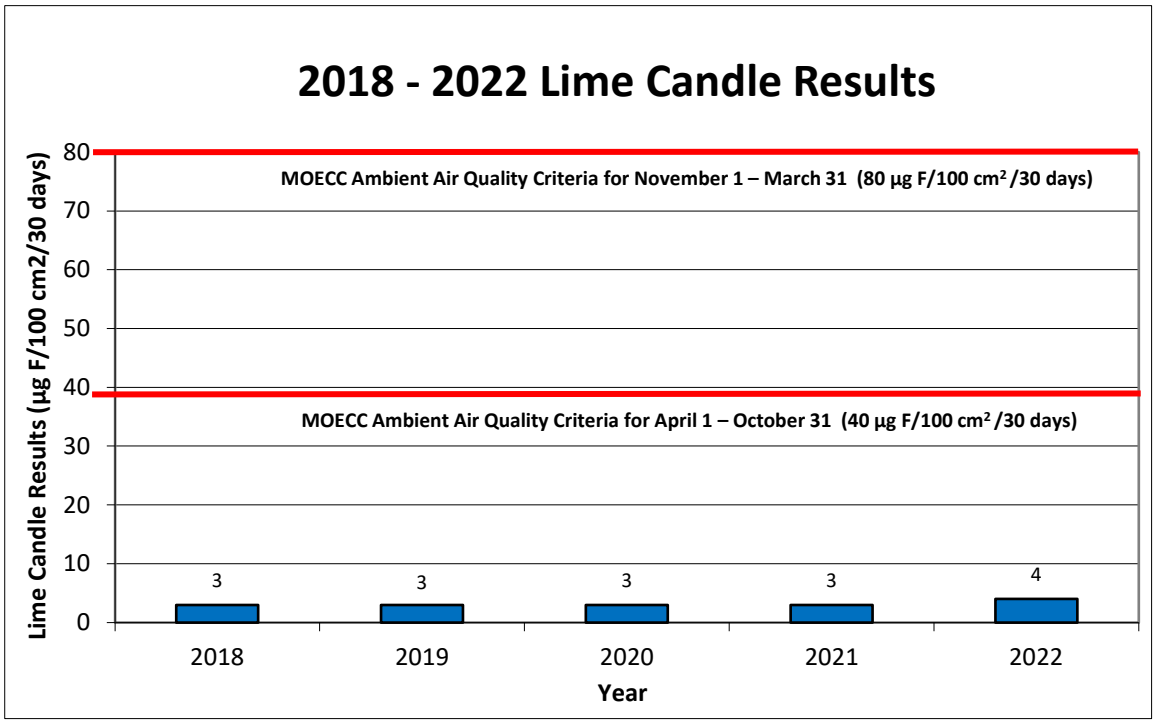
The quarterly average lime candle monitoring results are shown in Table 34 for 2018 through 2022. There were no lime candle results above the MECP AAQC in 2022. The 2022 lime candle annual average is comparable to levels observed in previous years.

Table 34

Comparison of Monthly Lime Candle Results by Quarter (µg F/100 cm²/30 days)					
Period	**2018**	**2019**	**2020**	**2021**	**2022**
First Quarter	3	2	3	3	4
Second Quarter	2	4	3	5	4
Third Quarter	3	2	4	3	4
Fourth Quarter	2	3	2	3	2
Average	**3**	**3**	**3**	**3**	**4**
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 cm²/30 days, changing to 80 µg F/100 cm²/30 days in winter.					

Figure 25 shows the average lime candle results from 2018 through 2022.

Figure 25



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 three monitoring locations beyond the facility fence line. Two of these locations are within a 0 to 500 m radius zone from the facility, while the remaining location is within the 1000 to 1500 m radius zone. Location 25 is no longer sampled as it was impacted by CNL remediation work in advance of the 2021 sampling program.

Figure 26 illustrates the general placement of soil monitoring locations beyond the PHCF. The 2022 soil sampling program was completed December 8, 2022. The soil sampling approach includes the sampling of 15 cm cores, which the contract laboratory separates into composite 0-5 cm, 5-10 cm and 10-15 cm core segments for uranium analysis.

The 2018 through 2022 uranium in soil data is provided in Table 35 for the clean plot monitoring location (location 2) that is positioned adjacent to the Port Hope Water Treatment Plant to the west of the facility. Reference is made to Table 36 for 2022 individual sampling location uranium in soil monitoring data.

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 (location 2) results were below the MECP Table 1 full depth background site condition uranium standard of 2.5 µg/g (ppm) for residential/parkland/institutional/industrial/commercial/community land use.

Concentrations of uranium in shallow soils at locations 12 and 19 are likely influenced by historic fill placements within the community. Small scale variability in shallow soils can be observed and the heterogenous nature of fill materials can influence uranium trending at discrete monitoring locations. At both locations, demolition fill materials have been observed in shallow core samples over time. Between the 2021 and 2022 monitoring programs, a mature tree adjacent to location 19 was removed to below grade level. Though shallow soil disturbances would have taken place in the immediate vicinity of the monitoring location, no trends to note are observed in the 2022 monitoring results.

Following completion of the Port Hope Area Initiative, Cameco will review and modify soil monitoring locations as appropriate. The siting of revised monitoring locations will consider among other items, CNL clean fill placements.

Figure 26: Soil Monitoring Locations

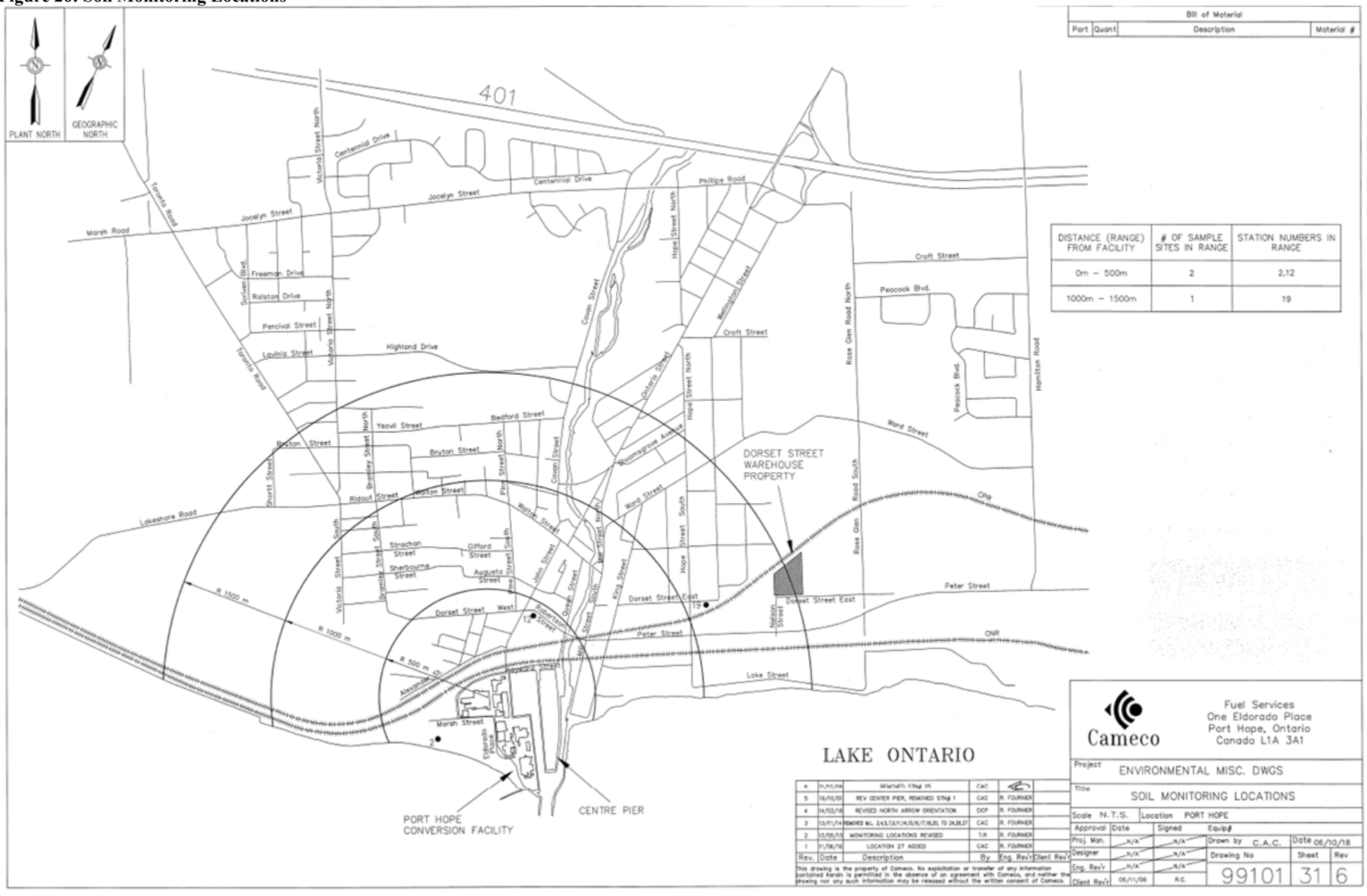


Table 35

Clean Fill Soil Plot (µg/g U)					
Depth (cm)	**2018**	**2019**	**2020**	**2021**	**2022**
0-5 cm depth	0.91	0.82	0.91	0.87	1.1
5-10 cm depth	0.85	0.74	0.84	0.80	1.0
10-15 cm depth	0.98	0.80	0.81	0.80	0.92

Table 36

2022 Soil Data (µg/g U)			
Depth (cm)	**Location 2 (Clean Plot)**	**Location 12**	**Location 19**
0-5 cm depth	1.1	5.5	4.8
5-10 cm depth	1.0	5.5	4.5
10-15 cm depth	0.92	4.4	4.8

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 August or early September for fluoride analysis and assessed for visible foliar damage. The monitoring program is completed in conjunction with the MECP, and samples are obtained from locations adjacent to PHCF and within the surrounding community. Substitute trees are added to the program where required and available as target tree locations may be inaccessible at the time of sampling or observed to have died off or been removed between sampling events.

The vegetation sampling program was modified in 2017 in coordination with the MECP, 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 program modification included an overall net increase in monitoring locations from 13 to 17 locations.

The sampling program was further modified in 2021 in coordination with the MECP. Locations 38, 39, 40, 41 were removed from the monitoring program. The locations in questions were added to the program in 2017 when the program was last significantly modified. Consistent with MECP feedback, results obtained from these locations were not adding value to the program and the locations were not positioned in primary areas of focus. Cameco contract laboratory results reported between 2018 and 2020 for the locations in question were all reported below the contract laboratory detection limit of 5 µg/g.

Location 32 trees were all replaced in 2021 as the previous cluster was removed in association with area CNL remedial work. Single trees from monitoring locations 29 and 33 were further replaced in 2021 and in 2022, a single tree was substituted in at location 31.

The sampling program currently consists of 13 cluster locations and the 2022 vegetation sampling program was completed September 1, 2022.Replicate composite samples otherwise continue to be sampled at each cluster location. Reference vegetation monitoring location clusters are illustrated in Figure 27.

Table 37 provides the soluble fluoride replicate composite sample results by location. Figure 28 illustrates the mean vegetation survey results for 2018 through 2022.

As a number of individual 2022 sample results (14 of 26) were reported less than the contract laboratory detection limit of 5 µg/g, the detection limit skews the plotted annual mean value when utilizing the detection limit value in place of the less than results. Of the values reported above the detection limit, the maximum value was 14 µg/g for the location 31 replicate samples. Location 31 is positioned well east of the PHCF, directly adjacent to an active foundry. The 2021 maximum value was similarly recorded at this location.

Figure 27: Vegetation Monitoring Locations

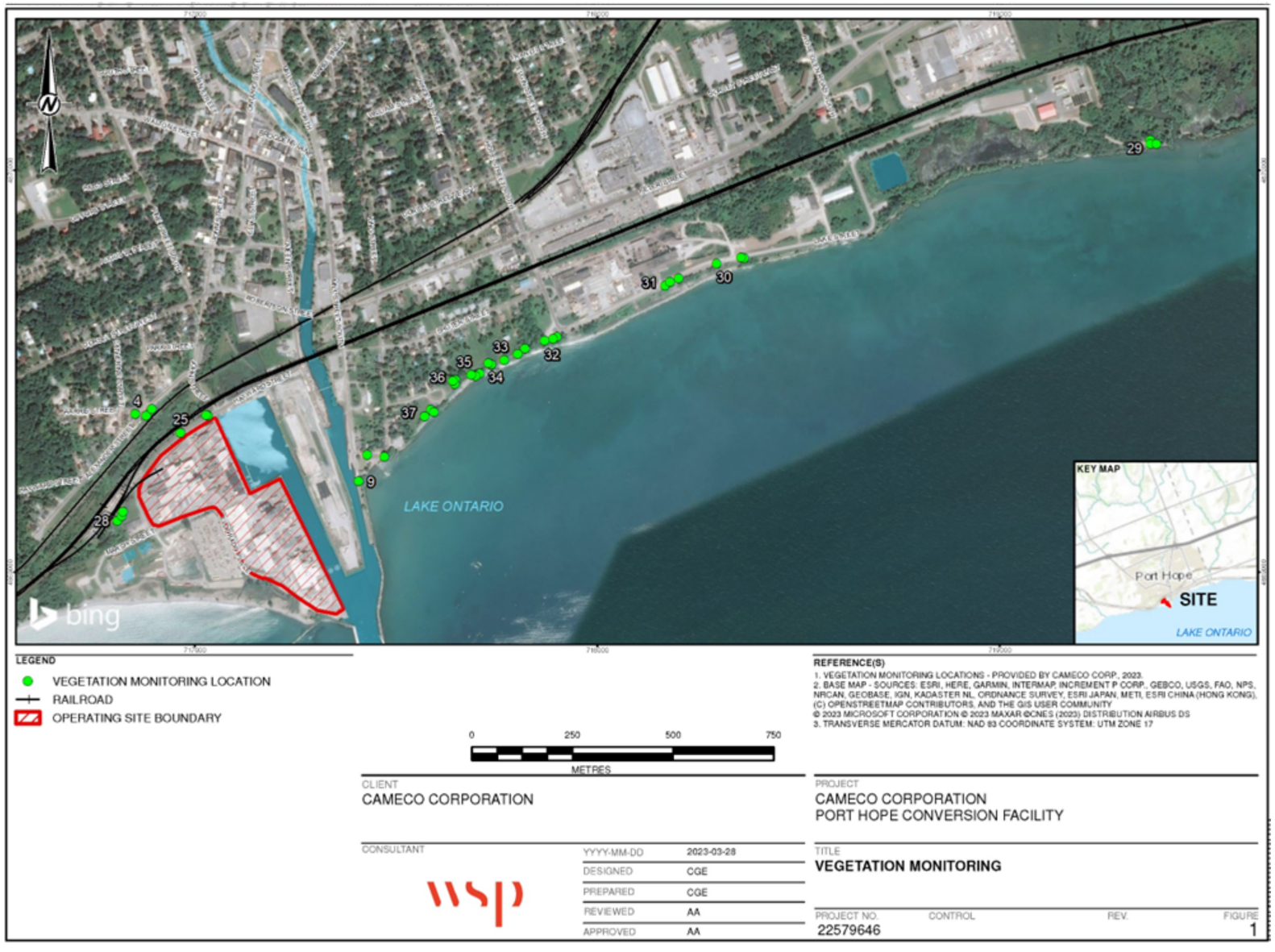
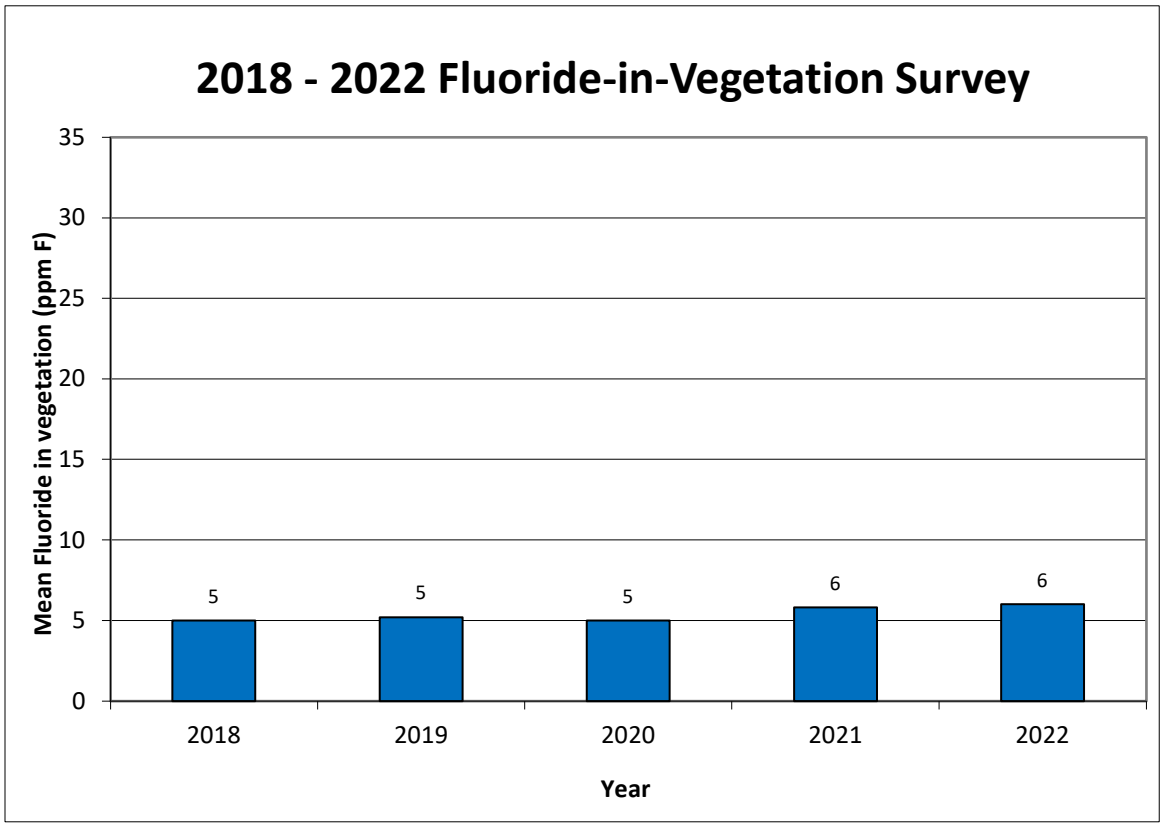


Table 37

2022 Vegetation Survey Results	
Vegetation Site	**Fluoride Result (µg/g)**
4A	< 5
4B	< 5
9A	8
9B	8
25A	< 5
25B	< 5
28A	< 5
28B	< 5
29A	< 5
29B	< 5
30A	7
30B	7
31A	14
31B	14
32A	< 5
32B	< 5
33A	7
33B	< 5
34A	6
34B	6
35A	< 5
35B	6
36A	6
36B	6
37A	< 5
37B	< 5

Figure 28



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: production facility cooling water returns, the combined facility sanitary sewage discharge, the combined backwash stream associated with the harbour water intake mechanical pre-treatment operations, and storm sewer outlets.

Most of the PHCF once-through cooling water system requirements are met by the facility cooling water intake, located at the entrance to the Port Hope harbour along the west approach channel wall. The remaining once-through cooling water requirements are met by municipal potable water.

The once-through cooling water system takings, operations and discharges are regulated by MECP via a Permit to Take Water (PTTW) and an ECA.

The municipal sewage treatment plant processes the sanitary sewer discharges from the PHCF, and sewage quality is defined by municipal sewer use by-law 30/94. Several sources contribute to the combined PHCF sanitary sewer discharge, principal sources being standard domestic contributions from throughout the facility, effluent discharges from the Powerhouse (such as boiler blowdown) and contributions from facility showering facilities. It should also be noted that a portion of the sanitary sewer discharge from PHCF originates upstream of the facility, primarily from the municipal water treatment facility. Figure 29 illustrates the combined sanitary sewage monitoring location positioned immediately upstream of the municipal system.

A 2022 summary of select water quality data relating to the PHCF harbour water intake and production facility returns are shown in Table 38. The cooling water monitoring locations in question are illustrated on Figure 29. The UO_2 plant transitioned to a closed loop cooling system within 2022, and as a result, Table 38 UO2S summary results represent monitoring results as of late-July.

Elevated mean and maximum uranium concentrations are noted at the UF_6 Plant/Building 2 (UO2N) and UO_2 Plant (UO2S) cooling water returns for 2022 as a function of elevated cooling water intake trending. A general decrease in uranium trending was noted from December 2021 through to February 2022 in relation to the interruption of Canadian Nuclear Laboratories (CNL) remedial work within the inner Port Hope harbour over the winter period. Following resumption of inner harbour dredge activities in March 2022, a corresponding increase in uranium trending was observed. Elevated mean and maximum conditions were subsequently observed through the balance of the 2022 calendar year as a function of on-going inner harbour remedial work.

An elevated UO2N maximum fluoride result was recorded relative to typical baseline concentrations and harbour water intake trending in association with harbour water supply challenges and a brief harbour water intake outage experienced in February. The 2022 mean fluoride result was at the generic CCME water quality guideline of 0.12 mg/L and all daily fluoride results were well below the CCME aquatic biota toxicity benchmark of 11.5 mg/L from which the generic guideline value is derived.

Ammonia results at SCI and UO2N otherwise generally increased in the fourth quarter 2022, which influenced the annual mean and maximum results. Ammonia is not a parameter of concern with respect to UF_6 plant heat exchanger operations. Trending is

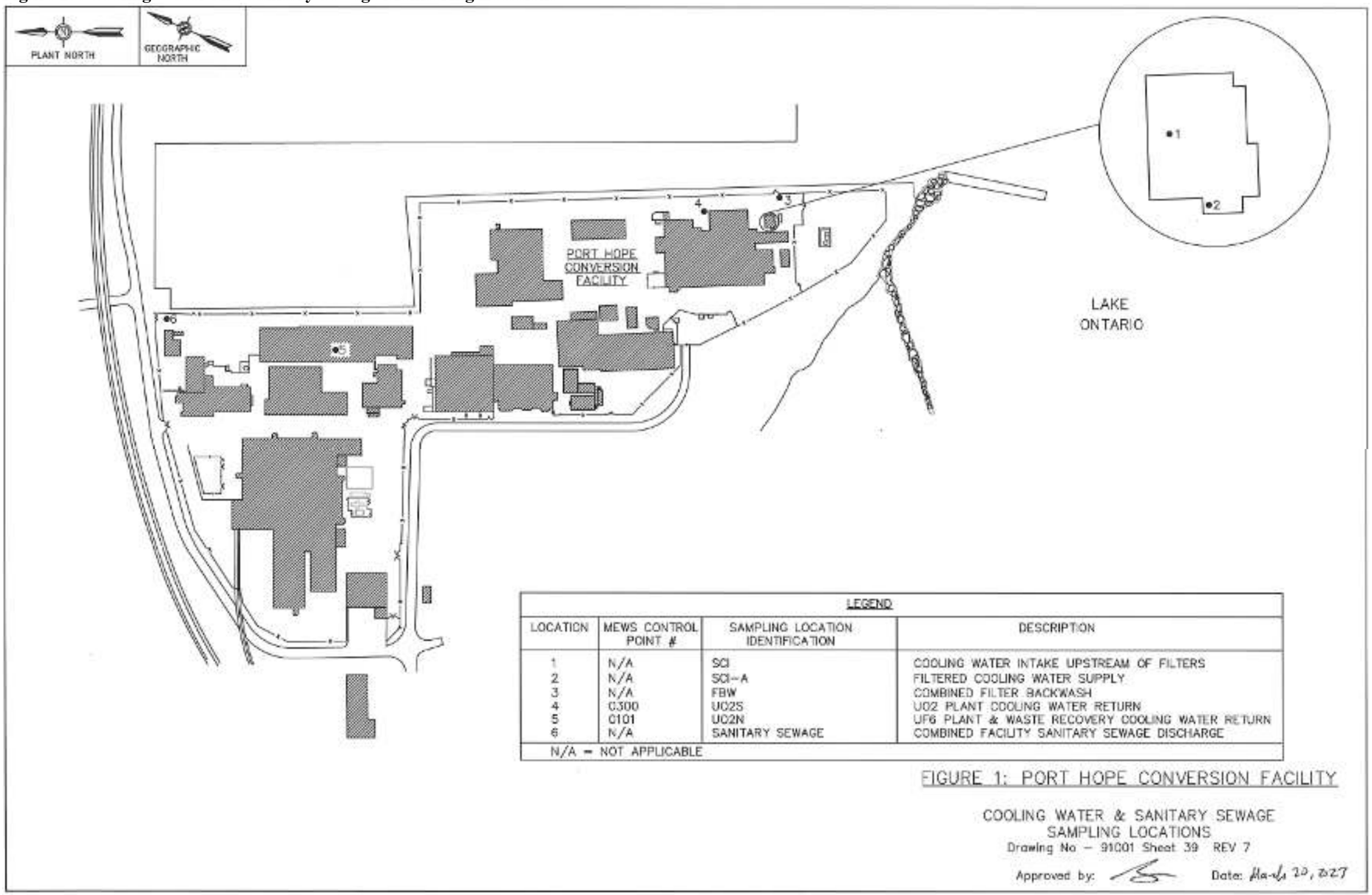
attributed to the accumulation and decomposition of surface water organic matter within the PHCF once-through cooling water works.

Table 38

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	120	500	0.11	0.22	0.045	0.76	0.89	1.9	7.94	8.74
UO2N	110	420	0.12	0.76	0.078	0.84	0.78	1.7	8.02	8.76
UO2S*	62	320	-	-	0.014	0.014	0.91	1.8	8.00	8.45
Note: Values are reported below the method detection limit, where applicable, to satisfy MECP 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 * UO2S was inactive as of July 28, 2022.										

Flow is monitored at both Port Hope harbour cooling water discharge points upstream of the respective discharges in accordance with MECP ECA requirements. Flow rate trending for the UO2N and UO2S sampling points for the period of 2018 through 2022 are presented in Figure 30. In 2022, the recorded average daily flow rates at the UO2N and UO2S sampling points were 11,992 m^3/day and 1,672 m^3/day respectively. The UO2S summary is limited to the period through to the end of the third quarter due to the aforementioned closed loop cooling system transition.

Figure 29: Cooling Water and Sanitary Sewage Monitoring Locations



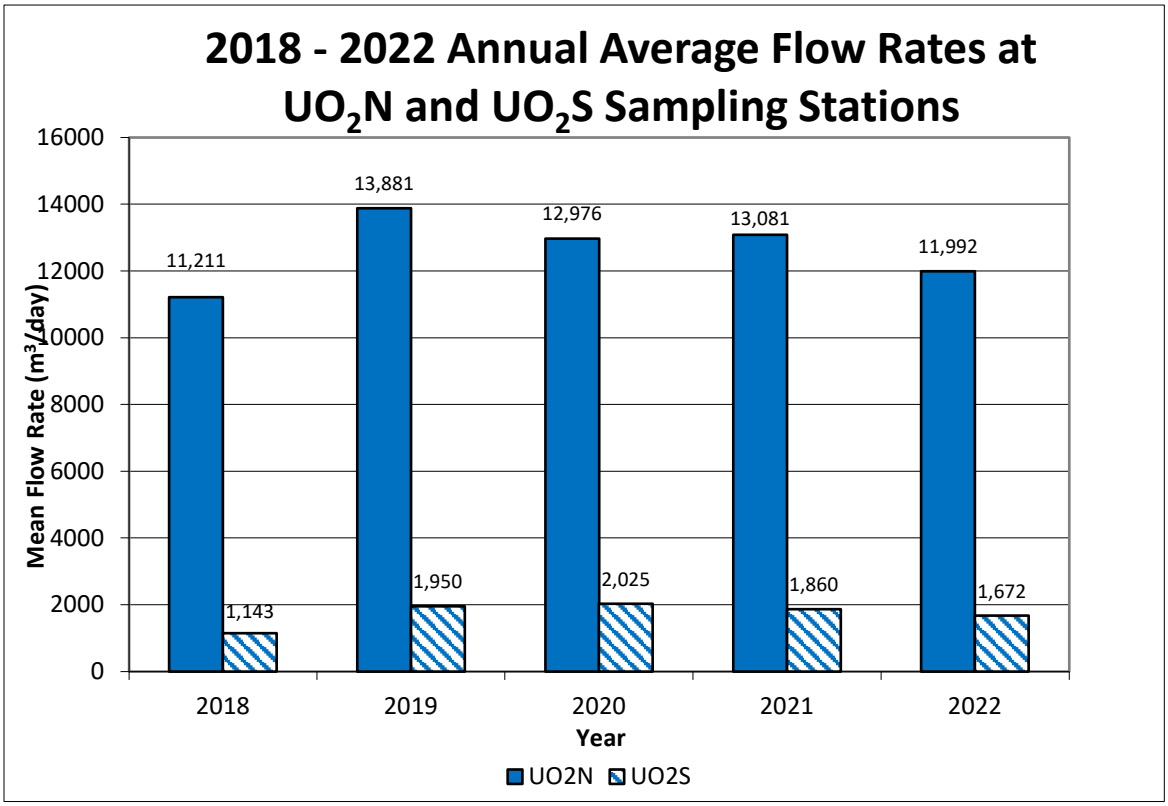
LEGEND			
LOCATION	MEWS CONTROL POINT #	SAMPLING LOCATION IDENTIFICATION	DESCRIPTION
1	N/A	SCI	COOLING WATER INTAKE UPSTREAM OF FILTERS
2	N/A	SCI-A	FILTERED COOLING WATER SUPPLY
3	N/A	FBW	COMBINED FILTER BACKWASH
4	C300	UO2S	UO2 PLANT COOLING WATER RETURN
5	C101	UO2N	UF6 PLANT & WASTE RECOVERY COOLING WATER RETURN
6	N/A	SANITARY SEWAGE	COMBINED FACILITY SANITARY SEWAGE DISCHARGE
N/A = NOT APPLICABLE			

FIGURE 1: PORT HOPE CONVERSION FACILITY

COOLING WATER & SANITARY SEWAGE
SAMPLING LOCATIONS
Drawing No – 91001 Sheet 39 REV 7

Approved by: Date: March 20, 2023

Figure 30



Amended ECA 0899-BULJQX, which has been replaced by ECA 1310-CK5MMH, requires specific sampling of the SCI, filtered cooling water supply (SCI-A), FBW and cooling water discharge points (UO_2N and UO_2S).

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 MECP 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. The combined sanitary sewage monitoring location is illustrated on Figure 29. Table 39 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 31. Table 40 summarizes the monthly averaging results for uranium concentration in sanitary sewer discharges for 2022.

In 2016 and early 2017, as part of the relicensing process, a daily sanitary sewer discharge action level of 100 µg/L and a monthly mean release limit of 275 µg/L were developed and accepted.

Substantive sanitary sewer system rehabilitation and replacement work was completed beween 2017 and 2019 on a pirority basis, taking into consideration pending infrastructure upgrades. Positive water quality trending had been observed in response to the sum of the efforts as is evidenced by the reductions in the 2020 mean uranium concentration and total uranium loadings.

The daily sanitary sewer action level was reached or exceeded 15 times in 2022. Sanitary sewer discharges otherwise remained well below the facility monthly mean release limit throughout the 2022 calendar year. 2022 uranium loadings were the highest annual loadings from the 5-year trend.

Groundwater infiltration to the underground civil works was the suspected primary causal factor for 2022 action level excursions. Factors that influence groundwater infiltration potential include Lake Ontario water level conditions and the significance and frequency of wet events. In relation to first quarter 2023 sanitary sewer investigations, it was confirmed impacted harbour water had also been entering the sanitary sewer system by way of the Powerhouse for some time. As harbour water trending has shown elevated uranium content in relation to CNL harbour remedial works, uses and associated discharges to the sanitary sewer system may have also contributed to elevated uranium in sanitary sewage recordings in 2022. Harbour water discharges to the sanitary sewer system from Powerhouse operations have been isolated as of January 2023.Cameco completed sanitary sewer infrastructure inspections in targeted areas in the fourth quarter of 2021, both within and upstream of the licensed facility, to identify potential infiltration of areas of concern and follow-up inspections were completed in the first quarter of 2022. Cameco continues to evaluate potential interim rehabilitation opportunities, taking into consideration sanitary sewer rehabilitation/replacement work completed to date and the planned site project and VIM project sanitary sewer system improvements that are anticipated to significantly reduce remaining groundwater infiltration conditions.

Targeted sanitary sewer replacement, rehabilitation and abandonment work is planned for the 2023 calendar year. Replacement sanitary sewer infrastructure is targeted for the sewage works located between three existing lift stations and downstream maintenance holes near the south perimeter of the Warehouse. Licensed facility rehabilitation work is focused on a lateral service at the northeast portion of the PHCF, east of Building 13. Lastly, utility abandonment work is focused on services rendered inactive as part of the aforementioned sewage works replacement activities and an inactive Building 20 service.

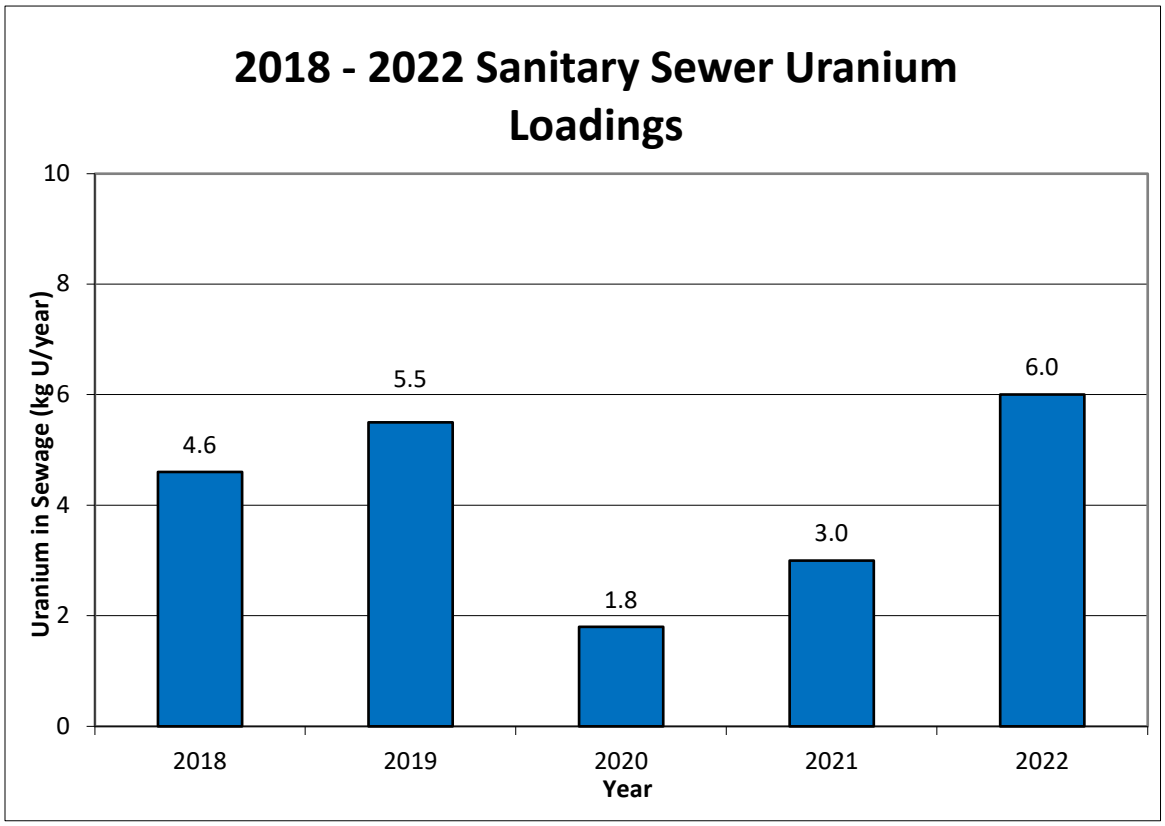
Table 39

2018 – 2022 Sanitary Sewer Discharges			
Period	**Annual Average Flow (m^3/day)**	**Annual Average Uranium Concentration (µg/L)**	**Uranium Loadings (kg/year)**
2018	361	37	4.6
2019	444	33	5.5
2020	383	13	1.8
2021	334	23	3.0
2022	423	39	6.0

Table 40

2022 Monthly Sanitary Sewer Discharges			
Period	**Sanitary Sewer Action Level/Release Limit**	**Monthly Average Uranium Concentration (µg/L)**	**Daily Maximum Uranium Concentration (µg/L)**
January	Action Level of 100 µg/L - daily composite sample Release Limit of 275 µg/L - monthly averaging period	23	38
February		30	48
March		77	140
April		67	100
May		47	78
June		37	280
July		11	38
August		12	47
September		46	180
October		31	80
November		42	94
December		47	89

Figure 31



Harbour Water Supply Monitoring

The ambient water quality program is concerned with monitoring the potential impacts of aqueous discharges into the receiving waters, namely production facility cooling water returns. 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 under routine/baseline conditions. Exemptions to note include unusual/non-routine circumstances such as the 2018 west turning basin wall failure, CNL harbour isolation works and on-going CNL harbour remedial activities.

The cooling water intake is sampled on a continuous basis via the collection of daily composite samples from monitoring location SCI. Table 41 provides a summary of select water quality parameters results.

In line with the Table 38 discussion text, a general decrease in uranium trending was noted from December 2021 through to February 2022 in relation to the interruption of CNL remedial work within the inner Port Hope harbour over the winter period.

Following resumption of inner harbour dredge activities in March 2022, a corresponding increase in uranium trending was observed. Elevated mean and maximum conditions were subsequently observed through the balance of the 2022 calendar year as a function of on-going inner harbour remedial work.

Ammonia results generally increased in the fourth quarter 2022, which influenced the annual mean and maximum results. Ammonia is not a parameter of concern with respect to production facility operations. Trending is attributed to the accumulation and decomposition of surface water organic matter within the PHCF once-through cooling water works.

The 2022 mean fluoride result was below the generic CCME water quality guideline of 0.12 mg/L. Moreover, all daily 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 41

2018 - 2022 Harbour Water Quality – Cooling Water Intake						
Parameter	**Value**	**2018**	**2019**	**2020**	**2021**	**2022**
Uranium (µg U/L)	Average	5.2	5.1	5.0	70	120
	Maximum	31	46	12	540	500
Fluoride (mg F/L)	Average	0.16	0.092	0.090	0.066	0.11
	Maximum	0.36	0.18	0.15	0.17	0.22
Nitrate (mg N/L)	Average	1.0	0.95	0.92	1.0	0.89
	Maximum	1.8	1.6	1.7	1.9	1.9
Ammonia +Ammonium (mg N/L)	Average	0.13	0.031	0.014	0.015	0.045
	Maximum	0.47	0.21	0.14	0.17	0.76
Note: Values reported below the method detection limit where applicable						

The results of the harbour water quality for 2018 through 2022 are also illustrated in Figure 32 through to Figure 35.

Figure 32

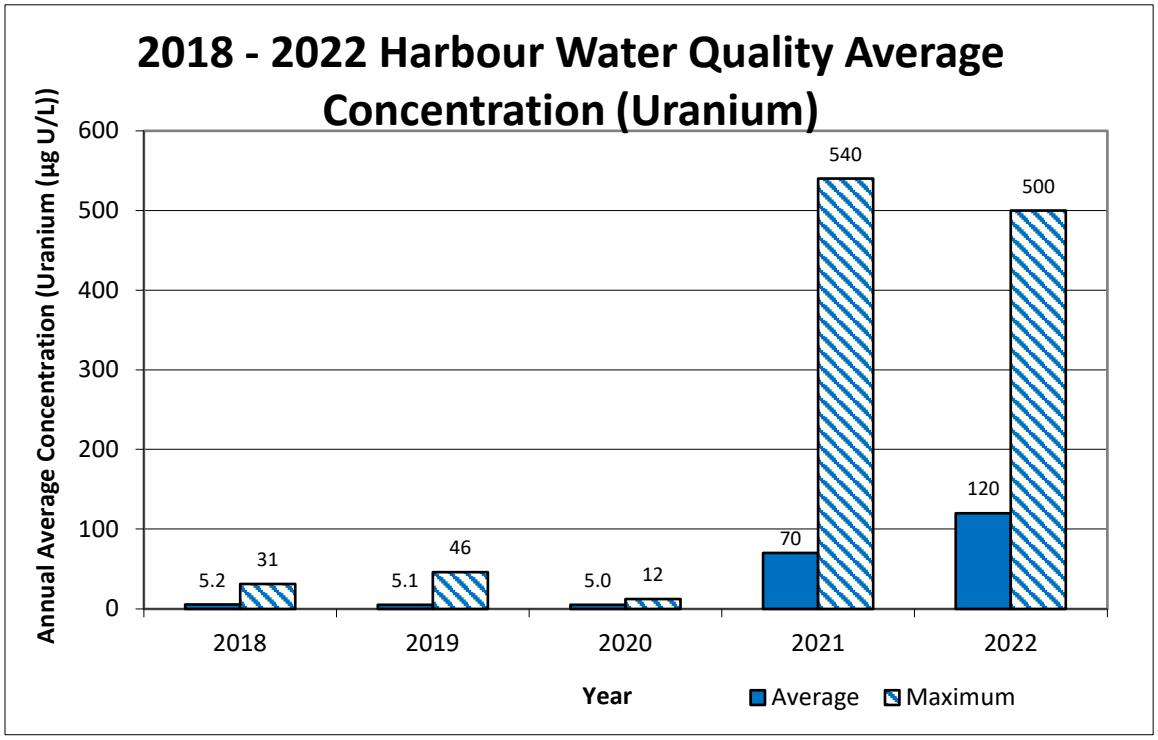


Figure 33

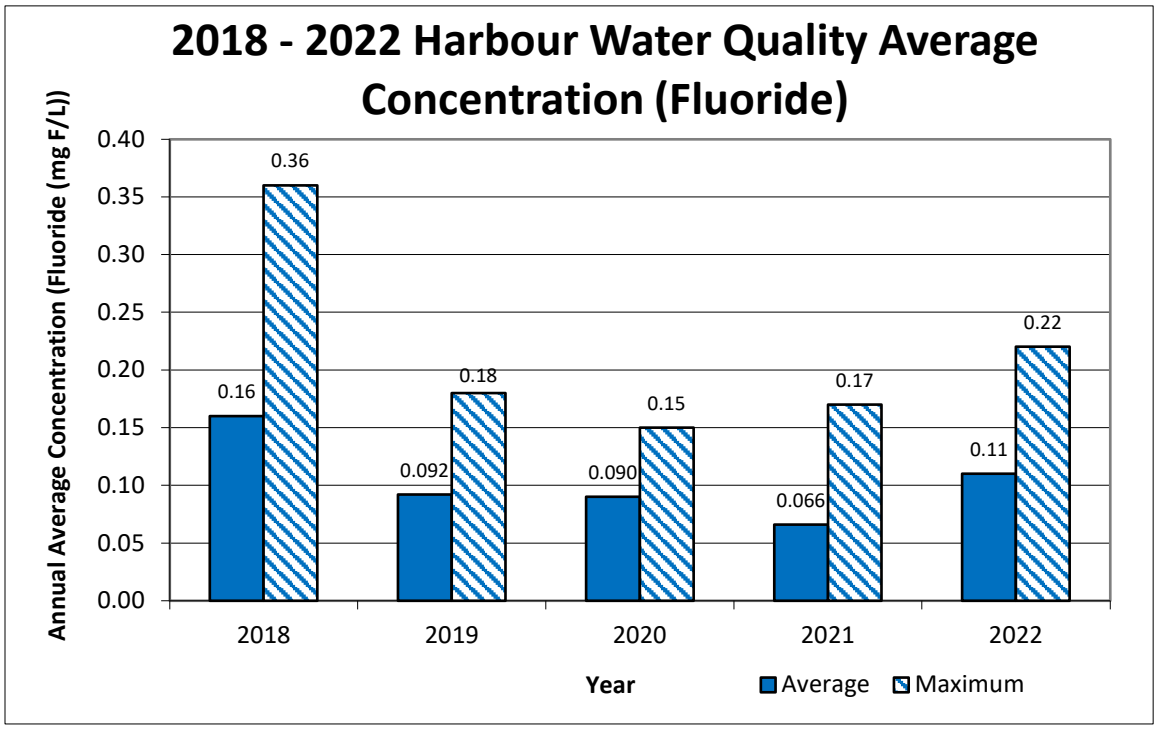


Figure 34

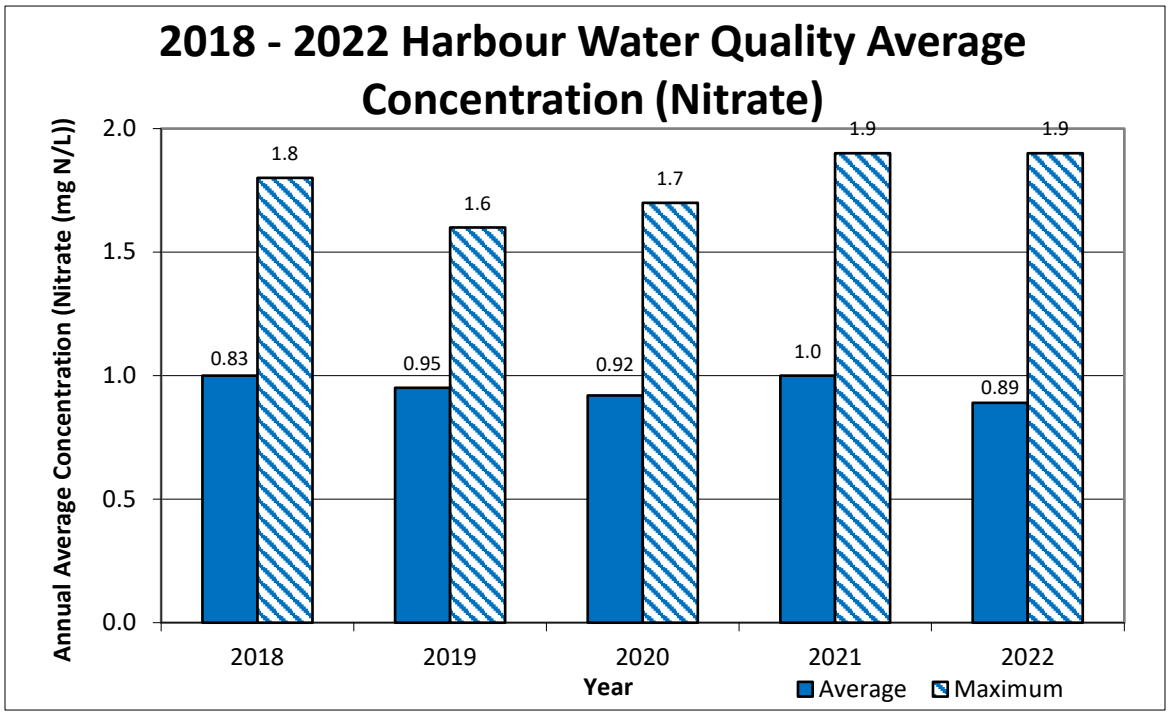
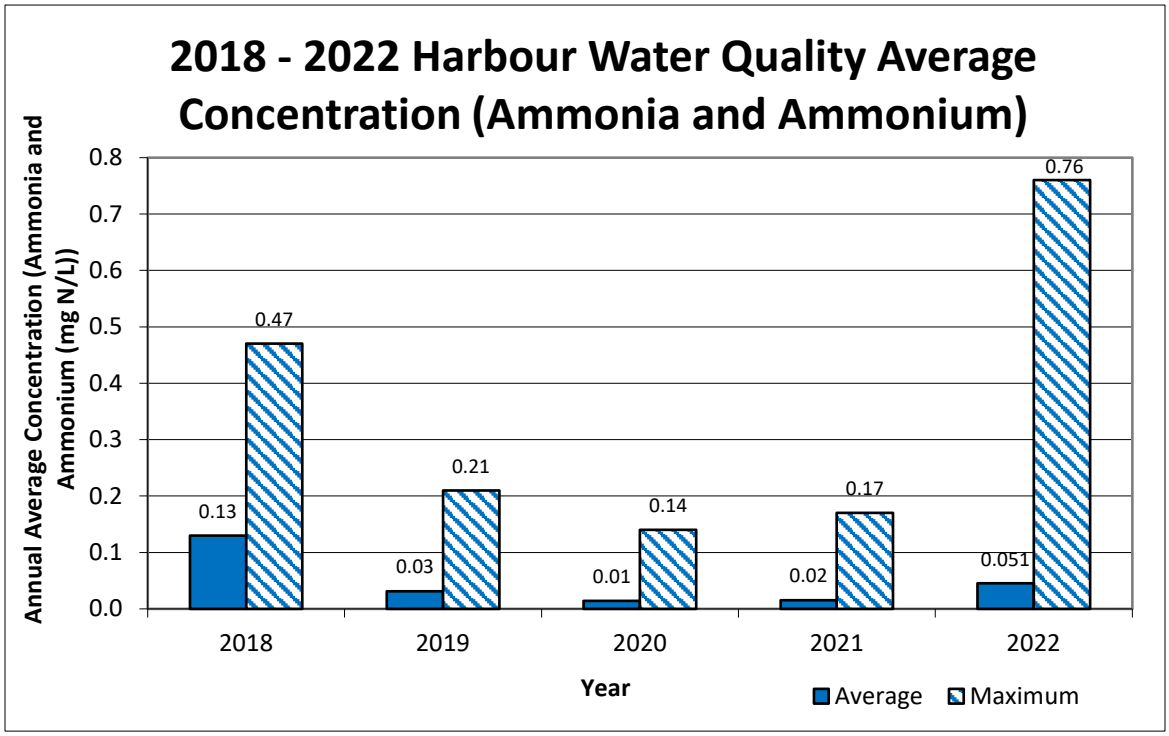


Figure 35



Storm Water Monitoring

The storm water monitoring program is currently 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.

Amended ECA 0899-BULJQX, which revoked ECA 4998-9CKL7F, includes a revised stormwater monitoring program specific to planned VIM storm sewer works upgrades and associated changes to all active storm sewer outlet locations. The revised monitoring program will be phased in on a per outlet basis following full completion of proposed works. A new VIM outlet is now operational at the southernmost portion of the facility, however, a portion of the proposed works upstream of the outlet remains to be completed. The outstanding civil works in question are to the east of the UO_2 plant and will displace existing Outlets 14 and 15 when operational.

Grab samples are currently obtained from up to six storm sewer outlets immediately upstream of the harbour at catch basin/maintenance hole 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). Outlets 2, 6, 8, 11, 13 and 15 are the focus of the current monitoring program.

Licensed facility storm sewer outlets are illustrated on Figure 36. Current monitoring locations are highlighted with markers for reference.

It is important to note that in the current storm sewer works operating condition, storm water quality is routinely highly variable and influenced by factors such as precipitation event duration and intensity as well as infrastructure deficiencies.

Table 42 provides a summary of storm water quality parameters results for the 2022 calendar year; field duplicate samples excluded.

Outlet 8 is typically dry during sampling events due to its catchment area comprising of granular cover. No Outlet 8 samples were collected during the 2022 sampling programs as there was no outlet flow at the time of the June and November sampling events. In addition, surface water interference was present at Outlet 13 and Outlet 15 during the June 7 sampling program, and as such, monitoring results should be interpreted with caution.

Despite reported variances in storm water quality for select parameters, Table 42 individual grab samples all passed their respective *Daphnia magna* and rainbow trout acute lethality single concentrations tests in 100% effluent.

As part of the planned VIM civil works upgrades, all historic site outlets are planned for abandonment. Existing infrastructure realignments and upgrades will take place upstream of active outlets and a reduced number of new harbour outlets will be installed with oil and grit separator systems. In the interim, all historic facility storm sewer outlets continue discharge to the CNL harbour work zone bounded by the wave attenuator installations.

Figure 36: Storm Sewer Outlets

Table 42

2022 Storm Water Monitoring Results								
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	June 7, 2022	0.0902	0.14	0.2	0.21	0.0088	0.0	0.0
	November 30, 2022	0.153	0.17	<0.1	0.25	0.0100	0.0	0.0
Outlet 6	June 7, 2022	0.0276	0.29	0.2	0.26	0.0009	0.0	0.0
	November 30, 2022	0.0389	0.32	0.2	0.21	0.0008	0.0	0.0
Outlet 11	June 7, 2022	0.0430	0.13	0.1	0.07	0.0010	0.0	0.0
	November 30, 2022	0.0400	0.12	0.2	0.16	0.0006	0.0	0.0
Outlet 13	June 7, 2022	0.0255	<0.06	0.5	0.29	0.0027	10	0.0
	November 30, 2022	0.0468	0.06	2.4	0.28	0.0012	0.0	20
Outlet 15	June 7, 2022	0.00611	<0.06	0.2	0.18	0.0017	0.0	0.0
	November 30, 2022	0.0167	<0.06	0.3	0.26	0.0065	0.0	0.0

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.

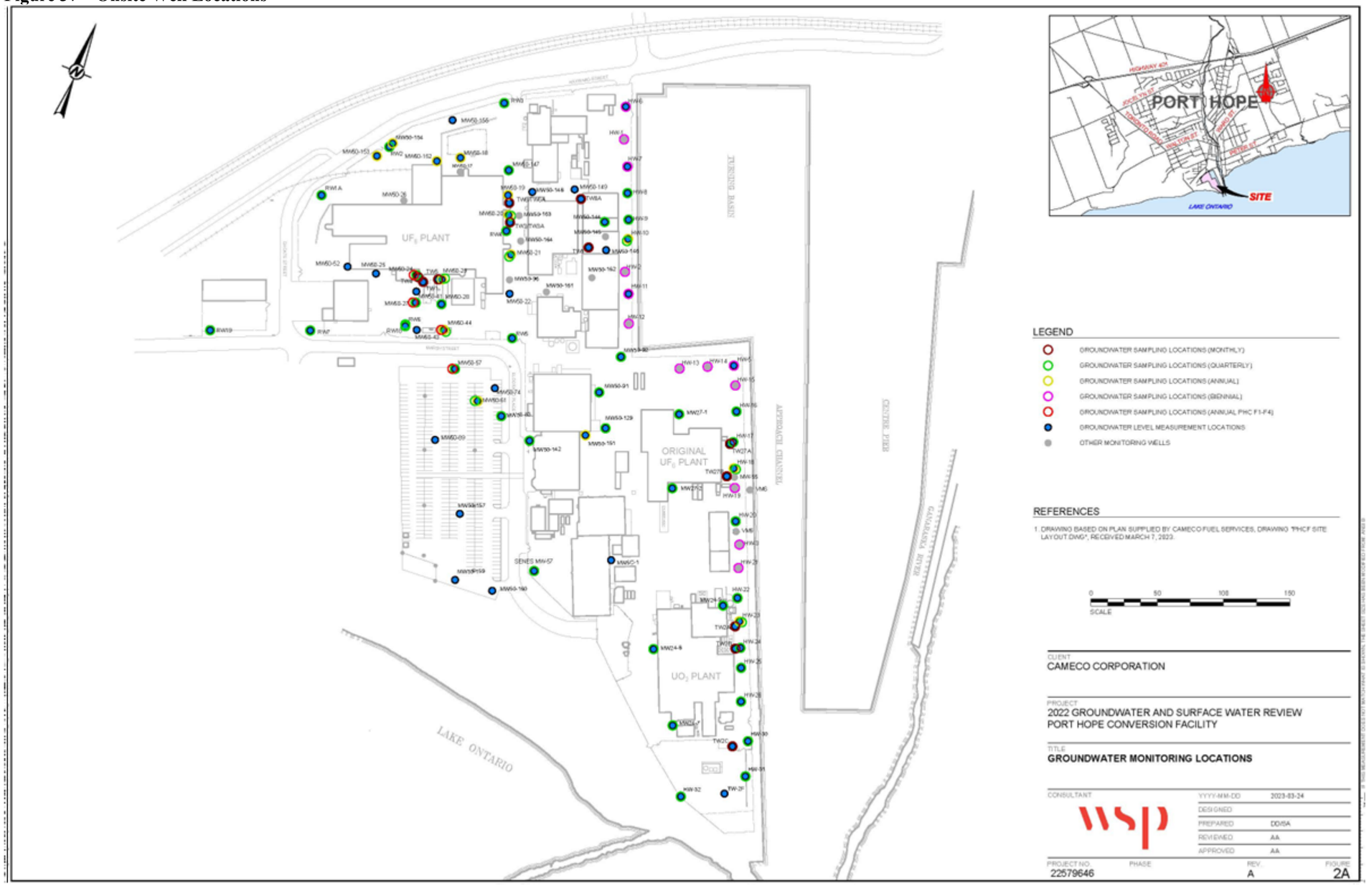
Groundwater is sampled under three separate schedules: monthly sampling of the operating treatment wells; quarterly sampling of overburden wells; and annual sampling of bedrock wells. Areas of focus include the UF_6 plant area (east and south); the waste recovery building/warehouse areas; the former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

Up to twelve pumping wells were in operation during the 2022 calendar year. Figure 37 illustrates the PHCF groundwater monitoring program well locations as of the end of the 2022 calendar year.

Figure 37 – Onsite Well Locations



Effluent and Environmental Monitoring Program Performance

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

- Water samples (i.e., cooling water, sanitary discharge) – 96.2% of planned samples were collected.
- Stack samples (i.e., stacks) – 98.0% of planned samples were collected.
- Environmental Samples (i.e., surface water, groundwater, hivol, dustfall, lime candle, fenceline gamma, soil, vegetation) – 98.3% of planned samples were collected.

In 2022, all analysis under the environmental program was completed with the quality control set out in the analytical methods. There were 120 instances where samples were flagged for issues with laboratory quality control. Of these, 116 were reviewed and/or repeated and deemed acceptable for use in accordance with the laboratory quality program. There were 4 sample analysis not included in the annual reporting due to analytical issues.

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 have 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 2022:

- 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
- Census drills
- Confined space drills
- Building evacuation drills
- 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 2022 included: PHFES members attended and assisted with training at Eastern Ontario Training Facility in Norwood. PHFES provided standby coverage crew and pumper at PHCF to allow Cameco's fire truck to attend Norwood training facility to be used for Live Fire training. PHFES participated in Cameco's Spill response full scale exercise.

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 2022, there were 2,832 hours of ERT training conducted with 100% of responders successfully meeting the training criteria, and 560 hours of medical training completed.

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.

There were no significant changes or improvements to the emergency preparedness program or to the fire protection program in 2022.

In order to confirm the effectiveness of the Fire Protection Program, the following third-party verifications were conducted in 2022:

- Annual Facility Condition Inspection
- Fire Hazard Assessment
- SHEQ Audit
- Annual Sprinkler Inspections Testing and Maintenance
- 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.

PHCF has a focus on reducing the inventory of accumulated radioactive waste and disposing of all eligible materials at the LTWMF. Under the Vision in Motion project, approximately 1,922 packages (drums and/or bags) of accumulated waste and 102 loads of bulk material were shipped to the LTWMF. In addition, approximately 900 packages were transferred to an appropriately permitted landfill.

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 2022, a total of 35.0 tonnes of non-contaminated wastes were sent to a local landfill. A total of 20.3 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 fertilizer company and fluoride product which is sent for uranium recovery at a licensed facility. The amount of ammonium nitrate recycled in 2022 was 1,739 m^3. A total of 3,311 drums of fluoride product were generated in 2022.

In 2022, PHCF generated 63.0 tonnes of contaminated combustible materials (CCM), and 0.0 tonnes of CCM was shipped to the BRR for incineration. During the same period a total of 2.2 tonnes were shipped to appropriately licensed hazardous waste facilities.

PHCF recycled 99.8 tonnes of metal after decontamination to free release criteria. PHCF did not recycle any glycol or oil in 2022.

Waste reduction activities associated with Vision in Motion are discussed in further detail in section 3.1.3 Improvement Plans and Future Outlook.

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 seven safeguard inspections/activities in 2022:

- An interim inventory inspection in June
- Five short notice random inspections (February, April, July, September, and November)
- A physical inventory verification in July

The safeguards program is well-established and continues to be effective through the successful implementation of the obligations arising from the Canada/IAEA Safeguards and Non-proliferation Agreement.

In June 2019, a Fuel Services Safeguards Program Manual was published to document how the Fuel Services Division, including PHCF, meets the requirements in Canadian Nuclear Safety Commission (CNSC) *REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy* for the establishment and maintenance of a safeguards program.

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 to other overseas fuel manufacturing facilities. 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 was one reportable transportation event related to the PHCF in 2022:

- On December 19, 2022, a truck carrying two flat racks each with a full 48Y cylinder was involved in a traffic accident. There was no damage to the cargo.

3.0 OTHER MATTERS OF REGULATORY INTEREST

3.1.1 Public Information Program

In 2022, Port Hope Conversion Facility continued to fully meet the requirements of the Canadian Nuclear Safety Commission's (CNSC) REGDOC 3.2.1, Public Information and Disclosure.

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

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

Education and Awareness

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

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

Summer 2022:
Energize - Summer 2022 - Making a Difference - Community - Cameco Fuel Services
Spring 2022:
Energize - Spring 2022 - Making a Difference - Community - Cameco Fuel Services
Winter 2022:
Energize - Winter 2022 - Making a Difference - Community - Cameco Fuel Services

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

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

In 2022 the cameco_ontario email received 19 emails from the public who RSVP'd to the annual BBQ. Cameco received two inquiries from members of the public through security. These questions were answered in a timely manner with no further follow-up required.

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

Public Polling

On October 5, 2022, Cameco announced the results of its annual Public Polling. Cameco has been polling the local community since 2004. The survey found that 93% of residents support the continuation of Cameco's operations in Port Hope. For the past decade, Cameco has maintained an approval rating above 80% and remains a trusted corporate citizen in the local community.

Other key findings from the 2022 survey include:

- 85% of respondents agree that Cameco does everything possible to protect people and the environment.
- 77% respondents recall receiving a newsletter from Cameco; 84% of them read the newsletters.
- 79% of respondents think that Cameco makes information about its operations in Port Hope readily available to residents.
- 94% of respondents describe themselves as knowledgeable about Cameco.
- 93% of respondents agree Vision in Motion is a step in the right direction and benefit for the community.

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

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

Social Media

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

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

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

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

Public Disclosures

PHCF made 13 public disclosures in 2022. Seven of the disclosures were related to sanitary sewer exceedances. Other disclosures included reportable spills and environmental releases. There were no health or safety risks posed to the public, workers or the environment.

Environment & Safety - Conversion: Port Hope - Fuel Services - Businesses - Cameco

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

Community Investment

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

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

Step Up 2022 - Past Events - Ontario - Events - Step Up for Mental Health

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

Ontario - The Fund - Step Up for Mental Health

Indigenous Engagement

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

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

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

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

Indigenous Community	Date of Meeting	Topics
Curve Lake First Nation	January 26	Review of 2021/open items Key focus areas for 2022
	February 23	Next steps for CFM licence renewal Briefing guide development
	April 1	CFM licence renewal – 20 years, production increase
	April 27	CFM licence renewal – review of environmental data
	July 27	CFM soil and groundwater monitoring programs; upcoming community activities

	September 28	Community activities; public opinion polling results
	November 28	General update and discussion following the CFM licence hearing
Mississaugas of Scugog Island First Nation	January 10	General reconnect – plan for 2022
	February 28	About Cameco Updates on licence renewal
	March 24	CFM licence renewal – 20 years, production increase
	May 13	CFM licence renewal – review of environmental data
	July 26	CFM soil and groundwater monitoring programs; upcoming community activities
	October 25	Community activities; public opinion polling results
	December 6	General update and discussion following the CFM licence hearing
Métis Nation of Ontario – Region 6	November 3	General overview of Cameco (PHCF and CFM specifically) and overview of CFM licence renewal

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

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

Vision in Motion

The winter 2022 issue of Energize provided a VIM project update, sharing key aspects of the project that were expected to take place throughout the year such as the installation of scaffolding around Building 27 in preparation for demolition. Energize - Winter 2022 - Making a Difference - Community - Cameco Fuel Services

Information about VIM was also made available at the community barbeque and Port Hope Fall Fair.

Industry

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

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

Earned Media

Cameco received media coverage throughout the year covering a range of activities:

- **Cameco Fund for Mental Health 2021 Awards Benefit Nine Northumberland Organizations** – Today's Northumberland – January 31, 2022
  - https://todaysnorthumberland.ca/2022/01/31/cameco-fund-for-mental-health-2021-awards-benefit-nine-northumberland-organizations/
- **Northumberland organizations benefit from Cameco Fund for Mental Health Fund** Northumberland 89.7 – Feb 1, 2022
  - Northumberland organizations benefit from Cameco Fund for Mental Health Fund — Northumberland 89.7 FM (northumberland897.ca)
- **'It's like being held by a caring person': New art program in Port Hope to support mental health** – Northumberland News – March 16, 2022
  - https://www.northumberlandnews.com/community-story/10588795--it-s-like-being-held-by-a-caring-person-new-art-program-in-port-hope-to-support-mental-health/
- **The Cameco Charity Golf Tournament Returns for 2022** – Today's Northumberland – June 30, 2022
  - The Cameco Charity Golf Tournament Returns for 2022 - Today's Northumberland - Your Source For What's Happening Locally and Beyond (todaysnorthumberland.ca)

- **Cameco recognized for its ongoing support of student nutrition programs in Northumberland County** – Today's Northumberland – April 26, 2022
  - Cameco Recognized for Its Ongoing Support of Student Nutrition Programs in Northumberland County - Today's Northumberland - Your Source For What's Happening Locally and Beyond (todaysnorthumberland.ca)
- **Hit the links with Cameco is support of mental health in Northumberland** – Northumberland News – Sept. 9, 2022
  - Hit the links with Cameco in support of mental health in Northumberland (northumberlandnews.com)
- **COMMUNITY SPOTLIGHT: CCN Volunteer Fair brings over 30 Local agencies together with prospective volunteers** – Oct 26, 2022 – Go Northumberland
  - COMMUNITY SPOTLIGHT: CCN Volunteer Fair brings over 30 Local agencies together with prospective volunteers | 93.3 myFM (gonorthumberland.ca)
- **Port Hope's Cameco golf tournament fundraiser means more money for mental health initiatives** – Nov 6, 2022 – Northumberland News
  - Port Hope's Cameco golf tournament fundraiser means more money for mental health initiatives (northumberlandnews.com)
- **Cameco Fund for Mental Health 2022 Awards Grants to Nine Northumberland County Organizations** – Today's Northumberland – Dec. 17, 2022
  - Cameco Fund for Mental Health 2022 Awards Grants to Nine Northumberland County Organizations - Today's Northumberland - Your Source For What's Happening Locally and Beyond (todaysnorthumberland.ca)https://www.northumberlandnews.com/whatson-story/10668366-hit-the-links-with-cameco-in-support-of-mental-health-in-northumberland/
- **Cameco contributing $50K to support Northumberland mental health initiatives** –Northumberland News – Dec. 24, 2022
  - Cameco contributing $50K to support Northumberland mental health initiatives (northumberlandnews.com)
- **Cameco contributing $50K to support Northumberland mental health initiatives** – The Peterborough Examiner – Dec. 24, 2022
  - Cameco contributing $50K to support Northumberland mental health initiatives | ThePeterboroughExaminer.com)

Advertising

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

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

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

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

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

Cameco placed print ads in booklets for events it sponsored, including the Northumberland Hills Hospital Gala booklet, Film Access Northumberland, Eye2Eye Film Festival book, Handbags for Hospice, as well as advertising on the Port Hope Police reusable shopping bag which was given out at community events by the Port Hope police.

Government Stakeholders

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

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

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

Tours

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

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

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

Website

Cameco has a dedicated website for its Ontario operations: Home - Cameco Fuel Services.

Cameco updated its website with information throughout 2022 including:

- Thirteen Public Disclosure related to PHCF
- Three Energize newsletters
- Public polling results
- Cameco Step Up for Mental Health activities including news releases
- Quarterly and annual CNSC reports
- Invitation to the community barbeque

Communications Products

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

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

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. 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 2022.

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

The VIM project is being executed in accordance with standard corporate Technical Services policies and procedures for project delivery. The project also conforms to PHCF site policies and procedures for activities carried out at PHCF.

VIM activities are detailed in the 2022 Annual VIM Supplementary Report.

The installation of a closed loop cooling water system was completed and commissioned for the UO_2 plant in October 2022. The closed loop cooling water system for the UF_6 plant is scheduled to be completed in 2023.

3.1.4 Safety Performance Objectives for Following Year

There are no major changes planned in 2023 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 2022, 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.