CMD 26-H3-REF1 - CNSC Staff Submission

Reference Package for CMD 26-H3 Application to Renew the Class 1B Nuclear Fuel Facility Operating Licence for Port Hope Conversion Facility in Port Hope, Ontario

Classification	UNCLASSIFIED
Type of CMD	References
CMD Number	26-H3-REF1
Original CMD	26-H3
Public hearing date	3-5 November 2026
Summary	This document contains documents referenced in CMD 26-H3 to be placed on the Record for the proceeding.
Actions required	There are no actions requested of the Commission. This CMD is in support of the actions and recommendations set out in CNSC staff CMD 26-H3.

CMD 26-H3-REF1 – Soumission par le personnel de la CCSN

Références liées au CMD 26-H3 Demande de renouvellement du permis d’exploitation d’une installation de combustible nucléaire de catégorie I pour l’installation de conversion de Port Hope, à Port Hope (Ontario)

Classification	NON CLASSIFIÉ
Type de CMD	Références
Numéro de CMD	26-H3-REF1
CMD Original	26-H3
Date de l’audience	Du 3 au 5 novembre 2026
Sommaire	Ce CMD supplémentaire comprend les documents mentionnés dans le CMD 26-H3 du personnel de la CCSN
Mesures requises	Aucune mesure n’est requise de la Commission. Le présent CMD appuie les mesures et les recommandations énoncées dans le CMD 26-H3 du personnel de la CCSN.

CMD 26-H3-REF1

Reference Package for CMD 26-H3 Application to Renew the Class 1B Nuclear Fuel Facility Operating Licence for Port Hope Conversion Facility in Port Hope, Ontario

Signed by:

X OwenWhitred, Karen

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Date: 2026.07.29 15:28:41 -04'00'

Karen Owen-Whitred

Director General

Directorate of Nuclear Cycle and Facilities Regulation

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1 Cameco Corporation, Port Hope Conversion Facility renewal of Licence FFOL-3631.00/2027 for a 20-year term, September 29, 2025

This reference document was submitted by the licensee to be on the Record for the proceeding.

2 Cameco Corporation, Supplemental Submission, Port Hope Conversion Facility Renewal of Licence FFOL-3631.00/2027 for a 20-year term, November 18, 2025

This reference document was submitted by the licensee to be on the Record for the proceeding.

3 CSA Group, CSA N286-12, *Management System Requirements for Nuclear Facilities*

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

4 Cameco Corporation, Safety Analysis Report for the Port Hope Conversion Facility, October 2025

The information in this reference document is subject to a request for confidentiality under rule 12 of the *Canadian Nuclear Safety Commission Rules of Procedure*.

5 CSA Group, CSA B51-19: *Boiler, pressure vessel and pressure piping code*

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

6 CSA Group, CSA B51-24: *Boiler, pressure vessel and pressure piping code*

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

7 CSA Group, CSA N393-22: *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

8 CSA Group, CSA Z94.4-18, Selection, Use and Care of Respirators

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

9 Cameco Corporation, Review of the Environmental Risk Assessment for Port Hope Conversion Facility, May 2023

Review of the Environmental Risk Assessment for Port Hope Conversion Facility

Fuel Facility Operating Licence FFOL-3631.00/2027

May 15, 2023

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1.0 Introduction

In accordance with its licence requirements, the Port Hope Conversion Facility (PHCF) maintains an environmental risk assessment (ERA) in accordance with the standardized requirements of CSA N286.6-12: *Environment Risk Assessments at Class 1 Nuclear Facilities and Uranium Mines and Mills* (N288.6-12). An ERA is a systematic process used to identify and assess the potential risk posed by contaminants and physical stressors in the environment on biological receptors. There are two parts to an ERA – an assessment of the facility's operations on human receptors through a human health risk assessment (HHRA) and an assessment on non-human environmental receptors through an ecological risk assessment (EcoRA).

PHCF completed its ERA in March 2016, which found there were no undue risks to the environment or to human health as a result of PHCF operations. A summary of the ERA and a redacted version of the ERA are available on the Cameco community website (www.camecofuel.com/library/media-library). Under Clause 11 of N288.6-12 Cameco is required to review the ERA for the PHCF every five years. The current review was undertaken in 2021 and 2022.

1.1 Scope of Review

As per N288.6-12 (R2017) Clause 11.1:

> *A nuclear facility shall review its ERA to verify its applicability, and shall update it as necessary, consistent with the overall iterative process for ERAs.*
>
> *The purpose of the periodic review of the ERA is to identify and assess any risks that might have emerged since the last ERA review. This review can indicate that the potential for risks is substantively the same and therefore that the ERA does not require changes. Conversely, the review can identify new risks or highlight changes in the risk assessment variables that need to be updated to reflect the new risk profile. In either case, the review process and findings shall be thoroughly documented. A full or partial update of the ERA may be completed, as needed, to reflect important changes since the last ERA review.*

The present review of the ERA is to identify:

(a) changes that have occurred in site ecology or surrounding land use;
(b) changes to the physical facility or facility processes that have the potential to change the nature of facility effluent(s) and the resulting risks to receptors;
(c) new environmental monitoring data collected since the last ERA update;
(d) new or previously unrecognized environmental issues that have been revealed by the EMP;
(e) scientific advances that require a change to ERA approaches or parameters; and
(f) changes in regulatory requirements pertinent to the ERA.

In addition, specific comments (CNSC, 2017) from CNSC staff regarding the March 2016 ERA have been considered and addressed in the current review. The purpose of the review is to evaluate the applicability of the final conclusions of the 2016 for the ongoing operations of the PHCF.

Under the current operating licence, operations of the PHCF include the Vision in Motion (VIM) project, Cameco's plan to clean up and renew the PHCF. The current review recognizes that during the ongoing execution of the VIM project, the site is under a constant state of improvements, all of which are expected to positively impact the environmental interactions of the site. The purpose of this review was to determine whether there were any potential gaps which would significantly alter the conclusions and require addressing in the interim. As the various aspects of the project were in progress during this review, preliminary assessment of the changes has been included. Once the VIM project is complete, a new ERA will be completed in accordance with N288.6 and submitted to the CNSC for review and acceptance. The Environmental Protection Program will be revised in accordance with the new ERA.

1.2 Available Data and Information Sources

The following facility data and information were used in the current review of the ERA.

1. Environmental monitoring data 2015-2022
2. 2020 Emission Summary Dispersion Model
3. 2022 Emission Summary Dispersion Model
4. Facility Design Change records 2015-2022
5. 2016 Environmental Risk Assessment
6. 2016 Derived Release Limit report
7. Annual Compliance Reports 2015-2022
8. Annual Groundwater and Surface Water Reports 2015-2022
9. Applicable provincial and federal guidelines for environmental protection
10. Literature reviews to support specific disposition of CNSC staff comments

1.3 Report Organization

This report is structured as follows, based on the guidance in N288.6-12 (R2017) Clause 11.1 for review of an ERA:

Section 2 provides a review of site changes (physical facility and facility processes), site ecology, and surrounding land use. It also identified opportunities for enhancing the site characterization.

Section 3 provides a review of the environmental monitoring data collected since the 2016 ERA. An updated screening of contaminants of potential concern (COPC) is provided.

Section 4 provides a review of environmental issues revealed by the 2016 ERA and a review of other issues identified with the methodology of the 2016 ERA.

Section 5 provides a review of scientific advances and changes in regulatory requirements that may impact the ERA approaches or parameters.

Section 6 provides a review of the information presented in Sections 2-5 and the impact of these issues on problem formulation in the ERA.

Section 7 provides an evaluation of the ongoing applicability of the final conclusions of the 2016 ERA.

2.0 Review of Site Characterization

This section provides a description of the review completed to identify changes that have occurred to site ecology or surrounding land use, changes to the physical facility or facility processes that have the potential to change the nature of facility effluents(s) and the resulting risks to receptors as recommended by Clause 11.1 (a) and (b) of N288.6-12. It also provides a description of information requested by CNSC staff to enhance the overall robustness of the site characterization and the conceptual site model.

2.1 Site Ecology and Surrounding Land Use

As described in the 2016 ERA, Cameco owns and/or leases 9.6 acres on which the secured area of the PHCF is situated. Since the 2016 ERA, Cameco permanently terminated its licensed activities on the Centre Pier property, which involved the transfer of stored wastes to the Long-Term Waste Management Facility (LTWMF) in Port Hope, demolition of the Centre Pier buildings and transfer of the demolition debris to the LTWMF and installation of flood-protection. The care and control of the property was transferred to Canadian Nuclear Laboratories (CNL) in July 2019.

In the immediate area of the PHCF, CNL has subsequently isolated access to the Port Hope harbour and is using the Centre Pier as a staging area for its ongoing remediation of the harbour as part of the Port Hope Area Initiative (PHAI).

In the surrounding area, the PHAI has commenced the clean-up of low-level radioactive waste within the MPH, including remediation of the former waterworks properties to the west of the facility, the viaducts northeast of the facility, residential properties to the north of the facility and the Centre Pier east of the facility. PHCF is located in a general employment zoned area of the MPH with floodplain overlay zoning along the east property boundary.

2.2 Changes to the Physical Facility and Facility Processes

In order to assess the changes to the PHCF between 2016 and 2022, a review of the facility design control files, annual reports and management review reports was carried out.

The following changes were made at the facility which had an impact on environmental performance. All these changes moved performance in a positive direction.

- Demolition of buildings on the Centre Pier
- Ongoing removal of obsolete process equipment and contaminated building material from various buildings as part of Vision in Motion (VIM)
- Ongoing relocation of utilities and supporting infrastructure as part of VIM, including relocation of the liquid hydrogen station

- Installation of new storm sewer infrastructure and an oil/grit separator with a new harbour outlet at the southernmost portion of the facility
- Disposal of accumulated waste at the LTWMF or other appropriately permitted facility
- Rehabilitation of targeted sanitary sewer infrastructure to reduce groundwater infiltration
- Soil remediation in targeted areas of the facility
- Construction and commissioning of closed loop cooling water systems for the UF_6 and UO_2 plants
- Rerouting of air emissions in the UO_2 plant to eliminate the UO_2 baghouse

The changes related to VIM and accumulated waste have an impact on the sources of gamma radiation at the facility, which resulted in a change in the critical receptor used for estimating dose to the public in 2019. Sanitary sewer rehabilitation has reduced the infiltration of contaminated groundwater into the sanitary discharge from the facility, which impacts total uranium loadings discharged to the sanitary sewer.

In the fall of 2022, the UO_2 plant commissioned its closed-loop cooling water system and severed the tie-ins to the harbour cooling water supply and cooling water return, eliminating the potential for uranium or other contaminant discharge to the harbour and reducing the overall thermal loading to the Port Hope harbour. The closed-loop cooling system for the UF_6 plant is scheduled to come online in 2023, which will eliminate operations-related discharges to the harbour and the associated chemical and thermal impacts as well as the physical impacts of the cooling water intake.

2.3 Opportunities for Enhancement of Site Characterization

Site characterization information was documented in Section 2 of the 2016 ERA. Additional information is provided to enhance the site characterization as part of this review of the 2016 ERA.

2.3.1 Information Regarding Site Selection

The development of land around the Port Hope harbour took place in the mid-to-late 1800's. The primary use of the land prior to 1932 was for agricultural products production/storage. Other industrial facilities were also located on the land, including a machine shop and a Florida rock phosphate processing plant. In 1932, Eldorado Gold Mines Limited selected the site for a new refining and extraction plant. The southern part of the current site, where the current UO_2 plant is located, includes land that was backfilled in a land reclamation project between 1940 and 1959. The land where the current UF_6 plant is located was a residential area prior to the plant's construction in the 1980's.

The nearest residence is approximately 200 m north of the facility on Alexander Street.

2.3.2 Information Regarding Topography

At the PHCF, the ground surface elevation generally increases northward away from Lake Ontario, rising from about elevation 76 m near the shoreline to an approximate elevation of 87 m near Hayward Street north of the UF_6 plant. The mean lake stage on Lake Ontario, and in the Port Hope harbour, has an approximate elevation of 75 m. South of the site, a breakwater exists along the shoreline and to the east of the site a steel sheet pile wall is present at the edge of the harbour.

2.3.3 Releases to the Environment

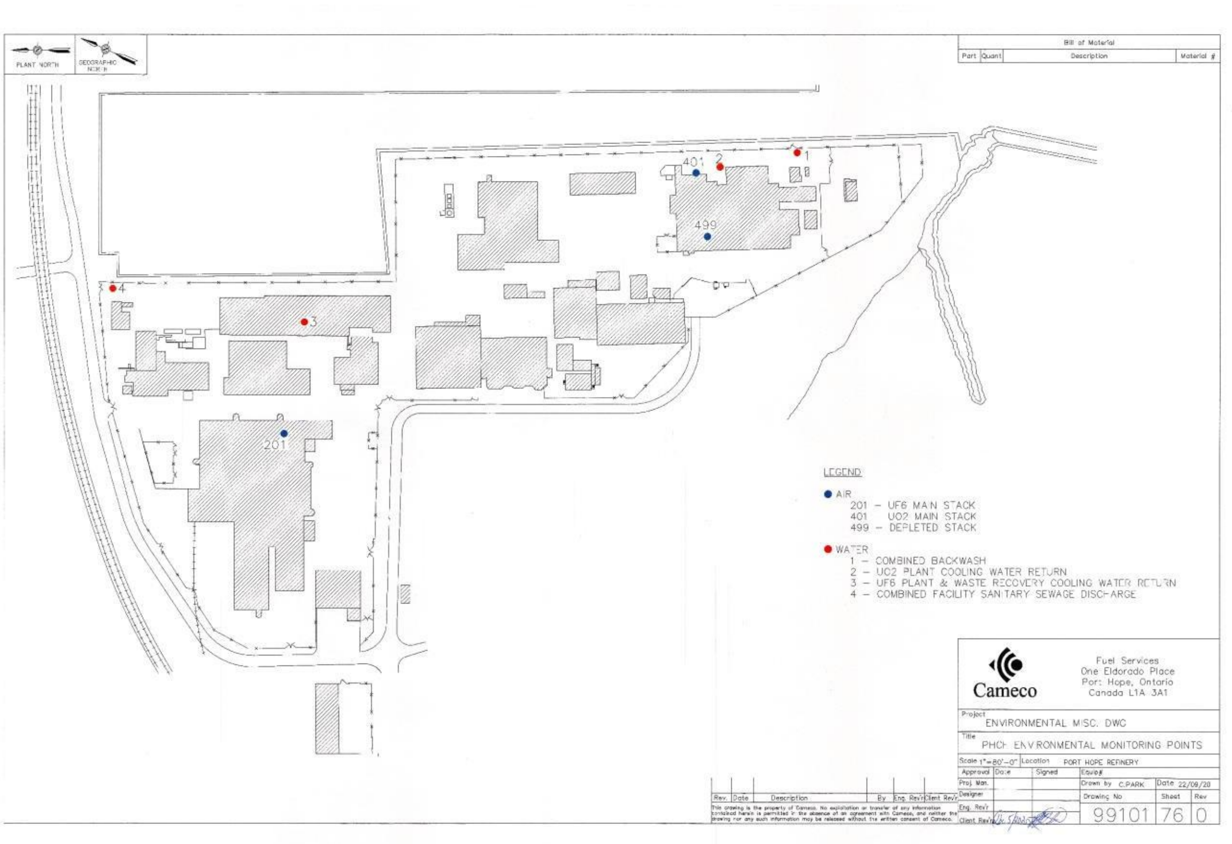
The primary air emissions associated with the PHCF are uranium, fluorides, ammonia and nitrogen oxides. These contaminant emissions are measured using source monitoring and/or estimated using available monitoring data. The main process stacks in the UF_6 plant and UO_2 plant are continuously sampled during operations. In the UF_6 main stack, fluoride and uranium emissions are monitored and in the UO_2 main stack, ammonia and uranium emissions are monitored. All other stacks and discharge points are sampled on an occasional or as requested basis.

The municipal sewage treatment plant processes the sanitary sewer discharges from the PHCF and sewage quality is defined by the municipal sewer-use by-law. The combined sanitary sewer discharge primarily consists of contributions from sanitary facilities, showering facilities, Powerhouse effluent (i.e. boiler blowdown, compressor cooling water, softener regeneration effluent) and condensates, among other items.

At the time of the review, PHCF cooling requirements were met by a closed loop cooling system for the UO_2 plant and the facility's harbour water intake located at the entrance to the Port Hope harbour. With the elimination of the UO_2 plant harbour cooling water return, the facility cooling water works currently includes two discharges. The combined backwash stream, consisting of contributions from the cooling water pumphouse and filter room associated with harbour water mechanical pre-treatment operations, discharges to the approach channel adjacent to building 25. The north cooling water return, consisting of UF_6 plant non-contact harbour and municipal water and a minor harbour water by-pass contribution from building 2, is discharged to the harbour turning basin. The balance of the once-through cooling system is being replaced with a closed loop cooling system in 2023, which will eliminate cooling water works harbour discharges in the near-term.

The environmental emission monitoring points from the PHCF are shown in Figure 1.

Figure 1 Environmental Emission Points from PHCF



Corresponding monitoring for COPCs in the environment was described in section 2.3 of the 2016 ERA.

2.3.4 Meteorological Statistics and Climate Setting

A review of available climatic data was carried out as part of this review. The long-term record of general meteorological conditions in the region and average climatic conditions of the PHCF facility are described by 30-year climate normals (1981-2010) from the closest Environment and Climate Change Canada (ECCC) climate station located in Cobourg (Climate ID 6151689 – Cobourg STP). The long-term averages of observed climate data at Cobourg station are summarized in Table 1.

The annual average daily temperature at Cobourg station is 7.5 degrees Celsius (°C), and monthly average air temperatures are at or below zero from December to March. January is the coldest month with a daily average of -5.6°C, while July is the warmest month with a daily average of 19.9°C. The extreme minimum temperature was -39°C (in January), while the extreme maximum temperature was 36°C (in July). Temperatures below -10°C have occurred in November through April, while temperatures above 30°C occur occasionally in May through August (IEC, 2021a).

Table 1 Cobourg Climate Normals (1981-2020) – Temperature

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average (°C)	-5.6	-4.3	-0.5	5.9	11.7	16.9	19.9	19.4	15.4	9	3.7	-2	7.5
Standard Deviation	3.2	2.1	1.5	1.3	1.6	1.4	1.2	1.3	1.3	1.0	1.2	2.6	1.0
Daily Max (°C)	-1.4	0	3.7	10.3	16.4	21.6	24.6	24.0	19.9	13.1	7.3	1.9	11.8
Daily Min (°C)	-9.7	-8.5	-4.6	1.5	6.9	12.1	15.2	14.9	10.8	4.8	0.1	-5.8	3.1
Extreme Max (°C)	13.0	13.0	20.0	26.0	29.0	31.5	**36.0**	34.0	30.0	24.0	18.0	15.5	
Extreme Min (°C)	**-39.0**	-27.8	-26.0	-12.0	-5.0	-1.0	5.0	1.0	-5.0	-10.0	-16.0	-29.0	
Days with Maximum Temperature													
<= 0 °C	16.9	13.6	7.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.2	10.5	49.9
> 0 °C	14.1	14.6	23.8	29.5	31.0	30.0	31.0	31.0	30.0	31.0	28.9	20.5	315.4
> 10 °C	0.3	0.2	3.0	14.0	28.8	30.0	31.0	31.0	29.7	23.4	7.7	0.8	199.9
> 20 °C	0.0	0.0	0.0	0.7	5.7	18.6	28.7	27.9	13.8	1.0	0.0	0.0	96.4
> 30 °C	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.3	0.0	0.0	0.0	0.0	1.1
> 35 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Days with Minimum Temperature													
> 0 °C	2.5	2.1	5.9	18.1	29.3	29.9	31.0	31.0	29.5	25.7	14.4	4.8	224.2
<= 2 °C	30.2	27.6	28.5	17.3	3.7	0.1	0.0	0.1	1.2	9.8	20.4	28.8	167.7
<= 0 °C	28.5	26.1	25.1	11.9	1.7	0.1	0.0	0.0	0.5	5.3	15.6	26.2	141.0
< -2 °C	24.8	22.4	19.0	4.7	0.1	0.0	0.0	0.0	0.1	1.0	8.8	20.3	101.0
< -10 °C	13.5	10.8	4.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	7.2	36.9
< -20 °C	3.3	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	5.2
< - 30 °C	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

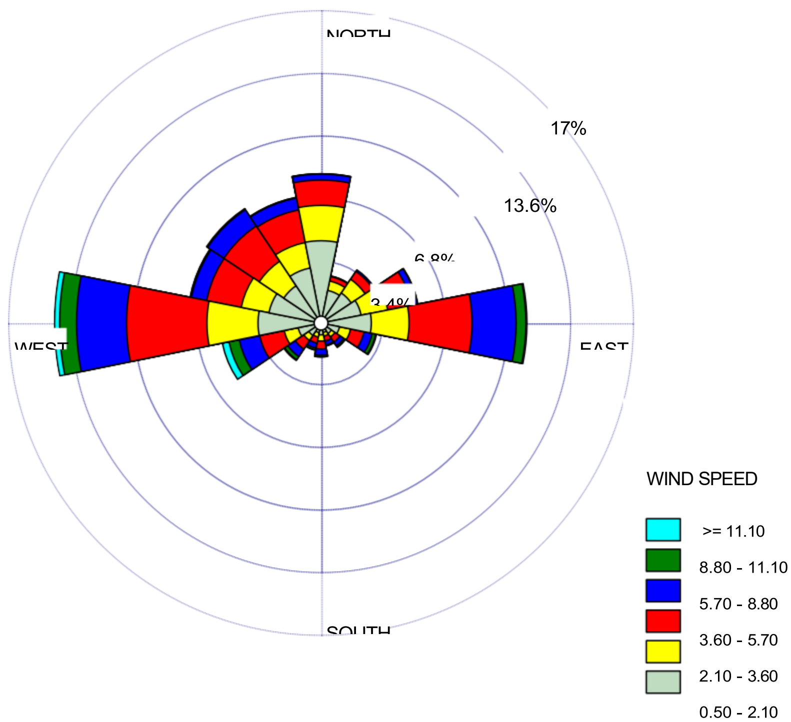
The monthly and annual precipitation observations at Cobourg station are summarized in Table 2. The average annual precipitation amount is 890.4 millimeters (mm), of which 793.9 mm falls as rain (i.e., 89 %). More than half of the total precipitation falls as rain between May and October, while the wettest month is September (average monthly rainfall of 93.2 mm). The greatest extreme daily precipitation also occurs in September at 73.4 mm. From November to April, most precipitation falls as snow, with January typically experiencing the heaviest snowfall (average monthly snowfall of 32.7 cm). The extreme daily snowfall occurs in February, while the extreme snow depth of 44 cm was recorded in January (IEC, 2021a).

Table 2 Cobourg Climate Normals (1981-2010) - Precipitation

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	34.0	32.9	42.7	74.3	81.2	80.5	64.8	71.7	93.2	76.3	89.2	53.1	793.9
Snowfall (cm)	32.7	21.2	14.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0	4.0	22.7	96.5
Precipitation (mm)	66.7	54.1	56.8	76.2	81.2	80.5	64.8	71.7	93.2	76.3	93.2	75.8	890.4
Extreme Daily Rainfall (mm)	65.0	31.0	49.5	46.1	53.0	52.5	62.5	70.0	**73.4**	51.0	54.8	40.0	
Extreme Daily Snowfall (cm)	20.0	**35.6**	17.0	17.3	0.0	0.0	0.0	0.0	0.0	0.0	13.2	25.4	
Extreme Snow Depth (cm)	44.0	35.0	22.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	25.0	
Days with Rainfall													
>= 0.2 mm	4.6	4.2	6.5	10.7	10.9	9.8	8.5	10.0	10.0	11.6	11.3	6.6	104.8
>= 5 mm	2.4	2.1	3.2	4.9	5.5	5.2	4.0	4.2	5.5	5.3	5.7	3.6	51.6
>= 10 mm	1.2	1.3	1.4	2.5	2.9	2.9	2.0	2.1	3.2	2.4	3.4	1.9	27.1
>= 25 mm	0.2	0.1	0.2	0.2	0.3	0.6	0.6	0.7	0.7	0.4	0.7	0.2	4.8
Days with Snowfall													
>= 0.2 cm	7.0	4.6	3.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.9	4.6	21.2
>= 5 cm	2.6	1.7	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.8	7.8
>= 10 cm	1.1	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9	3.2
>= 25 cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Days with Precipitation													
>= 0.2 mm	11.2	8.3	9.3	11.2	10.9	9.8	8.5	10.0	10.0	11.6	12.1	10.8	123.6
>= 5 mm	5.0	3.7	4.4	5.1	5.5	5.2	4.0	4.2	5.5	5.3	6.1	5.5	59.5
>= 10 mm	2.4	2.0	2.0	2.6	2.9	2.9	2.0	2.1	3.2	2.4	3.4	2.8	30.7
>= 25 mm	0.2	0.2	0.2	0.2	0.3	0.6	0.6	0.7	0.7	0.4	0.6	0.3	4.9

According to the climatic data files from ECCC, climate normals for wind observations for the period 1981-2010 are not available for Cobourg climate station. However, hourly wind observations are recorded at the nearby automated Cobourg station (Climate ID 6151684) for the period 1994-2010 and have been used to characterize long-term wind patterns at the site. A wind rose showing the annual frequencies of wind speed and wind direction is provided in Figure 2. Winds are predominantly from the west and from the east (14.5 % and 11.2 % of the time, respectively) and annual average wind speed is 3.7 m/s (IEC, 2021a).

Figure 2 Cobourg Historical Weather (1994-2010) – Wind Rose



A further discussion of meteorological data as it pertains to air dispersion modelling is provided in section 3.2.1.

3.0 Review of Environmental Monitoring Data

This section provides a description of the review of the environmental monitoring data collected since the 2016 ERA as recommended by Clause 11.1 (c) of N288.6-12. It also provides a review of modelling information relevant to the determination of contaminants of potential concern (COPC). An updated COPC screening is provided.

3.1 Overview of Available Data

The Environmental Protection Program (EPP) for PHCF describes the effluent and environmental monitoring programs. The data from this program is used in this review of the ERA.

The following discharge data and environmental monitoring data were included in the ERA review.

3.1.1 Air Quality Data

Uranium emissions from the UF_6 main stack is sampled nearly continuously during operations using a TSI sampler, and the sample analyzed in the site laboratory. Fluoride emissions are continuously monitored by three stack monitors on the main stack of the UF_6 plant. The monitors continuously withdraw a sample of gas from the main stack, and then measure the fluoride concentration in the impingement solution.

Uranium and ammonia emissions from the UO_2 main stack is sampled nearly continuously through a filter and impingement train, the sample is analyzed in the site laboratory.

During depleted uranium dioxide production runs NOx emissions are monitored using a continuous emission monitor and ammonia is measured using an impinger system. Third-party stack sampling has also been used during depleted production.

Monitoring data from the process stacks is summarized in the quarterly and annual compliance monitoring and operational performance reports which are available on the Cameco community website (www.camecofuel.com/library/media-library). This data is shown in Table 3. All emissions in the review period 2015 – 2022 were below all regulatory limits. All emissions from the UO_2 plant were below action levels during the review period. In 2022, the uranium action level and the fluoride action level for the UF_6 main stack were exceeded in separate events. Action levels serve as an early warning of a condition that warrants further investigation and do not represent an impact on the public or the environment.

Table 3 Comparison of 2014 Effluent Quality Data with 2015-2022 Data

Constituent	Unit	2016 ERA		2015-2022			
		2014 Average	2014 Maximum	7-year Average	Range of Annual Averages		7-year Maximum
					Min	Max	
UF_6 Main Stack - Uranium	g/h	1.2	6.3	1.9	1.1	2.7	44.7
UF_6 Main Stack – Fluoride	g/h	13	99	21.6	10	30	273
UO_2 Main Stack - Uranium	g/h	1.2	3.9	0.7	0.5	1.2	5.2
UO_2 Main Stack – Ammonia	kg/h	2.2	5.4	2.0	1.4	2.4	7.7

The facility maintains an Emission Summary and Dispersion Modelling Report (ESDM) documents the air emissions sources at the PHCF and maintains the most current listing of all stacks/sources, their specifications and parameters emitted as required by Ontario Regulation 419/05 *Air Pollution – Local Air Quality* (O. Reg. 419/05). The 2016 ERA used air quality data extracted from the 2013 ESDM. The information for ammonia, fluorides, nitrogen oxides, carbon monoxide, uranium, suspended particulate matter, and magnesium was summarized and screened for COPCs in the 2016 ERA. For the external review of the ERA, the 2020 ESDM (IEC, 2021b) and the 2022 ESDM (IEC, 2023) were used in the same screening process as described in section 3.3. All contaminants not considered negligible under s.8 of O. Reg. 419/05 were included in the screening. From this screening, although it was below applicable criteria, uranium was carried forward as a COPC due to the facility operations and observations in environmental endpoints.

3.1.2 Water Quality Data

Waterborne effluents from the PHCF consist of two discharges associated with facility cooling water system operations and a discharge to the municipal sanitary sewer system. The production facility cooling water returns and the combined facility sanitary sewage discharge point are included in this program and are continuously sampled. Monitoring data from the effluent discharges is summarized in the quarterly and annual compliance monitoring and operational performance reports which are available on the Cameco community website (www.camecofuel.com/library/media-library). The data is further summarized in Table 4.

The cooling water system at PHCF is a once-through non-contact system and discharge of uranium through this system is not expected in normal operations. However, the intake and discharges are monitored continuously to confirm that there is no net loading of uranium to the cooling water. During the review period, the harbour was isolated from Lake Ontario using a wave attenuator in preparation for remediation of the harbour by CNL. The initiation of remediation activities in 2021 has coincided with the increase in concentration of COPCs in cooling at both the intake and the outfall.

The combined sanitary sewer discharge is sampled continuously on a time-proportional basis and facility inputs to this discharge include sanitary facilities, showering facilities, Powerhouse effluent (i.e. boiler blowdown, compressor cooling water, softener regeneration effluent) and condensates, among other items. Discharges from municipal facilities upstream of the PHCF also flows through the site system. During the review period, a daily sanitary sewer discharge action level was developed and implemented. This action level has been exceeded numerous times in recent years due to contaminated groundwater infiltration to the underground civil works for the sanitary sewer. Assessment of the discharge to sanitary sewer is included in section 3.2.2.

While included in the routine effluent monitoring program, discharges to the sanitary sewer and cooling water discharges in the context of release of contaminants of concern were not discussed in the 2016 ERA.

The discussion of effluent quality of cooling water in this ERA review is limited because at the time of the writing of this report, PHCF was constructing a closed-loop cooling system for both operating plants, which are anticipated to be put online late 2022/early 2023. Once this transition occurs the cooling water system will be decommissioned and cooling water works harbour discharges will be eliminated.

Table 4 Comparison of 2014 Effluent Quality Data with 2015-2022 Data

Sampling Location	Constituent	Unit	2014 Data		2015-2022			
			2014 Average	2014 Maximum	5-year Average	Range of Annual Averages Min	Range of Annual Averages Max	5-year Maximum
Sanitary Sewer	Uranium	mg/L	0.017	0.25	0.039	0.013	0.044	3.0
North Cooling Water	Uranium	mg/L	0.003	0.007	0.025	0.0025	0.11	0.52
	Fluoride	mg/L	0.13	4.3	0.13	0.07	0.19	0.76
	Ammonia	mg/L	0.13	0.34	0.09	0.02	0.16	0.84
	Nitrate	mg/L	0.80	1.4	0.90	0.78	1.0	2.2
	TSS	mg/L	14	91	15	8.2	20	150
	Arsenic	ug/L	1.2	2.0	7.2	1.1	30	100
	Copper	ug/L	3.5	13	3.5	2.5	4.5	12
	Lead	ug/L	0.5	3.7	0.84	0.33	1.8	8.4
	Nickel	ug/L	2.8	6.0	2.5	1.5	4.0	20
	Zinc	ug/L	2.0	15	2.2	1.5	2.8	25
South Cooling Water	Uranium	mg/L	0.003	0.008	0.02	0.0026	0.078	0.54
	Ammonia	mg/L	0.20	1.1	0.08	0.01	0.18	8.8
	Nitrate	mg/L	0.85	1.4	0.89	0.40	1.1	2.2
	TSS	mg/L	15	98	17	9.6	22	290

3.1.3 Environmental Monitoring Data

The environmental monitoring program is intended to collect data to monitor the impact of the airborne and aqueous discharges into the offsite receiving area in the vicinity of the PHCF by verifying concentrations of contaminants of potential concern in the airborne, terrestrial and aquatic receiving environments. This data is used to determine exposure point concentrations for comparison to screening criteria from available standards to confirm COPCs.

The atmospheric environmental monitoring program is intended to collect data for uranium and fluorides to assess whether airborne emissions from the PHCF may be detected at offsite locations in the vicinity of the facility. Data from the high volume (hi-vol) air samplers and dustfall monitoring were used in the validation of the model in the ESDM (IEC, 2021b).

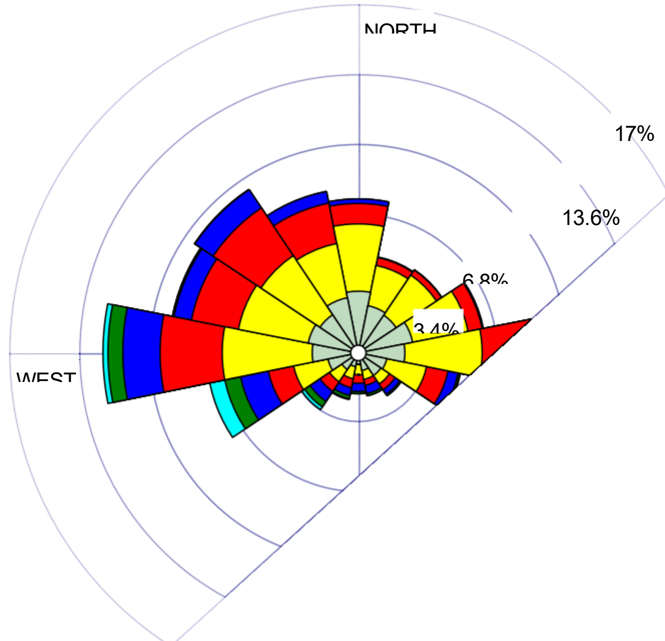
The 2016 ERA assessed groundwater data, soil data, surface water data, sediment data and gamma measurement data. This review of the ERA assessed groundwater data, soil data and surface water data available for the period 2015-2020 (CanNorth, 2021a). Gamma measurement data was not included in the ERA review, as this will be assessed in the 2023 Derived Release Limit report update.

3.2 Updated Modelling

3.2.1 Air Dispersion

As part of the review of the ERA, updated air dispersion modelling was completed for uranium (IEC, 2021a) using emissions data and model setup files from the 2020 Consolidated ESDM Report (IEC, 2021b). The site-specific meteorological data set used in the ESDM Report was prepared from 2013-2017 data at the Cobourg surface by the Ontario Ministry of Environment, Conservation and Parks (MECP) using AERMET. Figure 3 shows the wind rose plot based on the wind direction and wind speed data from the MECP meteorological data set. The predominant wind is from the west (12.4 % of time) and the annual average wind speed is 3.2 m/s. The wind distribution shown in Figure 3 is consistent with the long-term wind pattern at the automated Cobourg ECCC station (Figure 2). Overall, the wind data used in the updated dispersion modelling is representative of long-term climate in the region, and of the current local wind conditions at the site. Therefore, wind data set used in the updated modelling is considered suitable for dispersion modelling at the PHCF site (IEC, 2021a).

Figure 3. PHCF Air Dispersion Modelling (2013-2017)-Wind Rose



As the meteorological data set was prepared by the MECP and is acceptable for determining compliance with Ontario Regulation 419/05 (O.Reg. 419/05), this lends confidence to the meteorological data. The use of this dataset addresses a CNSC staff comment regarding the 2016 ERA (CNSC, 2016). Furthermore, any uncertainty with the data set can be examined through model validation, which is discussed below.

The uranium emission rates from the ESDM Report are replicated in Table 5, along with the source parameters used in the model. The building setup in the existing model files was used to run the building downwash model, BPIP-Prime. The emission rates from the production main stacks were based on stack testing. Emission rates for all other sources are based on stack testing, emission factors, engineering calculations or mass balance that are appropriate for the source in accordance with acceptable methods for assessing compliance with O.Reg. 419/05 standards.

Table 5: Model Source Parameters and Uranium Emission Rates

Source ID	Stack Volumetric Flow Rate (m^3/s)	Stack Gas Exit Temp. (deg C)	Stack Inner Diameter (m)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates UTM (m) [1]		Maximum Emission Rate
						Easting	Northing	
201	37.6	22	1.4	49.4	7.4	717007, 4869232		6.50E-04
202	5.4	22	0.7	20.0	6.0	716954, 4869260		2.02E-08
203	14.0	25	1.1	41.9	3.9	716989, 4869233		1.00E-04
204	14.0	25	1.1	41.9	3.9	716988, 4869227		4.35E-05
205	9.0	25	0.8	41.5	3.5	716986, 4869224		3.89E-05
212	0.1	76	0.2	40.8	2.8	717000, 4869226		2.70E-07
238	3.2	25	0.0	13.7	1.7	717020, 4869206		1.04E-05
248	1.3	25	0.4	21.3	0.0	716973, 4869254		2.12E-05
250a	38.0	29	1.8	39.6	15.6	716981, 4869234		9.20E-06
270	4.7	25	0.0	14.5	1.1	716942, 4869208		9.63E-06
280_281	95.0	25	16.6 x 0.51	25.3	0.0	716991, 4869247		2.70E-05
287	6.8	25	1.5 x 1.0	3.0	N/A	716970, 4869276		9.99E-08
314	4.7	25	0.0	17.3	4.7	717048, 4869232		1.41E-05
350	1.0	100	0.3	17.5	4.9	717044, 4869239		7.26E-05
352	1.0	100	0.5	17.5	4.9	717045, 4869238		7.26E-05
401	5.8	60	0.6	32.1	20.8	717285, 4869039		2.27E-04
402	6.1	35	0.7	14.8	3.5	717268, 4869046		1.84E-05
403	7.1	35	0.7	20.4	9.1	717278, 4869016		4.25E-05
405	2.5	232	0.4	22.5	8.2	717265, 4869040		7.30E-07
406	2.5	232	0.4	22.5	8.2	717272, 4869039		1.14E-06
407	0.6	25	0.2	3.2	0.0	717251, 4869054		8.50E-07
409	0.9	25	0.3	11.3	3.0	717255, 4869033		2.55E-06
410	1.0	100	0.3	29.3	18.0	717283, 4869026		7.00E-05
491	8.5	37	0.8	20.9	6.2	717277, 4868999		9.60E-06
495	23.8	25	1.5	14.3	3.0	717291, 4868993		8.00E-06
496	15.8	25	1.2	14.3	3.0	717285, 4869000		8.00E-06
497	13.8	25	1.2	14.3	3.0	717287, 4868992		1.30E-05
498	3.8	25	0.5	14.3	3.1	717255, 4869018		1.12E-05
607	0.3	25	0.2	11.7	2.1	717147, 4869069		4.25E-07
608	3.8	25	0.5	18.2	8.6	717164, 4869093		1.14E-05
613	4.7	25	0.6	10.7	1.1	717169, 4869077		3.52E-06
614	4.7	25	0.6	10.7	1.1	717164, 4869075		4.63E-06
615	4.7	25	0.6	10.7	1.1	717147, 4869077		4.81E-06
640	4.0	25	0.5	12.7	3.1	717143, 4869085		1.21E-05
851	1.3	25	0.3	10.8	3.0	717029, 4869347		3.96E-06

Notes:

[1] Universal Transverse Mercator (UTM) coordinates are defined in the North American Datum of 1983 (NAD83).

Modelled uranium concentrations at the hi-vol receptors were used for validation of the updated modelling assessment. The updated validation results are provided in **Error! Reference source not found.**6 and are compared to the validation results (i.e., ratio of modelled vs. monitored uranium concentrations) from the 2016 ERA report.

Table 6: Comparison of Modelled vs. Monitored Annual Uranium Concentrations at the Hi-Vol Stations

Hi-Vol Station	Annual Uranium Concentration (µg/m^3)			2016 ERA Ratio Model vs. Monitor
	Monitored [1]	Modelled [2]	Ratio Model vs. Monitor	
Marsh Street	0.0029	0.0042	1.4	1.5
Waterworks	0.0016	0.0021	1.3	0.9
Hayward Street	0.0018	0.0017	0.9	0.8
Shuter Street	0.0013	0.0005	0.4	0.5

Notes:

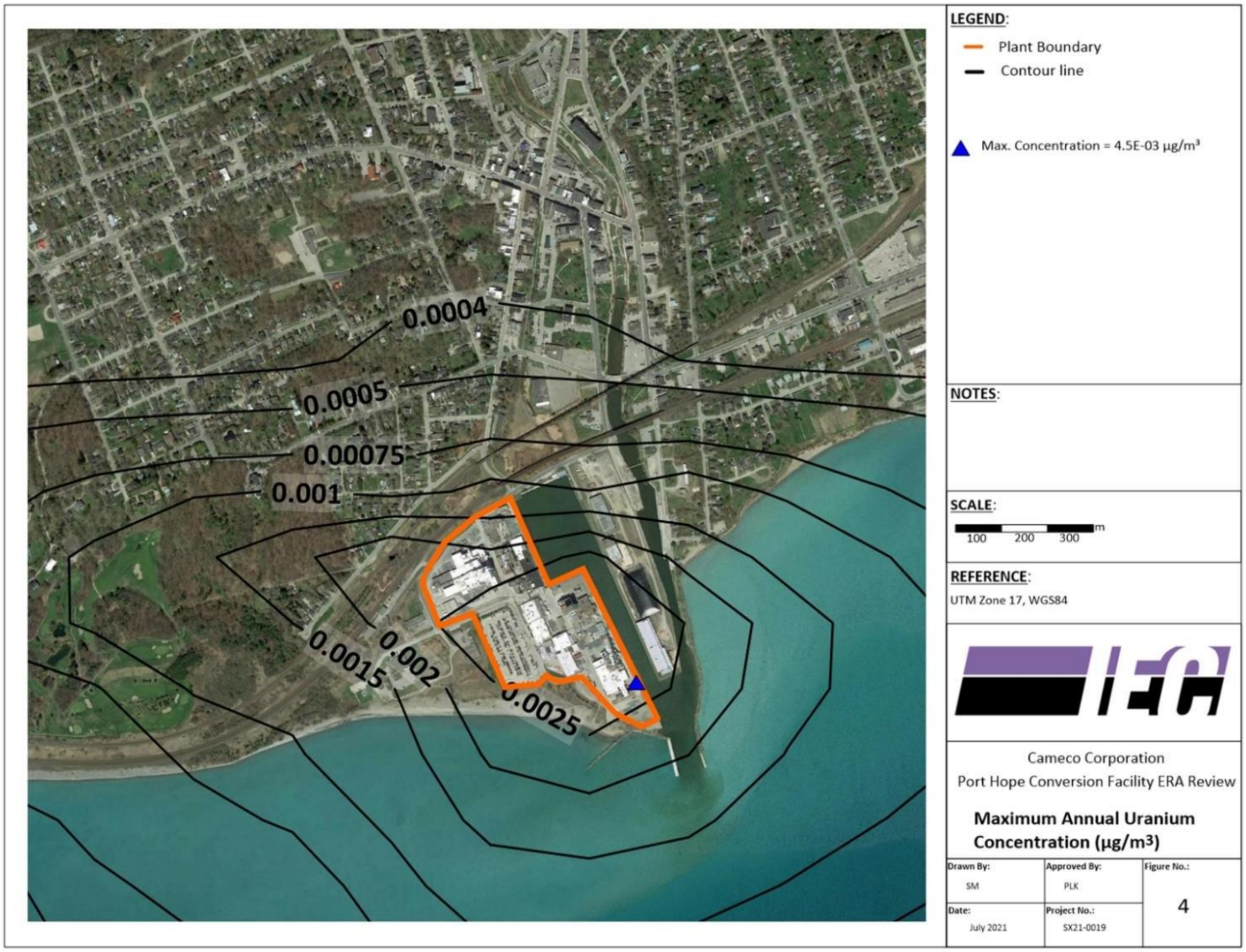
[1] Based on the five-year annual average of hi-vol data (2016-2020). Concentrations at the detection limit (0.0001 µg/m^3) were assumed equal to the detection limit.

[2] Based on the modelled five-year annual average concentration.

As can be seen in **Error! Reference source not found.**6, the results from the updated validation are consistent with the findings in the 2016 ERA report. The ratios of modelled vs. monitored data range from 0.4 at Shuter Street to 1.4 at Marsh Street. The modelled concentrations are within an acceptable factor of two, except for the Shuter Street location which is the furthest hi-vol station from the PHCF facility. A model is considered to perform well if the model results are within a factor of 2 of observed values (U.S.EPA, 2003). Modelled concentrations at Shuter Street station are below measured concentrations. This suggests that model uncertainty may increase with distance from the facility (CanNorth, 2021a).

Figure 4 presents the contour plot for maximum annual uranium concentrations predicted by AERMOD. The predicted concentrations at the risk receptors in the 2021 ERA review are within a similar range to the results presented in the 2016 ERA. The highest annual concentration is predicted to occur at a fenceline receptor on the east side of the facility and has a value of 4.5E-03 µg/m^3 (IEC, 2021a). This prediction is consistent with the 2016 ERA and does not change the conclusion of the 2016 ERA as the air pathway only represents a minor pathway of exposure (CanNorth, 2021a).

Figure 4 Maximum Annual Uranium Concentration



In the ERA review, a deposition velocity was calculated and applied to the model predicted concentrations using monitoring data for the 2016-2020 period, using dustfall jars co-located with hi-vol stations. The highest monthly deposition rate was predicted to be 0.166 mg/m^2/30 days (IEC, 2021a).

Figure 5 presents the contour plot for maximum annual uranium deposition rates predicted by AERMOD. The highest annual deposition rate has a value of 1.38E-05 g/m² which is 3 times lower than the maximum deposition rate in the 2016 ERA (4.25E-05 g/m^2). The uranium deposition rates calculated at the eight dustfall monitoring locations are compared to the dustfall data as shown in Table 7. The calculated (i.e., predicted) uranium deposition rates are within a factor of 2 of monitored data, with exception at the Shuter Street dustfall (i.e., Station 9).

Figure 5 Maximum Annual Uranium Deposition Rate (g/m^2)

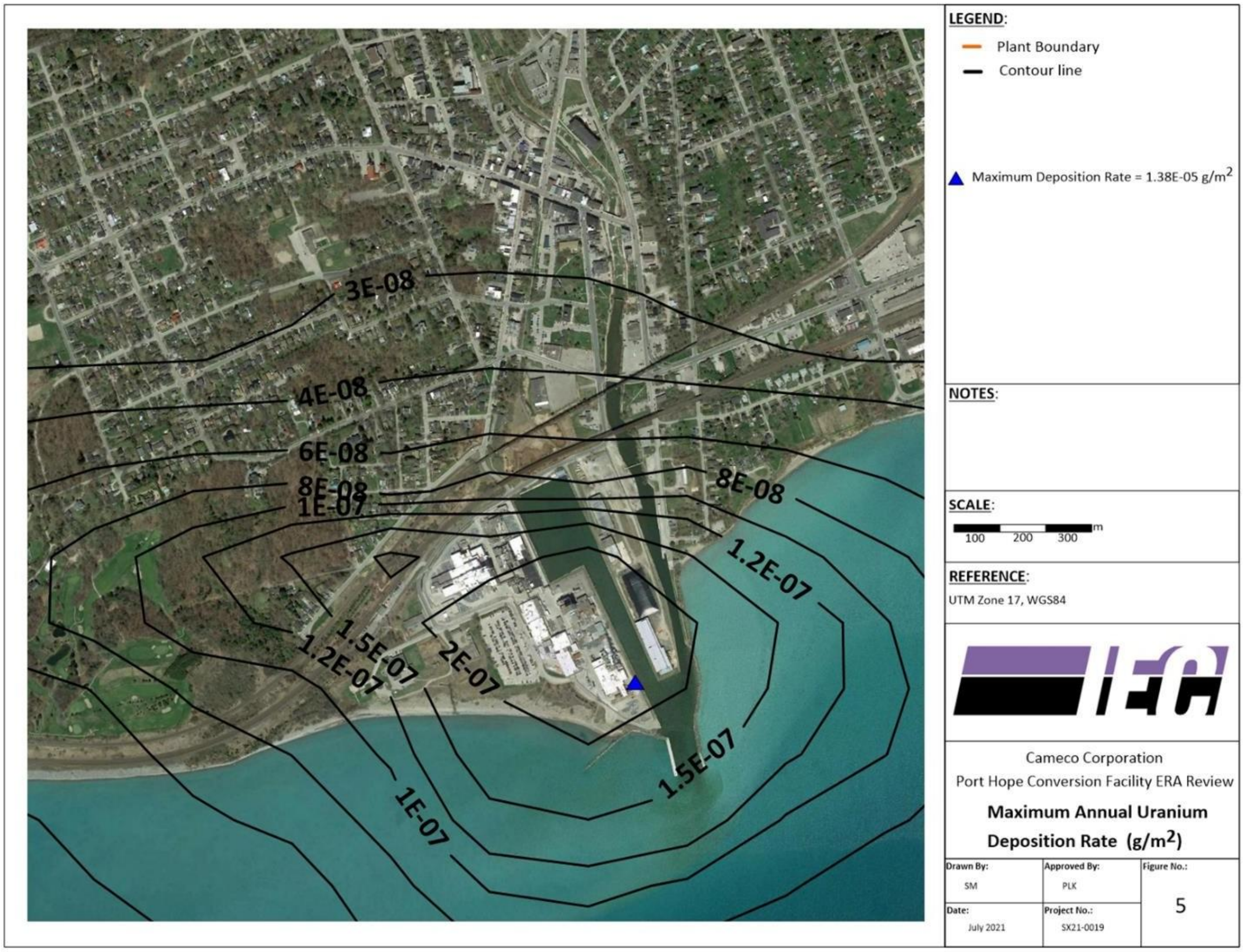


Table 7 :Comparison of Modelled vs. Monitored Uranium Deposition Rates

Station Location	UTM Coordinates		Uranium Deposition Rate (mg/m²/30 days)		
	Easting (m)	Northing (m)	Monitored (2016-2020)	Modelled	Ratio Model vs. Monitor
Station 1	716890	4869025	0.044	0.078	1.8
Station 2	716632	4869081	0.065	0.060	0.9
Station 4	717043	4869312	0.090	0.111	1.2
Station 7	717430	4869455	0.050	0.033	0.7
Station 8	717392	4868884	0.040	0.082	2.0
Station 9	717612	4869638	0.038	0.017	0.4
Station 10	716949	4869293	0.078	0.061	0.8
Station 15	716999	4869157	0.122	0.154	1.3

The results of the updated air dispersion modelling show that predicted uranium concentrations are comparable to the results of modelling completed as part of the 2016 ERA. The summary of monitoring data on uranium deposition from the period 2016-2020 indicates the lower deposition rates in comparison to the PHCF 2014 monitoring data and that is reflected in lower deposition velocity calculated in this assessment.

Overall, the results of the updated air dispersion modelling have shown no significant changes in the air pathway that might affect the conclusions of the ERA and the conclusion from the 2016 ERA that uranium in air is not a concern for off-site receptors remains valid (IEC, 2021a).

3.2.2 Liquid Effluent Release Modelling

Liquid effluent release modelling was completed as part of the 2016 DRL (ARCADIS, 2016c) based on sanitary sewer quality data from 2014. The PHCF monitors the uranium released to the sanitary sewer which is processed at the municipal sewage treatment plant (STP). Following processing in the STP, the treated water is released to Lake Ontario, via a diffuser located east of the PHCF and harbour.

Dispersion calculations were completed to develop a dilution factor that accounts for dispersion between the STP outfall and the harbour using the Cornell Mixing Zone Expert System (CORMIX). Overall, CORMIX modelling results indicate that a dilution of approximately 2090x is achieved between the STP diffuser and the Port Hope Harbour (Arcadis, 2016c). This predicts a contribution of 0.0014 µg U/L from the discharge of the STP at the Port Hope harbour.

The CORMIX model was updated for the STP outfall for work supporting the 2021 Derived Release Limit for CFM (ARCADIS, 2021). As the CORMIX model uses a unit-concentration of effluent (1 ppm) rather than specific concentrations of analytes in effluent, generic dilution factors are developed which apply to any particular analyte (ARCADIS, 2021) and the model may be used for assessment of PHCF contributions to the STP.

The 2021 modelling assessed concentrations from the STP outfall at the public beach in Port Hope (1.5 km west of the STP outfall), the drinking water intake (2.9 km west of the STP outfall) and in concentration at the STP outfall (ARCADIS, 2021). The dilution factors from the CORMIX modelling are 2260 times at the beach, 4219 times at the drinking water intake and no dilution at the STP outfall (ARCADIS, 2021).

Since the PHCF sanitary discharge is released to the STP, it is required to consider the additional volume of waste water treated at the STP. Table 8 illustrates the derivation of the lowest dilution factor (12X) to be used for assessment of impact of uranium discharges to the sanitary sewer.

Table 8 PHCF effluent dilution with municipal sewage

	PHCF Effluent		STP Effluent		Dilution Factor
Year	Concentration (µg/L)	Volume (m^3)	Volume (m^3)	Concentration (µg/L)	
2017	44	138,012	2,163,874	2.8	16
2018	37	131,589	1,857,391	2.6	14
2019	33	161,938	1,912,776	2.8	12
2020	13	140,029	1,665,680	1.1	12

Using the minimum dilution (12X) for the PHCF to STP effluent and the maximum annual PHCF effluent concentration (44 ug/L) a maximum STP effluent concentration was derived. Using the dilution factors from the CORMIX model, predicted concentrations of uranium at the receptor locations can be determined as shown in Table 9.

Table 9 Predicted Concentrations of Uranium from PHCF discharge to sanitary sewer

Receiving Location	PHCF Contribution to STP effluent (µg/L)	Dilution Factor from CORMIX	Predicted Concentration (µg/L)
STP Outfall	3.7	1	3.7
Public Beach	3.7	2260	0.0016
Drinking Water Intake	3.7	4419	0.0008

This is a negligible contribution at all receptor locations and well below the short-term exposure criterion of 33 µgU/L used for development of Exposure-Based Release Limits for Cameco's Ontario facilities (Cameco, 2021).

3.3 Updated COPC Screening

The environmental monitoring data collected since the last ERA in 2016 was reviewed to determine whether additional contaminants of potential concern (COPC) need to be considered. The 2016 ERA used the maximum concentrations in soil, groundwater, surface water and sediments in the screening process. COPC screening followed the methodology set out in the 2016 ERA (ARCADIS, 2016a). Analytes were carried forward for further evaluation in the ERA review if the analyte satisfied one of the following three conditions:

1. The maximum concentration exceeds the corresponding screening criterion; or
2. a) There are measurable concentrations; and

   b) corresponding screening criteria are not available; and

c) toxicity benchmarks are available; or

3. They were identified in other relevant connected environmental media as COPCs (i.e., at levels exceeding screening criteria in those connected media) and are related to current site operations.

3.3.1 Air

Air screening follows the overall screening procedure outlined above using concentrations at the point of impingement (POI), all contaminants not considered negligible under s.8 of O. Reg. 419/05 were included in the screening. The results of air screening are shown in Table 10 (IEC, 2023).

Only uranium was identified as a COPC due to its relevance to current site operations. There is no change to the conclusions of the ERA based on this review.

Table 10 Air – COPC Screening (From 2022 ESDM –IEC (2023)

Contaminant	CAS No.	Aggregate Emission Rate (g/s)	Averaging Period	AERMOD Maximum Ground-level Concentration (µg/m³)	Screening Criteria (µg/m³)	% of Criteria (%)	Evaluate as COPC?	Comments
Ammonia	7664-41-7	2.34E+00	24	4.28E+01	100	43%	No	Less than screening criterion
Ammonia (without source 499)*	7664-41-7	2.25E+00	24	3.76E+01	100	38%	No	Less than screening criterion
Fluorides (as HF) – Gaseous (Growing Season)	7664-39-3	2.10E-02	24	4.07E-01	0.86	47%	No	Less than screening criterion
Fluorides (as HF) – Gaseous (Growing Season)	7664-39-3	2.10E-02	30-day	1.37E-01	0.34	40%	No	Less than screening criterion
Fluorine	7782-41-4	6.32E-04	24	9.25E-03	0.1	Below De Minimus	No	Less than screening criterion
Nitrogen oxides	10102-44-0	2.41E+00	24	2.81E+01	200	14%	No	Less than screening criterion
Nitrogen oxides	10102-44-0	2.41E+00	1	1.39E+02	400	35%	No	Less than screening criterion
Particulate Matter	N/A	4.74E-01	24	5.23E+00	120	4%	No	Less than screening criterion
Potassium	7440-09-7	9.39E-03	24	1.98E-01	1	< JSL	No	Less than screening criterion
Sulphur dioxide	7446-09-5	2.01E+00	24	2.34E+01	275	9%	No	Less than screening criterion
Sulphur dioxide	7446-09-5	2.01E+00	1	1.15E+02	690	17%	No	Less than screening criterion
Uranium (and Uranium compounds) [4]	7440-61-1	2.12E-03	Annual	4.62E-03	0.03	15%	Yes	Less than screening criterion. Identified as a COPC in other relevant connected media. Directly relevant to site operations.
Uranium (and Uranium compounds)	7440-61-1	2.12E-03	Annual	4.62E-03	0.15	3%	Yes	Less than screening criterion. Identified as a COPC in other relevant connected media. Directly relevant to site operations.
Uranium (and Uranium compounds)	7440-61-1	2.12E-03	24	3.17E-02	1.5	2%	Yes	Less than screening criterion. Identified as a COPC in other relevant connected media. Directly relevant to site operations.

3.3.2 Soil

Table 11 provides a summary of the updated screening for soil. Generally, the concentrations are lower in the recent dataset than the maximum concentrations considered in the 2016 ERA. The updated screening utilized off-site soil concentrations for uranium from 2015 through 2020 and soil borehole data from November 2020. It is noted that the borehole data were collected under a concrete slab and may not be completely appropriate for consideration in the risk assessment. The recent data does not include all constituents considered in the 2016 ERA. The updated screening process removed contaminants that are associated with the Earth's crust such as calcium, magnesium, potassium etc. and also removed contaminants that were not associated with PHCF operations and those for which toxicity information do not exist (CanNorth, 2021a).

A procedural change has occurred in off-site soil sampling since the completion of the 2016 ERA. In 2014, the PHCF soil monitoring program was amended to focus on uranium as the priority contaminant of concern for the PHCF (Cameco 2014); this modification was accepted by the CNSC (2014). Therefore, only uranium concentrations are available in off-site soil from 2015. The number of monitoring locations has also decreased over time.

As identified in **Error! Not a valid bookmark self-reference.**, there were some changes to the COPC identified for the assessment based on consideration of the recent 2020 data. Maximum concentrations of antimony, boron, cadmium, cobalt, nickel, selenium, vanadium, and zinc were below screening criteria in the 2020 dataset and were not identified as COPC in the updated screening. The 2016 ERA did not identify issues for terrestrial ecological receptors for these COPC. Maximum concentrations of silver and TCE were above screening criteria in the 2020 dataset; however, the sample location beneath the floor slab does not represent an operable exposure pathway. Iron, magnesium, and potassium are associated with the Earth's crust and aluminium, barium, copper, lead, manganese, and strontium are not related to PHCF operations, and these constituents were therefore not selected for further consideration. Parameters identified as COPC in the previous dataset without updated information were also carried forward (CanNorth, 2021a).

It is noted that the recent dataset only considers limited data from a focussed site study and does not represent a comprehensive site characterization for soil. Ultimately changes in the screening of soil for human health based on the recent data have no influence on the results of the risk assessment, since none of the identified human receptors were considered to have contact with on- site soil. The only human receptors in the 2016 ERA assumed to contact soil were the nearby resident and the recreational park user. Uranium is measured in off-site soil and the maximum concentration from all depths from 2015 to 2020 was 15 µg/g. This maximum measured concentration is well below the screening criteria of 33 µg/g and therefore, no COPC are identified for soil in the human health assessment (CanNorth, 2021a).

Table 11 Soil: updated screening

Constituent	Units	Screening Criteria MOE Table 3a	2016 ERA Max Value	Recent Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Aluminum	µg/g	NA	36300	No data	**Yes**	No	Not associated with PHCF operations
Antimony	µg/g	40	166	12	**Yes**	No	Below screening criteria
Arsenic	µg/g	18	1790	160	**Yes**	**Yes**	
Barium	µg/g	670	2020	3500	**Yes**	No	Not associated with PHCF operations
Beryllium	µg/g	8	1.6	1.1	No	No	
Bismuth	µg/g	NA	55	No data	No	No	No toxicity data
Boron (total)	µg/g	120	1790	13	**Yes**	No	Below screening criteria
Calcium	µg/g	NA	316000	No data	No	No	Part of Earth's crust
Cadmium	µg/g	1.9	9.8	0.24	**Yes**	No	Below screening criteria
Chromium	µg/g	160	114	0.35	No	No	
Cobalt	µg/g	80	2730	70	**Yes**	No	Below screening criteria
Copper	µg/g	230	8830	730	**Yes**	No	Not associated with PHCF operations
Iron	µg/g	NA	180000	No data	**Yes**	No	Part of Earth's crust
Lead	µg/g	120	30000	4000	**Yes**	No	Not associated with PHCF operations
Magnesium	µg/g	NA	84300	No data	**Yes**	No	Part of Earth's crust
Manganese	µg/g	NA	3600	No data	**Yes**	No	Not associated with PHCF operations
Molybdenum	µg/g	40	15	1	No	No	
Nickel	µg/g	270	5690	51	**Yes**	No	Below screening criteria
Phosphorus	µg/g	NA	44900	No data	No	No	Part of Earth's crust
Potassium	µg/g	NA	45000	No data	**Yes**	No	Part of Earth's crust
Selenium	µg/g	5.5	16	<0.5	**Yes**	No	Below screening criteria
Silicon	µg/g	NA	5800	No data	No	No	Part of Earth's crust
Silver	µg/g	40	40	67	No	No	Above screening criteria; recent data max from BH4 SA2 of floor slab and does not represent an exposure pathway
Sodium	µg/g	NA	10000	No data	No	No	Part of Earth's crust
Strontium	µg/g	NA	3000	No data	**Yes**	No	Not associated with PHCF operations
Thallium	µg/g	3.3	0.94	0.22	No	No	
Titanium	µg/g	NA	2100	No data	No	No	Part of Earth's crust
Uranium	µg/g	33	16800	1900	**Yes**	**Yes**	
Vanadium	µg/g	86	150	55	**Yes**	No	Below screening criteria
Zinc	µg/g	340	5500	97	**Yes**	No	Below screening criteria
Radium-226	Bq/g	NA	32	No data	**Yes**	**Yes**	
Benzene	µg/g	0.32	<0.002	0.022	No	No	
Ethylbenzene	µg/g	9.5	0.012	0.021	No	No	
Toluene	µg/g	68	0.028	0.11	No	No	

Constituent	Units	Screening Criteria MOE Table 3a	2016 ERA Max Value	Recent Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Xylene (total)	µg/g	26	0.212	0.55	No	No	
Bromodichloromethane	µg/g	18	<0.002	<0.04	No	No	
Bromoform	µg/g	0.61	<0.002	<0.04	No	No	
Bromomethane	µg/g	0.05	<0.009	<0.04	No	No	
Carbon tetrachloride	µg/g	0.21	<0.002	<0.04	No	No	
Chlorobenzene	µg/g	2.4	<0.002	<0.04	No	No	
Chloroform	µg/g	0.47	<0.003	0.36	No	No	
Dibromochloromethane	µg/g	13	<0.002	<0.04	No	No	
1,1-Dichloroethane	µg/g	17	<0.002	<0.04	No	No	
1,2-Dichloroethane	µg/g	0.05	<0.002	<0.049	No	No	
1,1-Dichloroethylene	µg/g	0.064	<0.002	<0.04	No	No	
cis-1,2-Dichloroethylene	µg/g	55	0.003	<0.04	No	No	
trans-1,2-Dichloroethylene	µg/g	1.3	<0.004	<0.04	No	No	
1,2-Dichloropropane	µg/g	0.16	<0.002	<0.04	No	No	
cis-1,3-Dichloropropene	µg/g	0.18	<0.002	<0.03	No	No	
trans-1,3- Dichloropropene	µg/g	0.18	<0.002	<0.04	No	No	
Ethylenedibromide	µg/g	0.05	<0.002	0.021	No	No	
Dichloromethane	µg/g	1.6	0.021	<0.049	No	No	
1,1,1,2-Tetrachloroethane	µg/g	0.087	<0.002	<0.04	No	No	
1,1,2,2-Tetrachloroethane	µg/g	0.05	<0.004	<0.04	No	No	
Tetrachloroethylene	µg/g	4.5	<0.002	0.086	No	No	
1,2,4-Trichlorobenzene	µg/g	3.2	0.004	No data	No	No	
1,1,1-Trichloroethane	µg/g	6.1	<0.003	<0.04	No	No	
1,1,2-Trichloroethane	µg/g	0.05	<0.002	<0.04	No	No	
Trichloroethylene	µg/g	0.91	0.188	1	No	No	Above screening criteria; recent data max from BH2 SA1A of floor slab and does not represent an exposure pathway
Vinyl Chloride	µg/g	0.032	<0.003	<0.019	No	No	
1,2-Dichlorobenzene	µg/g	6.8	<0.002	<0.04	No	No	
1,3-Dichlorobenzene	µg/g	9.6	0.005	<0.04	No	No	
1,4-Dichlorobenzene	µg/g	0.2	0.002	<0.04	No	No	
Trichlorofluoromethane	µg/g	4	<0.002	<0.04	No	No	
Dichlorodifluoromethane	µg/g	16	<0.002	<0.04	No	No	

Note: Recent data is based on November 2020 borehole sampling and annual off-site soil sampling for uranium from 2015-2020. Not all parameters considered in the 2016 ERA screening Table 4.2 were included here and constituents are limited to those included in recent data and/or relevant for assessment. The 2016 ERA used data from SENES (2013), as well as data from the 2014 off-site soil monitoring program for uranium.

For the ecological assessment, the secondary screening for soil compared the maximum measured concentrations to the ecological soil components (plants and soil invertebrates, mammals and birds) of the Table 3[1] MOE (2011) criteria for full-depth, non-potable water, coarse textured soil. The updated screening is provided in Table 12. Differences in the screening of soil for the ecological assessment are due to changes in the underlying dataset. Arsenic is no longer above the criteria for mammals and birds, while uranium is no longer above the criteria for plants and soil invertebrates.

Table 12 Soil: updated secondary screening for ecological assessment

Parameter	Units	MOE Table 3		2016 ERA Max Value	Recent Data Max Value	Plants and Soil Invertebrates		Mammals and Birds	
		Plants and Soil Invertebrates	Mammals and Birds			2016 ERA COPC?	Updated COPC?	2016 ERA COPC?	Updated COPC?
Arsenic	µg/g	40	330	1790	160	**Yes**	**Yes**	**Yes**	No
Uranium	µg/g	2000	33	16800	1900	**Yes**	No	**Yes**	**Yes**
Radium-226	Bq/g	NA	NA	32	No data	**Yes**	**Yes**	**Yes**	**Yes**

Note: The 2016 ERA indicated that ecological screening criteria were from MOE Table 2 (for potable groundwater); for ecological screening criteria these are the same as the Table 3 values (for non-potable groundwater), however the reference has been updated to MOE Table 3 (full depth, non-potable water scenario, industrial/commercial land use). Also, the plants and soil invertebrates criteria were switched with the mammals and birds in the 2016 ERA secondary screening for ecological receptors (Table 6.4). The corrected values are presented here.

3.3.3 Groundwater

Table 13 provides a summary of the updated screening for groundwater. Screening criteria for groundwater were from Table 9 of MOE (2011) for non-potable groundwater within 30 m of a water body. The 2016 ERA used groundwater data from the 2014 Annual Groundwater and Surface Water Review Report (Golder 2015), which included data from PHCF's internal groundwater monitoring program for 2014 (ARCADIS, 2016a). The recent data maximum value presented in Table 13 is based on data collected from 2015 through 2020, including both Cameco and contract laboratory analyses as available from Golder (2021). The 2016 ERA considered data for petroleum hydrocarbons (PHCs) from the 2009 Site-Wide Risk Assessment (SWRA; SENES 2009a); more recent data for PHCs in groundwater are not available for consideration in the current comparison. As discussed above these data are not considered to represent current conditions and are not discussed further. Similarly, polychlorinated biphenyls (PCBs) are not reported in the recent monitoring data. Thus the information related to these contaminants are dated and not discussed below.

The updated screening process also removed contaminants that are associated with the Earth's crust such as calcium, magnesium, potassium etc. and also removed contaminants that were not associated with PHCF operations and those for which toxicity information do not exist (CanNorth, 2021a).

[1] Indicated as Table 2 in the 2016 ERA text. Table 2 is for potable water and the values in Table 2 and Table 3 (non-potable water) are the same for ecological criteria, but the reference is corrected here for completeness.

Table 13 Groundwater: updated screening

Constituent	Units	Screening Criteria	2016 ERA Max Value	Recent Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Fluoride	mg/L	NA	75	100	**Yes**	**Yes**	
Ammonia	mg-N/L	NA	150	400	**Yes**	**Yes**	
Calcium	mg/L	NA	12200	23200	**Yes**	No	Part of Earth's crust
Chloride	mg/L	1800	82000	130000	**Yes**	**Yes**	
Magnesium	mg/L	NA	5190	5716	**Yes**	No	Part of Earth's crust
Nitrite	mg-N/L	NA	<0.3	0.32	No	**Yes**	Previously below detection limit and was not considered; recent data max from 2018 at HW-23C (near UO_2 plant)
Nitrate	mg-N/L	NA	115	140	**Yes**	**Yes**	
Potassium	mg/L	NA	1080	1000	**Yes**	No	Part of Earth's crust
Sodium	mg/L	1800	23700	24200	**Yes**	No	Part of Earth's crust
Sulphate	mg/L	NA	1200	1500	**Yes**	**Yes**	
Aluminum	µg/L	NA	220	6710	**Yes**	No	Not associated with PHCF operations
Antimony	µg/L	16000	30	13.1	No	No	Not associated with PHCF operations
Arsenic	µg/L	1500	1150	1690	**Yes**	**Yes**	
Barium	µg/L	23000	6540	7320	No	No	Not associated with PHCF operations
Beryllium	µg/L	53	<0.007	0.3	No	No	
Boron	µg/L	36000	1470	1360	No	No	Not associated with PHCF operations
Bismuth	µg/L	NA	<0.007	2.7	No	**Yes**	Previously below detection limit and was not considered; recent data max from 2019 at MW50-19B (near UF_6 plant)
Cadmium	µg/L	2.1	<0.003	0.003	No	No	Not associated with PHCF operations
Cobalt	µg/L	52	20	17.3	No	No	
Chromium	µg/L	640	20	68.4	No	No	Not associated with PHCF operations
Copper	µg/L	69	290	114	**Yes**	No	Not associated with PHCF operations
Iron	µg/L	NA	36700	32000	**Yes**	No	Part of Earth's crust
Lead	µg/L	20	20	15	No	No	Not associated with PHCF operations
Manganese	µg/L	NA	2600	2810	**Yes**	No	Not associated with PHCF operations
Molybdenum	µg/L	7300	230	572	No	No	
Nickel	µg/L	390	100	54	No	No	Not associated with PHCF operations

Constituent	Units	Screening Criteria	2016 ERA Max Value	Recent Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Selenium	µg/L	50	538	608	**Yes**	No	Not associated with PHCF operations
Silicon	µg/L	NA	20400	21400	No	No	
Silver	µg/L	1.2	30	22.6	**Yes**	**Yes**	
Strontium	µg/L	NA	1090000	1300000	**Yes**	No	Not associated with PHCF operations
Thallium	µg/L	400	<0.005	3.2	No	No	
Titanium	µg/L	NA	20	29.7	No	No	Part of Earth's crust
Uranium	µg/L	330	21000	21100	**Yes**	**Yes**	
Vanadium	µg/L	200	20	64	No	No	Not associated with PHCF operations
Zinc	µg/L	890	2220	534	**Yes**	No	Below screening criteria
Radium-226	Bq/L	NA	0.89	12	**Yes**	**Yes**	
Benzene	µg/L	44	277	277	**Yes**	**Yes**	
Ethylbenzene	µg/L	1800	21.3	26	No	No	
Toluene	µg/L	14000	275	286	No	No	
Xylene (Total)	µg/L	3300	192	218	No	No	
Bromodichloromethane	µg/L	67000	2	<0.5	No	No	
Bromoform	µg/L	29000	1	<0.5	No	No	
Bromomethane	µg/L	5.8	<0.5	<0.5	No	No	
Carbon tetrachloride	µg/L	0.35	1.2	<0.2	**Yes**	No	Below screening criteria
Chlorobenzene	µg/L	500	<0.5	1	No	No	
Chloroform	µg/L	240	17	1.3	**Yes**	No	Updated guideline; below screening criteria
Dibromochloromethane	µg/L	65000	0.59	<0.5	No	No	
1,1-Dichloroethane	µg/L	320	31.7	21	No	No	
1,2-Dichloroethane	µg/L	1.6	<0.5	0.9	No	No	
1,1-Dichloroethylene	µg/L	1.6	20.8	7.6	**Yes**	**Yes**	
cis-1,2-Dichloroethene	µg/L	1.6	1020	1080	**Yes**	**Yes**	
trans-1,2- Dichloroethene	µg/L	1.6	28.6	10.8	**Yes**	**Yes**	
1,2-Dichloropropane	µg/L	16	<0.5	<0.5	No	No	
cis-1,3-Dichloropropene	µg/L	5.2	<0.5	<0.5	No	No	
trans-1,3-Dichloropropene	µg/L	5.2	<0.5	<0.5	No	No	
Ethylenedibromide	µg/L	0.25	<1	<0.2	**Yes**	No	Below screening criteria
Dichloromethane	µg/L	1400	2	<0.5	No	No	
1,1,1,2-Tetrachloroethane	µg/L	3.3	<0.5	<0.5	No	No	
1,1,2,2-Tetrachloroethane	µg/L	3.2	0.25	<0.5	No	No	
Tetrachloroethylene (perchloroethylene)	µg/L	1.6	1.4	<0.5	No	No	
1,2,4-Trichlorobenzene	µg/L	180	0.25	0.8	No	No	
1,1,1-Trichloroethane	µg/L	640	15.1	3.9	No	No	
1,1,2-Trichloroethane	µg/L	4.7	<1.2	1.2	No	No	
Trichloroethylene	µg/L	1.5	1800	207	**Yes**	**Yes**	
Vinyl Chloride	µg/L	0.5	613	911	**Yes**	**Yes**	
1,2-Dichlorobenzene	µg/L	4600	<0.5	<0.5	No	No	
1,3-Dichlorobenzene	µg/L	7600	<0.5	0.9	No	No	
1,4-Dichlorobenzene	µg/L	8	0.6	1.4	No	No	

Constituent	Units	Screening Criteria	2016 ERA Max Value	Recent Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Trichlorofluoromethane	µg/L	2000	<5	<5	No	No	
Dichlorodifluoromethane	µg/L	3500	2.3	4.1	No	No	

Note: NA – not available. For simplicity, not all constituents considered in the 2016 ERA screening Table 4.1 were included here (i.e., pH, conductivity, hardness and some general chemistry constituents like phosphorus and TDS). Data for PHCs and PCBs from 2009 considered in the 2016 ERA is not included in the comparison, because no recent data are available and data from 2009 are over 10 years old and no longer representative of concentrations at the site. The identification of maximum concentrations considered data from 2018 through 2020 for organic constituents.

As identified in Table 13 , there were some changes to the COPC identified for the assessment based on consideration of the 2015 through 2020 data. Nitrite and bismuth, which have no screening criteria, were previously reported with all data less than the detection limit and were not selected for further consideration. With detected concentrations in the 2015 to 2020 data, nitrite and bismuth were identified for further evaluation in the updated screening. Updated concentrations of zinc, carbon tetrachloride, and ethylene dibromide were below the available screening criteria and were not selected for further evaluation, which is a change from the 2016 ERA. Finally, chloroform has an updated screening criteria and the maximum concentrations are below this value; therefore, chloroform is no longer identified as a COPC. Calcium, magnesium, potassium, sodium, iron, and titanium were not identified for the assessment since these constituents are part of the Earth's crust, while aluminium, antimony, barium, boron, cadmium, chromium, copper, lead, manganese, nickel, selenium, strontium, and vanadium are not associated with PHCF operations (CanNorth, 2021a).

Generally the concentrations considered in the 2016 ERA are similar to the maximum values from more recent data. However, there is one notable difference for radium-226; the 2016 ERA considered a concentration of 0.89 Bq/L (2014) and the maximum concentration in the recent data is 12 Bq/L. Both values are from bedrock well HW-18D (screened from 19.2 m to 21.2 m bgs) and data has ranged at this location from < 0.01 Bq/L (2010) to 12 Bq/L (2017), with an average of 3.4 Bq/L based on detected concentrations. In 2020, radium-226 was reported at a level of 0.02 Bq/L at this location. The variability in concentrations reflect that radium-226 concentrations are not increasing. The use of the maximum concentration in the screening process may be an overestimation of the current radium-226 groundwater concentrations at that location (CanNorth, 2021a).

As part of the annual groundwater and surface water review, WSP (previously Golder) reviews the current years data against that used in the 2016 ERA. The most recent review identified three monitoring wells with data above the maximums in the 2016 ERA (WSP, 2023). Of these, three parameters (calcium, manganese, sodium) are not identified as COPCs in this ERA review. In addition, for the wells screened in bedrock which have consistently elevated concentrations, it has been inferred that these results are representative of naturally occurring conditions, not anthropogenic sources (WSP, 2023).

The 2016 ERA completed a secondary screening for groundwater for both humans and ecological receptors. The secondary screening for humans compared the maximum measured groundwater concentrations to human health components of the MOE (2011) Table 6 for coarse textured shallow soil and potable groundwater. The GW1 component associated with the potable groundwater scenario was used as a surrogate for direct contact. Ultimately changes in the screening of groundwater for human health based on the recent data and changes in approach have no influence on the results of the risk assessment, since none of the identified human receptors were considered to have contact with groundwater.

For the ecological assessment, the secondary screening for groundwater in the 2016 ERA compared the maximum measured concentrations to the GW3 component of the Table 9 MOE (2011) criteria for groundwater within 30 m of a water body. The GW3 component is protective of aquatic biota in surface water bodies potentially affected by groundwater and are also considered protective of terrestrial species such as earthworms. It is important to note that depth to groundwater at the site is generally 3.5 to 4.5 mbgs and becomes shallower at about 1 mbgs towards the southern part of the site. These depths generally do not represent an exposure pathway for humans or terrestrial species such as earthworms. Surface water integrates inputs from groundwater as well as stormwater runoff from the PHCF and represents the potential exposure pathway for humans and aquatic receptors.

The updated screening is provided in Table 14. Differences in the screening of groundwater for the ecological assessment are due to changes in the underlying dataset. Nitrite was previously less than detection limit, but in the more recent data was reported at detected concentrations. With no criteria available for comparison, it is selected for further assessment. The maximum concentration of arsenic in groundwater is higher in the more recent dataset and no longer below the screening criteria; therefore, arsenic is also added to the groundwater COPC list for the ecological assessment (Can North, 2021).

Table 14 Groundwater: updated secondary screening for ecological assessment

Constituent	Units	MOE Table 9 Non-Potable GW3	2016 ERA Max Value	Recent Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Fluoride	mg/L	NA	75	100	**Yes**	**Yes**	No GW3
Ammonia	mg-N/L	NA	150	400	**Yes**	**Yes**	No GW3
Chloride	mg/L	NA	82000	86000	**Yes**	**Yes**	No GW3
Nitrite	mg-N/L	NA	<0.3	0.32	No	**Yes**	No GW3
Nitrate	mg-N/L	NA	115	140	**Yes**	**Yes**	No GW3
Sulphate	mg/L	NA	1200	1500	**Yes**	**Yes**	No GW3
Arsenic	µg/L	1500	1150	1690	No	**Yes**	Above GW3
Bismuth	µg/L	NA	<0.007	2.7	No	**Yes**	No GW3
Silver	µg/L	1.2	30	22.6	**Yes**	**Yes**	Above GW3
Uranium	µg/L	330	21000	21100	**Yes**	**Yes**	No GW3
Radium-226	Bq/L	NA	0.89	12	**Yes**	**Yes**	No GW3
Benzene	µg/L	4600	277	277	No	No	Below GW3
1,1-Dichloroethylene	µg/L	12000	20.8	10.3	No	No	Below GW3
cis-1,2-Dichloroethene	µg/L	140000	1020	1180	No	No	Below GW3
trans-1,2-Dichloroethene	µg/L	220000	28.6	14.1	No	No	Below GW3
Trichloroethylene	µg/L	220000	1800	884	No	No	Below GW3
Vinyl Chloride	µg/L	360000	613	911	No	No	Below GW3

Note: Screening criteria from MOE (2011) Table 9 for non-potable groundwater within 30 m of a water body.

3.3.4 Harbour Water - Inferred from Groundwater and Stormwater

The 2016 ERA completed modelling for water quality in the Port Hope Harbour based on stormwater and groundwater discharges from the PHCF. Groundwater discharge estimates were based on 2014 average pumping rates and annual loadings while stormwater discharge estimates were based on information for 2010 (ARCADIS, 2016a).

The current review compared the previous groundwater mass loading to the harbour that was used in the 2016 ERA with more recent data on mass loadings (2016, 2018, and 2020) to determine if there have been increased loadings to the harbour since the completion of the 2016 ERA (CanNorth, 2021a). The more recent groundwater mass loadings to the harbour (2016, 2018, 2020 and 2022) were presented in WSP (Table 7, 2023) and are reproduced in Table 15. Table 155 shows that, in general, the estimated mass loadings from groundwater to the harbour are similar over the 2014 to 2022 period. Estimated mass loadings of some constituents have decreased (i.e., fluoride, ammonia, nitrate, and uranium) while other constituents have shown variability (i.e., arsenic, radium-226, cis-1,2-DCE, and VC). The most significant difference is noted for radium- 226, with a 3x increase from 2014 to 2020 (CanNorth, 2021a), however, it is noted that 2022 represented a reduction to 2016 levels. Fluoride and uranium loadings have decreased by a factor of two over the 2014-2022 period and ammonia and nitrate loadings have decreased by a factor of three over the same period. This decrease in loadings/mass discharge is partially attributable to the sustained operation of pumping wells and the gradual decrease of COPCs in groundwater as a consequence of pump-and-treat operations (WSP, 2023).

Table 15 Comparison of estimated groundwater mass loading to Port Hope Harbour

Constituent	Estimated Mass Discharge to Harbour (kg/yr[a])				
	2014	2016	2018	2020	2022
Arsenic	2.0	1.7	1.3	2.7	2.5
Fluoride	15	9.4	11	11	6.5
Ammonia	95	116	66	42	30
Nitrate	3.8	3.4	2.0	2.3	1.2
Radium-226	657	1216	1812	1829	1345
Uranium	5.1	4.2	3.9	3.2	2.6
cis-1,2-Dichloroethene	0.02	0.02	0.01	0.04	0.03
Trichloroethylene	0.01	0.01	0.01	0.01	0.01
Vinyl Chloride	0.03	0.01	0.01	0.05	0.01

Note: Based on average pumping scenario from Table 7 of Golder (2021) and WSP (2023).
a – As specified in Table 7 of Golder (2021) and WSP (2023).

Table 16 presents the comparison of the stormwater concentrations used in the 2016 ERA for loading estimates to the harbour with the measured concentrations from 2015 to 2020. The stormwater assumptions from the 2016 ERA were based on information for 2010 presented in Golder (2011). Data from stormwater monitoring were available from Cameco's internal monitoring program, which is summarized in annual reports. The table shows that, in general, the concentrations considered for stormwater in the 2016 ERA modelling are similar to concentrations measured from 2015 to 2020 from stormwater discharge outlets, with the average concentration typically less than the assumed concentration for the 2016 ERA (CanNorth, 2021a). The concentrations in 2022 monitoring continue to exhibit this general trend (Cameco, 2023). As the VIM project is further implemented, these trends are expected to continue.

Table 16 Comparison of stormwater concentrations

Year	Stormwater Concentration					
	Uranium	Fluoride	Ammonia	Arsenic	Radium	Zinc
	mg/L	mg/L	mg/L	mg/L	Bq/L	mg/L
2010 (2016 ERA)	0.195	0.69	0.38	0.067	0.09	0.24
2015-2020 Min	0.02	<0.06	No data	0.0002	<0.01	0.04
2015-2020 Avg	0.19	0.22	No data	0.01	0.08	0.28
2015-2020 Max	1.5	0.63	No data	0.11	0.73	0.95
2022 Average	0.05	0.14	0.45	0.003	0.021	0.1
2022 Max	0.15	0.32	2.4	0.01	0.064	0.2

Note: 2016 ERA values based on information presented in Table 3.7 of ARCADIS (2016a). Average calculations assumed values reported as < method detection limit (MDL) were equal to the MDL.

Exposure point concentrations (EPCs) for surface water were primarily based on measured data in the 2016 ERA; the results of the harbour surface water modelling, which incorporated stormwater and groundwater loadings, were only considered in the 2016 ERA for the calculation of incremental concentrations for arsenic, uranium, and radium-226 (Tables 5.10 and 5.11, ARCADIS 2016a). Based on the groundwater mass loading comparison and stormwater concentration comparison, the modelling completed for the 2016 ERA remains valid.

3.3.5 Surface Water

At the time of the 2016 ERA, the surface water sampling program consisted of thirteen sampling locations distributed along the perimeter of the Port Hope harbour turning basin and approach channel with many locations were specifically placed adjacent to harbour proximal monitoring wells exhibiting elevated contaminants of concern in groundwater. As a result of the installation of the phase 1 wave attenuator and associated turbidity curtain(s) by the PHAI, commencing in August 2018, this program was suspended until the remediation of the harbour by Canadian Nuclear Laboratories is complete. It will be reactivated once these activities are complete.

Table 17 provides a summary of the updated screening for surface water. The 2016 ERA considered results from Cameco's quarterly monitoring program in 2014. The 2016 ERA supplemented the 2014 data with data for additional constituents from the 2009 SWRA (SENES 2009a). Recent data are based on quarterly surface water sampling from 2015 to 2018 at shallow and deep locations in the harbour and limited constituents were available. As shown in **Table 1718**, ammonia and fluoride were not selected as COPC for surface water based on a comparison with recent data and updated screening considerations.

Table 1718 Surface water: updated screening

Constituent	Units	Screening Criteria	2016 ERA Max Value	Recent Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Ammonia (total)	mg-N/L	1.8[a]	0.5	0.4	**Yes**	No	2016 ERA used incorrect screening criteria
Nitrate	mg-N/L	2.9	<2.2	1.4	No	No	Below screening criteria
Uranium	µg/L	5	7.8	23	**Yes**	**Yes**	Above screening criteria
Radium-226	Bq/L	1	<0.055	<0.055	**Yes**	**Yes**	Radionuclides included
Arsenic	µg/L	5	3.2	8.8	**Yes**	**Yes**	Concern at site and above screening criteria
Fluoride	mg/L	1.94[b]	0.3	1.0	**Yes**	No	Below screening criteria

Note: Recent data is based on quarterly surface water sampling at shallow and deep locations from 2015-2018. Not all parameters considered in the 2016 ERA screening Table 4.3 were included here and constituents are limited to those included in recent data. The 2016 ERA used data for additional constituents from the 2009 SWRA (SENES 2009a); more recent data are not available.

a – The 2016 ERA used a screening value of 0.197 mg-N/L for total ammonia, based on CCME protection of aquatic life guidelines. The footnote to Table 4.3 indicates that a pH of 8.5 and temperature of 15ºC were assumed for the conversion. However, the value of 0.197 mg-N/L corresponds to a pH of 10 and temperature of 15ºC. The value has been corrected to represent a pH of 8.5 and temperature of 15ºC as originally intended.

b – The CCME protection of aquatic life guideline for fluoride is 0.12 mg/L and this value was used in the 2016 ERA. This guideline was developed in 2002. Since that time additional toxicity have become available and McPherson et al. (2014) developed a chronic effects benchmark for fluoride based on an SSD approach. A value of 1.94 mg/L F- was derived for fluoride. Thus, if concentrations of fluoride exceed the CCME value, a secondary step can be implemented to compare the measured concentrations to a value of 1.94 mg/L F-.

Exposure point concentrations (EPCs) for surface water were primarily based on measured data in the 2016 ERA; the results of the harbour surface water modelling, which incorporated stormwater and groundwater loadings, were only considered in the 2016 ERA for the calculation of incremental concentrations for arsenic, uranium, and radium-226 (Tables 5.10 and 5.11, ARCADIS 2016a). Based on the groundwater mass loading comparison and stormwater concentration comparison, the modelling completed for the 2016 ERA remains valid for present day conditions. On completion of the harbour remediation and the VIM project, remodelling will be required for the new site conditions.

3.3.6 Sediments

The CNSC commented on the groundwater and stormwater loading assumptions and asked for a determination of whether the future groundwater contamination and stormwater discharge would re-contaminate the sediments. The 2010 Assessment of Recontamination Potential in the Harbour (SENES, 2010) assessed the potential for future re-contamination of sediments from stormwater and groundwater loadings. Based on the hydro-geochemical model predictions, dredging of sediments will result in improved water and sediment quality even with continued groundwater and stormwater loadings into the Harbour (assuming current loadings). Based on 2010 stormwater quality, dredging the sediment would result in the Harbour water meeting Provincial Water Quality Objectives (PWQOs) and sediment quality meeting Lower Exposure Limits (LELs) for the compounds of potential concern (COPCs). Implementation of VIM remedial work will further improve both surface water and sediment quality and further reduce the discharges to the harbour which will contribute to sediment loading in the future (SENES, 2010). These assumptions will be revalidated in the ERA to be completed after the VIM project.

3.3.7 Comparison of EMP with 2016 ERA Predictions

From looking at the data in the 2016 ERA in comparison with the more recent monitoring data at the PHCF, it appears that concentrations in the various media are declining and therefore the more recent data does not have a significant impact on the screening process for the COPC. In the revised screening, fewer COPCs are identified for evaluation than the 2016 ERA due to improvement in environmental performance and overly conservative assumptions in the 2016 ERA. The more recent monitoring data were compared to the exposure point concentrations (EPCs) used in the 2016 exposure assessment to determine the impact on the conclusions of the 2016 ERA. This comparison found that that most of the recent data remain consistent with the EPCs and the results of the revised screening does not have a significant effect on the conclusion of the 2016 ERA (CanNorth, 2021a).

4.0 Review of Environmental Issues Identified in 2016 ERA

This section provides a review of environmental issues revealed by the 2016 EMP and a review of other issues identified with the methodology of the 2016 ERA and the impact of these issues on problem formulation in the ERA.

4.1 Follow-up to 2016 ERA Results

The 2016 ERA results are summarized in Table 19:

Table 19 2016 ERA Results

Stressor Type	Members of the Public	Aquatic Biota	Terrestrial Biota
Radiological	No adverse effect expected from COPCs associated with PHCF operations.	No adverse effect expected from COPCs associated with PHCF operations.	No adverse effect expected from COPCs associated with PHCF operations.
Non-Radiological	Non-Arsenic exposure is below background, but it is recommended to minimize arsenic risk to the extent that it is practical. The facility has restricted the arsenic levels in chemicals it is using (as of 1989)	No adverse effect expected from COPCs associated with PHCF operations.	Potential for adverse effects from F, PHCs in limited area that is not suitable habitat (i.e., the grass patch along Harbour wall)
Physical*	N/A	No I&E issues identified. Thermal exceedances tend to be limited spatially (i.e., localized near the discharge)	No adverse effect expected from stressors associated with PHCF operations.(i.e., noise)
Notes: N/A – Not applicable or not assessed. * - Physical stressors include fish entrainment, fish thermal effects, fish acute stormwater effects and acoustic assessment. For terrestrial receptors, only acoustic assessment is applicable.			

4.1.1 Non-radiological Impacts on Members of the Public

In the 2016 ERA, arsenic and uranium were identified for further evaluation in the Tier 2b assessment. Uranium was ultimately determined to not be a concern in a Tier 2c evaluation. As mentioned above in the selection of COPC, comparison of the maximum measured uranium concentration from all depths in off-site soil between 2015 and 2020 (15 µg/g) to the screening criteria of 33 µg/g would not have identified uranium as a COPC for quantitative evaluation in the human health assessment (CanNorth, 2021a). The Tier 2c evaluation for arsenic considered background exposures to assess arsenic exposure on an incremental basis. The evaluation of incremental exposure to arsenic should have been completed initially since cancer risk levels are assessed on an incremental basis. In addition, fish exposures derived using transfer factors were the driver of arsenic risk and exposure and there is high uncertainty in this approach (CanNorth, 2021a). Although the conclusions of the assessment remain unchanged, this was a convoluted approach for the assessment and was unnecessarily complicated. For the HQ calculations, the comparison to background exposure would have demonstrated that there was very little increased exposure associated with the PHCF (CanNorth, 2021a).

Based on this review, conclusions of the 2016 ERA are overly conservative.

4.1.2 Non-Radiological Impacts on Terrestrial Biota

In the 2016 ERA a potential for adverse effects from fluoride and PHCs were identified in a limited area (off-site grass strip along the harbour wall). The 2016 assessment recommends to address the contamination in the grass patch along the Harbour walls in coordination with Cameco's Vision In Motion (VIM) and the Port Hope Area Initiative (PHAI) due to exposure to earthworms.

The ERA review identified that as these grass patch areas are not suitable habitat for the ecological receptors and in this case, the area should not have been considered in the exposure assumptions for the assessment (CanNorth, 2021a). This area is planned for remediation under the PHAI and VIM projects and will be included in a Record of Site Condition completed under Ontario Regulation 153/04 once the remediation is complete.

4.1.3 Physical Stressor Impacts on Aquatic Biota

In the 2016 ERA, physical stressors in the aquatic environment were discussed related to the operation of the harbour cooling water system, including the potential impacts to the aquatic environment due to physical stressors, such as impingement and entrainment, and the potential for thermal effects from the cooling water discharge.

During the ERA review period, the PHCF made a business decision to move from a harbour cooling water system to a closed loop cooling system. At the time of the report, the UO_2 plant was using the closed loop system and activities were in progress to transition the UF_6 plant to closed loop in 2023. This change will eliminate the physical stressors on the aquatic environment.

4.2 Follow-Up to Issues raised in Regulatory Review of the 2016 ERA

CNSC staff raised a number of areas for follow-up with the 2016 ERA which is summarized in this section. There were 25 comments raised in the original ERA submission. For this section they are grouped as:

- Addressed in March 2016 ERA
- Addressed in other sections of the ERA review

4.2.1 Comments Addressed in March 2016 ERA

The following topics were addressed in the March 2016 ERA and accompanying disposition of comments (ARCADIS, 2016b) and are not discussed further in this review.

- Evaluation of uncertainties applicable to both HHRA and EcoRA
- Description of QA/QC activities performed
- Additional information regarding the source(s) of soil data
- Additional information regarding the source(s) of surface water data
- Additional information regarding storage loadings for gamma and neutron dose
- Additional discussion regarding ocular exposure
- Additional information regarding exposure factors, dose coefficients and transfer factors

selected and information sources
- Inclusion of sample calculations
- Information regarding physical stressors on the aquatic environment

4.2.2 Comments Addressed other Sections of the ERA Review

The description of meteorological and climate setting for the PHCF was incomplete and additional information was included in sections 2.3.4 and 3.2.1 of the ERA review.

Additional detail of the internal groundwater monitoring data was provided in sections 3.3.3 and 3.3.4 of the ERA review.

Additional information regarding the environmental monitoring program and air quality monitoring was provided in sections 3.2.1 and 3.3.1 of the ERA review.

Additional information regarding groundwater and stormwater loadings was provided in section 3.3.4 of the ERA review.

Information on COPC screening is provided in section 3.3 and conservatism in problem formulation in section 4.3.1.

A discussion of problem formulation and issues with the conservative approach is included in section 6.0.

A discussion of changes to the physical stressors in the aquatic environment is included in section 4.1.3

A discussion on air dispersion modelling is included in section 3.2.1 of the ERA review.

4.3 Review of 2016 ERA Compliance with N288.6-12

As part of the review of the ERA, an independent accounting of the 2016 ERA compliance with N288.6-12 (CanNorth, 2021a) was completed. There were technical deficiencies identified, including in the problem formulation for human and ecological receptors.

4.3.1 Levels of Conservatism in Problem Formulation

The 2016 assessment incorporated Tier 1 and Tier 2 assessments, which builds on the database of environmental and operations data, while also, to the extent possible and where appropriate, maintaining consistency with past assessments. Since it was built on current assessments it was not necessary to use the extremely conservative assumptions that necessitated a Tier 1 and Tier 2 assessment. In addition, the exposure point concentrations and the doses calculated for the HHRA were extremely conservative values of potential exposures (CanNorth, 2021a). Reasonable exposure scenarios is also discussed in the Problem Formulation Update for Exposure Assumptions (Section 6.2).

Simplification of the problem statements and the screening assessments can help with communication of this information to interested members of the public.

5.0 Review of Changes to Scientific and Regulatory Information

The review process considered the potential for changes to scientific and regulatory information.

5.1 Scientific Advances

Screening criteria used in risk assessment are selected from appropriate standards and guidelines published by federal and/or provincial government agencies. These standards and guidelines are established on the basis of review of scientific literature and other sources of information regarding health or environmental impacts from exposure to a contaminant. Standards and guidelines are periodically reviewed to incorporate new information. As the 2020 Review of the ERA utilized the current standards and guidelines in the COPC screening, relevant advances in scientific information was included in the review.

Under O. Reg. 419/05, PHCF is required to use AERMOD to demonstrate compliance with the provincial regulatory requirements. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. The model code and supporting documents are regularly updated to incorporate the best available science.

5.2 Regulatory Requirements

There have been no significant changes to environmental legislation applicable to PHCF operations since the 2016 ERA. There were no changes to the site-specific provincial Environmental Compliance Approval (ECA) for air emissions. There were several changes to the site-specific ECA for industrial sewage works to reflect the upgrades to stormwater infrastructure, and transition from harbour water cooling to closed loop cooling that were in progress during the review period.

6.0 Problem Formulation Updates

6.1 Conceptual Site Model

From a human health perspective, the 2016 ERA provided a conceptual site model for off-site members of the public. The off-site members of the public included 11 off-site receptors which encompassed a nearby resident, recreational fisherperson, recreational boater, recreational park user, fenceline walker, and a commercial worker. Reducing the number of receptors which represent the maximum potential exposure should be considered in future ERA to simplify the analysis and (CanNorth, 2021a). Various exposure pathways were also discussed including, direct soil exposure, consumption of backyard produce, consumption of local fish, incidental exposure to surface water, inhalation, and gamma exposure. These are typical receptors and exposure pathways considered within an ERA (CanNorth, 2021a).

The ecological CSM considered a wide range of receptors including fish, benthic invertebrates, aquatic and terrestrial plants, terrestrial invertebrates, aquatic and terrestrial birds, and terrestrial mammals. These are typical ecological receptors and the pathways presented are also typical to an ERA. A number of the receptors were evaluated both on-site and off-site. Off-site amphibians and aquatic mammals should be considered for subsequent ERA (CanNorth, 2021a).

The HHRA and EcoRA both used a tiered approach, where all relevant receptor-COPC combinations were assessed at a Tier 1 screening level. Exceedances identified at the Tier 1 level were carried into a Tier 2 assessment comprising more realistic assumptions. The tiered approach used in the 2016 ERA led to an overly complicated assessment, with no benefit or change to the ultimate conclusions (CanNorth, 2021a).

The current review recognizes that during the ongoing execution of the VIM project, the site is under a constant state of improvements, all of which are expected to positively impact the environmental interactions of the site. At the conclusion of the VIM project, a comprehensive environmental risk assessment will be completed to reflect the changes to the site and operations and evaluate the updated operating conditions in an HHRA and EcoRA. The purpose of this review was to determine whether there were any potential gaps which would significantly alter the conclusions and require addressing in the interim.

There is an opportunity for PHCF to simplify the screening and problem formulation in the new risk assessment to focus on the contaminants and pathways that were identified as being of concern in the previous risk assessments.

6.2 Exposure Assumptions

The 2016 ERA is an update of the 2009 ERA and should represent a detailed quantitative risk assessment (DQRA) where reasonable and not consider the highly conservative implausible estimates of exposure that were used. It is very important at the Problem Formulation Stage to set up the foundation for the risk assessment and to ensure that reasonable exposure scenarios are being evaluated (CanNorth, 2021a).
Areas where less conservatism should be used in the post-VIM ERA include:

- Screening out COPC not associated with site operations
- Screening using representative concentrations for COPC
- not maximum concentrations
- appropriate for exposure pathway
- incremental above background exposure
- Realistic exposure scenarios for receptor age groups
- Assessment of habitat suitability for ecological receptors

6.3 Receptor Selection and Characterization

6.3.1 Aquatic Receptors

The 2016 ERA identified fish, benthic invertebrates, and aquatic vegetation as the major biota groups

(Table 6.1, ARCADIS 2016a). Amphibians were considered for inclusion, but not identified in the receptor selection. Additional discussion is provided in the TRV evaluation.

6.3.2 Terrestrial Receptors

The 2016 ERA selected ecological receptors based on SENES (2009a; 2009b) studies. According to ARCADIS (2016a), indicator species were selected based on knowledge of the site and surrounding environment, relevant environmental studies, accessibility of the environmental media, and potential species present in the area. Selected indicator species were representative of aquatic birds (scaup, horned grebe), terrestrial birds (warbler, robin, owl, cormorant, swallow), terrestrial mammals (fox, rabbit, vole, mouse), and terrestrial invertebrates and vegetation. Species representative of aquatic mammals (such as beaver, muskrat) were not identified for the assessment, although they were considered for inclusion (CanNorth, 2021a).

The 2016 ERA also considered species at risk in the selection of indicator species for the assessment. Eight bird species were identified as potentially relevant for the site and of those, the horned grebe was selected for the assessment. Table 6.2 of the 2016 ERA demonstrates that the remaining bird species are represented by other selected ecological receptors. In addition, one plant species was identified as vulnerable and is represented in the assessment by the terrestrial vegetation receptor (ARCADIS 2016a). In terms of the risk assessment, SAR species are evaluated at the individual level (CSA 2012, Clause 7.2.4.3), and this evaluation influences the selection of TRVs, which is discussed in the TRV Section below (CanNorth, 2021a).

6.3.3 Human Receptors

As mentioned above, the 2016 ERA selected off-site members of the public (residents, recreational fisherperson, recreational boater, recreational park user, fenceline walker, and a commercial worker). The assessment also considered combined resident and other user (i.e., worker, fenceline walker, park user, fisherperson, boater) receptors. The consideration of Nuclear Energy Workers (NEWs) is beyond the scope of the assessment, consistent with CSA N288.6-12 (Table 5.6 of 2016 ERA). Cameco defines all employees, maintenance workers, and contractors who conduct work outside of an office area as NEWs and they are treated accordingly following health and safety protocols (ARCADIS 2016a).

The 2016 ERA considered the presence of First Nations groups in the development of the receptor characteristics for the assessment and determined that no groups were present in the study area (ARCADIS 2016a, Table 5.6). The 2016 ERA established exposure factors for the HHRA based on the values from Health Canada[2] (2012, as recommended by CSA 2012). During the review period, Cameco has expanded its Indigenous engagement with local First Nations and now understands that land around the PHCF is included in the traditional hunting/gathering territory for the Williams Treaties First Nations. Future collaboration with the First Nations is expected to result in relevant dietary consumption information for inclusion in future ERAs.

Eleven human receptors were identified for evaluation in the assessment; this led to an overly complicated evaluation. Representative receptors in each group (residents, recreational fisherperson, recreational boater, recreational park user, fenceline walker, and a commercial worker) who are maximally exposed should have been evaluated to simplify the findings.

6.4 Pathways

The 2016 ERA ultimately did not assess any potential exposures to human receptors from on-site soil or groundwater, such as those that might occur for a sub-surface worker or groundwater sampler. The rationale for not considering exposures to on-site workers, like a sub-surface worker, was that all workers at the PHCF are NEW and therefore not appropriate for consideration in the assessment as per CSA N288.6-12 (2012).

The assessment considered exposure to off-site soil, swimming or falling into the water and consumption of fish from the harbour. These were appropriate pathways to evaluate (CanNorth, 2021a).

6.5 TRVs

The 2016 ERA used the methodologies of the time as well as the toxicity reference values (TRVs). This review examines the TRVs and determines whether any values have been changed since the 2016 ERA and indicates the impact of these changes. For the radiological assessment, the selected dose coefficients and dose limits in the 2016 ERA were based on CSA N288.6-12 (2012).

6.5.1 Aquatic Receptors

From an aquatic environment perspective, individual TRVs for benthic invertebrates, aquatic plants, and fish were used. Cameco is now using a Species Sensitivity Distribution (SSD) approach, which considers the aquatic environment as a holistic community. This approach is used

[2] ARCADIS (2016a) referenced the 2010 version of the Health Canada PQRA guidance and CSA (2012) specifies the 2004 Part I guidance; this was updated in 2012.

by the CCME for the setting of water quality guidelines and is currently the approach used by many in the risk assessment community to evaluate risks in the aquatic environment. Based on the SSD approach, potential effects on aquatic receptors are evaluated on a community basis rather than individual receptor types.

As an example, Figure 6 provides the arsenic SSD with the 2016 ERA TRVs (ARCADIS 2016a, Table 6.29) indicated in relation to the SSD curve. As seen from the curve, more sensitive toxicity data are available for aquatic plants and invertebrates than those considered in the 2016 ERA, although the TRVs considered for fish are more sensitive than values considered in the arsenic SSD. The highest SI value for arsenic calculated in the 2016 ERA for aquatic receptors was 0.02 (ARCADIS 2016a, Table 6.48) using a maximum measured concentration of 2.7 µg/L (ARCADIS 2016a, Table 6.12); with consideration of the maximum measured surface water for arsenic in the 2015-2018 dataset (8.8 µg/L, **Table 1718**) it is unlikely that there would be any changes to the results of the assessment (CanNorth, 2021b).

No amphibians were identified for the assessment. Since there is a lack of toxicity data for amphibians, they are typically assessed as fish. Therefore, consideration of amphibians in the assessment is not expected to change the conclusions of the 2016 ERA. It happens that toxicity data for an amphibian species (*Rana pipiens*) is available for arsenic (Figure 6); the value is similar to the TRV for fish (pelagic) considered in the 2016 ERA. The 2016 ERA calculated a SI of 0.004 for arsenic and fish (pelagic) (ARCADIS 2016a, Table 6.48) using a maximum measured concentration of 2.7 µg/L (ARCADIS 2016a, Table 6.12). With the maximum measured surface water for arsenic in the 2015-2018 dataset (8.8 µg/L, **Table 1718**), the SI for fish (pelagic) would remain well below 1 and therefore, negative effects on amphibians would not be expected (CanNorth, 2021b).

Figure 6 Arsenic species sensitivity distribution

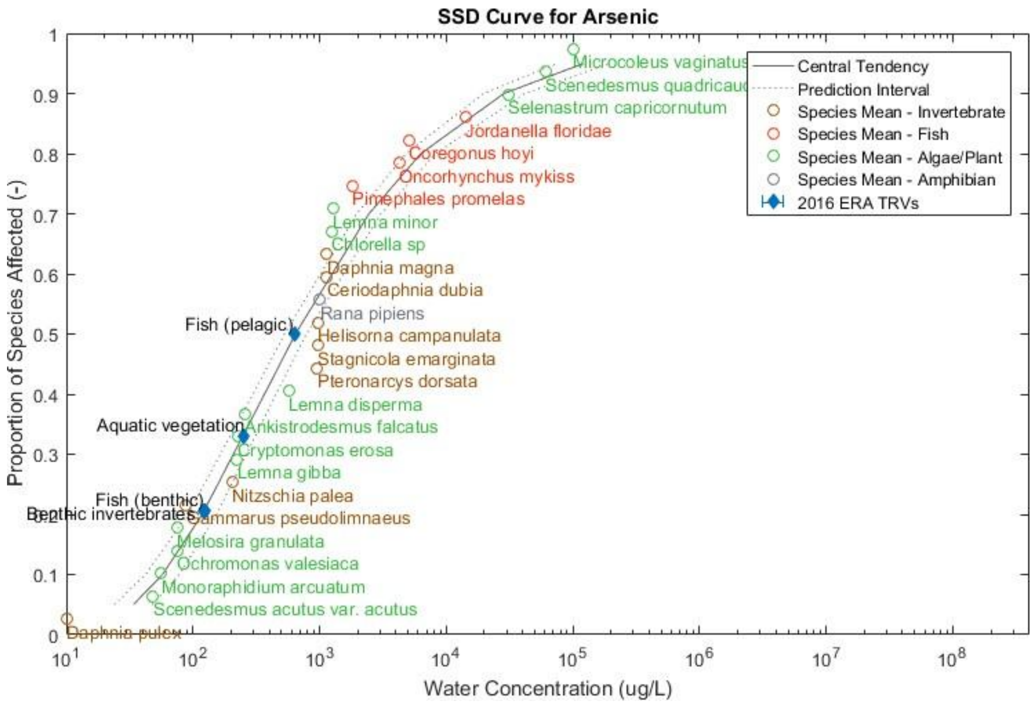
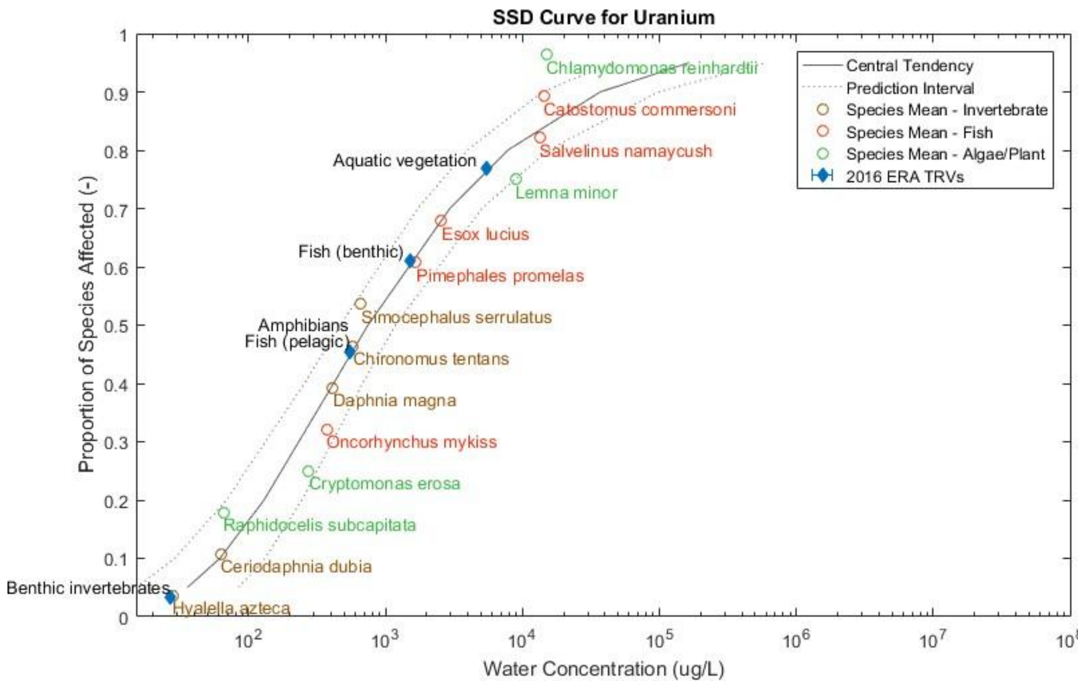


Figure 7 provides the uranium SSD with the 2016 ERA TRVs (ARCADIS 2016a, Table 6.20) indicated in relation to the SSD curve. The use of the SSD approach for uranium incorporates all available toxicity data, provided these data pass quality control and applicability criteria. For uranium specifically, the SSD curve (Figure 6) is based on CCME (2011 Table 11), with additional data from U.S. EPA ECOTOX and a literature review including Goulet et al.(2015). As seen from the curve, a number of the TRVs used in the 2016 ERA are on the curve and thus it is unlikely that the conclusions of the aquatic assessment would change (CanNorth, 2021b).

Figure 7 Uranium species sensitivity distribution



The 2016 ERA did not identify any aquatic receptor SAR in the assessment. Per CSA N288.6-12 (2012, Clause 7.2.4.3), the assessment of SAR influences the selection of TRVs. The use of the SSD curve can assist in the evaluation of potential aquatic SAR species for non-radiological effects. For radiological dose, there are no available dose limits for the assessment of aquatic SAR species. However, from the results presented in the 2016 ERA (ARCADIS 2016a, Table 6.32), the SI values calculated using a dose limit of 9.6 mGy/d are very low (<0.1), which indicates that there is a wide margin of safety for the protection of individual aquatic receptors, including amphibians, fish, and aquatic plants and thus SAR species would not experience adverse effects (CanNorth, 2021a).

6.5.2 Terrestrial Receptors

The TRVs for mammals and birds in the 2016 ERA were primarily obtained from the U.S. EPA ecological soil screening levels (Eco-SSLs) (U.S. EPA 2005) and from Sample et al. (1996). A similar approach was used for more recent ERAs for Cameco in Northern Saskatchewan, with an updated approach for surrogate selection. The approach for the selection of TRVs in the 2016 ERA is considered to be valid (CanNorth, 2021a).

The 2016 ERA considered the horned grebe and lesser scaup as surrogates for other SAR species in the assessment. Per CSA N288.6-12 (2012, Clause 7.2.4.3), the assessment of SAR influences the selection of TRVs. The 2016 ERA appropriately considered NOAEL TRVs (ARCADIS 2016a, Table 6.28) for the assessment of SAR to evaluate protection at an individual level. For radiological dose, a dose threshold value of 1 mGy/d can be used to assess species at risk as IAEA (1992) determined this was the dose rate with no observable effects to biota. The radiological assessment for terrestrial receptors in the 2016 ERA (ARCADIS 2016a, Table 6.30) used a dose limit of 2.4 mGy/d for all terrestrial animals. However, the calculated doses for the horned grebe and lesser scaup (ARCADIS 2016a, Table 6.32) were erroneously compared to a dose limit of 9.6 mGy/d. The horned grebe at the harbour had the highest calculated total dose of 0.098 mGy/d. This dose remains below the dose limit considered for no observable effects to biota (i.e., 1 mGy/d) and therefore the conclusions of the assessment remain unchanged.

6.5.3 Human Receptors

The TRVs specified for the HHRA in the 2016 ERA (ARCADIS 2016a, Table 5.17) are from typical sources, consistent with N288.6-12 (CanNorth, 2021a)

7.0 Conclusion

The 2016 ERA was generally conducted using the framework outlined in N288.6-12 and using the available toxicity information at that time (CanNorth, 2021a). There are a few issues that have been noted:

- Use of extremely conservative measures of exposure (maximum concentrations and 95%tile concentrations) instead of the more reasonable and acceptable exposure of a 95%UCLM.
- Evaluation of a wide range of COPC that were part of the Earth's crust or not associated with PHCF operations.
- Assessment for arsenic risk should have been completed only on incremental exposures to humans
- Complicated problem formulation, screening and tiered approach to the assessment
- Incorrect application of radiation benchmarks in the ecological assessment.

Since the completion of the 2016 ERA, additional monitoring has been completed resulting in decreases in some concentrations of COPCs in monitoring data. In addition, the approach to the evaluation of aquatic receptors has evolved and some toxicity values have changed. The changes in monitoring data and changes in toxicity values and approaches to evaluation of aquatic receptors do not result in changes to the 2016 ERA conclusions.

Physical changes underway at the site as part of ongoing operations and the VIM project will eliminate potential risks identified in the 2016 ERA. This includes the elimination of physical stressors on the aquatic environment through the transition to a closed loop cooling system and remediation of subsurface infrastructure and contamination to improve capture and control of legacy contamination. These changes have improved environmental performance and reduced the overall impact of PHCF operations on the environment. Once completed, these activities are expected to eliminate the potential risks identified in the 2016 ERA.

7.1 Recommendations

This review of the ERA was completed by Cameco subject matter experts with support from third- party experts in the areas of risk assessment and environmental modelling.

Based on this review completed in accordance with Clause 11.1 of N288.6-12, there are no identified risks that have emerged since the last ERA review. In fact, the review identified that several potential risks are becoming less significant. The changes under the VIM project will require a full update of the ERA to establish a new baseline of environmental performance on which to revise the site Environmental Protection Program. It is important that this full update be undertaken once the site remediation and harbour remediation are largely complete and there are no remaining activities such as building demolition or soil excavation which could skew the operational monitoring data required for the ERA update. It is anticipated that this will occur early in the next licence period.

It is recommended that an ERA review be carried out in support of the licence renewal in 2027, with specific consideration to site changes 2023-2025 and the full ERA update be completed within 2 years of the completion of VIM and PHAI remedial activities in the vicinity of the PHCF.

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CanNorth

Canada North Environmental Services Limited Partnership
A First Nation Environmental Services Company

Revalidation of the Environmental Risk Assessment for Port Hope Conversion Facility

Final Report Rev. 2

April 2026

Project # 4691-1

Prepared for:
Cameco Corporation
Prepared by:
Canada North Environmental Services

LIST OF ACRONYMS

COPC	Constituents of Potential Concern
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CORMIX	Cornell Mixing Zone Expert System
EcoRA	Ecological Risk Assessment
EPP	Environmental Protection Program
EPC	Exposure Point Concentration
ERA	Environmental Risk Assessment
HHRA	Human Health Risk Assessment
IEMP	Independent Environmental Monitoring Program
LEL	Lower Exposure Limit
LTWMF	Long-Term Waste Management Facility
MECP	Ontario Ministry of Environment, Conservation and Parks
MPH	Municipality of Port Hope
PHAI	Port Hope Area Initiative
PHCF	Port Hope Conversion Facility
PWQO	Provincial Water Quality Objectives
STP	Sewage Treatment Plant
VIM	Vision in Motion

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1.0 INTRODUCTION

In accordance with its licence requirements, the Port Hope Conversion Facility (PHCF) maintains an environmental risk assessment (ERA) in accordance with the standardized requirements of CSA N288.6-22: Environment Risk Assessments at Class 1 Nuclear Facilities and Uranium Mines and Mills (CSA 2022). The ERA is a scientific process that identifies and assesses the potential risk posed by contaminants and physical stressors in the environment on human and ecological receptors. The ERA consists of a human health risk assessment (HHRA) and an ecological risk assessment (EcoRA).

In March 2016, an ERA was completed for the PHCF (ARCADIS 2016a). The results determined that there were negligible risks to human health and the environment from exposure to contaminants associated with activities from the PHCF. A summary of the ERA and a redacted version of the ERA are available on the Cameco community website[1]. This ERA is referenced in the Licence Condition Handbook for the facility and is considered to represent a conservative bounding scenario for the PHCF as it assesses the environmental risk associated with the PHCF prior to the initiation of the Vision in Motion (VIM) project. The VIM project underwent an Environmental Assessment and was authorized by the Canadian Nuclear Safety Commission (CNSC) as part of the PHCF licence renewal in 2017. The VIM project is an environmental clean- up, modernization and site-renewal initiative. Activities related to VIM started in 2018.

Under Clause 11 of N288.6-22 Cameco is required to review the ERA for the PHCF every five years. A review was submitted to CNSC in June 2024 based on additional monitoring carried out between 2015 and 2022, which incorporated VIM activities. The findings of the review were that concentrations of contaminants had decreased over time and even though there has been changes in toxicity and methodologies over the review period, the conclusions of the 2016 ERA remain unchanged.

This review uses data from 2023 and 2024 to validate the results of the June 2024 review and determine whether the results of the 2016 ERA remain unchanged.

1.1 Scope of the Revalidation

The scope of the present revalidation is to:

- Identify any changes to the Site ecology or surrounding land use since 2022.
- Identify any changes to the PHCF or to processes at the PHCF that have the potential to change emissions and the resulting risks to receptors.
- Summarize monitoring data collected between 2023 and 2024 and determine the outcomes with respect to the results of the 2016 ERA.
- Determine whether there were changes in regulatory requirements which affect the outcomes of the 2016 ERA.

Under the current operating licence, operations of the PHCF include the VIM project which represents Cameco's plan to clean up and renew the PHCF. The current revalidation recognizes that during the ongoing execution of the VIM project, changes and improvements are continually being made at the Site. These improvements are expected to result in lower emissions to the environment and thus reduce risks associated with PHCF. This revalidation discusses improvements that occurred in 2023 and 2024 at the PHCF. As agreed by CNSC staff (M. Jones to L. Sayeau), once the VIM project is complete, a new ERA will be completed in accordance with N288.6-22 and submitted to the CNSC for review and acceptance. The Environmental Protection Program will in turn be revised in accordance with the new ERA.

1.2 Available Data and Information Sources

The following facility data and information were used in the current revalidation of the ERA:

1. Environmental monitoring data for 2023 and 2024
2. 2024 ERA Review
3. 2016 ERA
4. 2025 Derived Release Limits (DRL) Report
5. 2016 DRL Report
6. Annual compliance reports for 2023 and 2024
7. Annual groundwater and surface water report for 2024
8. CNSC IEMP results for Port Hope
9. Applicable provincial and federal guidelines for environmental protection

1.3 Scope of the Revalidation

This report is structured as follows:

Section 2 discusses Site changes that have occurred in 2023 and 2024 and other potential changes to the surrounding environment.

Section 3 provides a summary of the environmental data from 2023 and 2024 and provides a comparison to previously measured data. The IEMP conducted by CNSC is also discussed in this Section.

Section 4 discusses any changes to regulations that occurred in 2023 and 2024 that would impact the conclusions of the 2016 ERA.

Section 5 provides a summary of the revalidation.

[1] https://www.camecofuel.com/media/media-library

2.0 REVIEW OF SITE CHARACTERIZATION

This section provides a description of the review completed to identify changes that have occurred to site ecology or surrounding land use, changes to the physical facility or facility processes that have the potential to change the nature of the facility effluent(s) and the releases to the environment.

2.1 Site Ecology and Surrounding Land Use

As described in Cameco's 2024 ERA Review (Cameco 2024a) and 2025 DRL (CanNorth and IEC 2025). Cameco owns and/or leases 9.6 hectares on which the secured area of the PHCF is situated. Since the 2016 ERA, Cameco permanently terminated its licensed activities on the Centre Pier property, which involved the transfer of stored wastes to the Long-Term Waste Management Facility (LTWMF) in Port Hope, demolition of the Centre Pier buildings and transfer of the demolition debris to the LTWMF. The care and control of the property was transferred to Canadian Nuclear Laboratories (CNL) in July 2019.

In the immediate area of the PHCF, CNL has isolated access to the Port Hope harbour. The Centre Pier has been used as a staging area for CNL's ongoing harbour remediation work and associated harbour wall upgrades.

In the surrounding area, the Port Hope Area Initiative (PHAI) has continued the clean-up of low- level radioactive waste within the Municipality of Port Hope (MPH), including remediation of the former waterworks properties and West Beach to the west of the facility, residential properties and a former industrial site to the north of the facility, the viaducts northeast of the facility, and the Centre Pier east of the facility. The PHCF is located in a general employment zoned area with floodplain overlay zoning along the east property boundary.

2.2 Changes to the Physical Facility and Facility Processes

2.2.1 Soil Monitoring

As of 2023, location 2 (background monitoring location) for the soil monitoring program was no longer sampled as it had been impacted by the CNL remediation work zone established at the West Beach to the west of the municipal water treatment facility (Cameco 2024b). Therefore, in 2023 and 2024, there were only two soil monitoring locations beyond the facility fence line, with one of the locations within a 0 to 500 m radius zone from the facility and the other location within the 1000 to 1500 m radius zone. Following the completion of the PHAI project, Cameco will modify the soil monitoring program locations as appropriate, including consideration of CNL clean fill placements.

2.2.2 Cooling Water

The uranium dioxide (UO_2) plant transitioned to a closed loop cooling system in 2022. The production facility cooling water return last operated on July 27, 2022, and is permanently inactive.

The uranium hexafluoride (UF_6) plant subsequently transitioned to a closed loop cooling system in 2023. The production facility cooling water return, which included a municipal water component, last operated on July 13, 2023, and is permanently inactive. In relation, the former harbour water intake and pumphouse facilities have since been decommissioned. The uranium concentrations measured in the harbour water intake and UF_6 plant cooling water return during the January to July 2023 time period were elevated (i.e., above typical background) in relation to the CNL inner harbour remedial works (Cameco 2024b). Since the elevated uranium concentrations in cooling water measured during the 2023 monitoring period (January to July) are due to the remedial work and not typical of the facility, these results are not included in this revalidation.

2.3 Releases to the Environment

As described in Cameco's 2024 ERA Review (Cameco 2024a), the primary air emissions associated with the PHCF are uranium, fluorides, and ammonia. These contaminant emissions are measured using source monitoring and/or estimated using available monitoring data. The main process stacks in the UF_6 plant and UO_2 plant are continuously sampled during operations. In the UF_6 main stack, fluoride and uranium emissions are monitored and in the UO_2 main stack, ammonia and uranium emissions are monitored. All other stacks and discharge points are sampled on an occasional or as requested basis.

The municipal sewage treatment plant processes the sanitary sewer discharges from the PHCF. Daily composite samples are collected from the combined sanitary sewer discharge for uranium and pH analysis. The facility discharge primarily consists of grey water and blackwater sources, Powerhouse effluent (i.e. boiler blowdown, softener regeneration effluent) and condensates, among other items. Production facility process effluent, laboratory effluent, laundry effluent, groundwater recovery system water takings other effluent streams are directed to the site wastewater treatments facilities for treatment.

3.0 REVIEW OF ENVIRONMENTAL MONITORING DATA

This section provides a description of the review of the environmental monitoring data collected in 2023 and 2024 at the PHCF as well as off-site data collected by the CNSC.

3.1 Overview of Available Data

The Environmental Protection Program (EPP) for PHCF describes the effluent and environmental monitoring programs. The following discharge data and environmental monitoring data are obtained from the documentation associated with this program.

3.1.1 Air Quality Data

Uranium emissions from the UF_6 main stack are sampled nearly continuously during operations using a TSI sampler and analyzed in the site laboratory. Fluoride emissions are continuously monitored by three stack monitors on the main stack of the UF_6 plant. The monitors continuously withdraw a sample of gas from the main stack and then measure the fluoride concentration in the impingement solution.

Uranium and ammonia emissions from the UO_2 main stack are sampled nearly continuously through a filter and impingement train and analyzed in the site laboratory.

During depleted uranium dioxide production runs, NO_x and ammonia emissions are monitored using a continuous emission monitor. Third-party stack sampling has also been used during depleted production runs. There were no depleted uranium dioxide activities in 2023 or 2024.

Monitoring data from the process stacks is summarized in the quarterly and annual compliance monitoring and operational performance reports which are available on the Cameco community website[2]. This air quality data is provided in Table 3-1.

Table 3-1 Comparison of 2016 ERA air quality data with 2015 – 2024 data

Constituent	Unit	Action Level	Regulatory Limit	2016 ERA		2015 - 2022				2023[a]		2024[b]	
				2014 Avg	2014 Max	7-Year Avg	Range of Annual Averages		7-Year Max	Avg	Max	Avg	Max
							Min	Max					
UF_6 Main Stack - Uranium	g/h	40 g/h	280 g/h	1.2	6.3	1.9	1.1	2.7	44.7	2.4	10.7	2.2	9.3
UF_6 Main Stack - Fluoride	g/h	230 g/h	650 g/h	13	99	21.6	10	30	273	12	197	15	226
UO_2 Main Stack - Uranium	g/h	10 g/h	240 g/h	1.2	3.9	0.7	0.5	1.2	5.2	0.8	2.9	0.6	1.7
UO_2 Main Stack - Ammonia	kg/h	10 kg/h	58 kg/h	2.2	5.4	2.0	1.4	2.4	7.7	2.0	4.6	1.9	3.7

Note : [a] - Cameco (Cameco 2024b).
[b] - Cameco (2025).

[2] www.camecofuel.com/library/media-library

The 2023 and 2024 air quality data provided in Table 3-1 shows that all emissions were below the regulatory limits, corresponding action levels and is similar to that used in the 2016 ERA. The average uranium concentration from the UF_6 main stack is higher in 2023 and 2024 than the average uranium concentration used in the 2016 ERA; however, both of these average concentrations are within the range of annual averages from 2015 to 2022 that were used in the updated air quality modelling (Cameco 2024b). Therefore, the 2023 and 2024 air quality data are consistent with the conclusions of the 2024 ERA Review.

3.1.2 Water Quality Data

Waterborne effluents from the PHCF currently consist of the discharge to the sanitary sewer system. However, previously the PHCF also had waterborne effluent discharges associated with the facility once-through cooling water system operations (refer to Section 2.2). Monitoring data from the waterborne discharges is summarized in the quarterly and annual compliance monitoring and operational performance reports which are available on the Cameco community website[3].

The 2016 ERA evaluated only the discharges to the Port Hope Harbour associated with the production facility cooling water returns. A comparison of this water quality data is provided in Table 3-2. As the discharges to the sanitary sewer system were not included in the 2016 ERA, the data from the relevant period (2014 to 2024) has been summarized in Table 3-3.

[3] www.camecofuel.com/library/media-library

Table 3-2 Comparison of 2016 ERA water quality data with 2015 – 2024 data

Sampling Location	Constituent	Unit	2016 ERA		2015 - 2022				2023[a]		2024[b]	
			2014 Avg	2014 Max	5-Year Avg	Range of Annual Averages		5-Year Max	Avg	Max	Avg	Max
						Min	Max					
UF_6 Plant Cooling Water Return	Uranium	mg/L	0.003	0.007	0.025	0.025	0.11	0.52	-[c]	-[c]	-[e]	-[e]
	Fluoride	mg/L	0.13	4.3	0.13	0.07	0.19	0.76	-[c]	-[c]	-[e]	-[e]
	Ammonia	mg/L as N	0.13	0.34	0.09	0.02	0.16	0.84	-[c]	-[c]	-[e]	-[e]
	Nitrate	mg/L as N	0.80	1.4	0.90	0.78	1.0	2.2	-[c]	-[c]	-[e]	-[e]
	TSS	mg/L	14	91	15	8.2	20	150	-[c]	-[c]	-[e]	-[e]
	Arsenic	µg/L	1.2	2.0	7.2	1.1	30	100	-[c]	-[c]	-[e]	-[e]
	Copper	µg/L	3.5	13	3.5	2.5	4.5	12	-[c]	-[c]	-[e]	-[e]
	Lead	µg/L	0.5	3.7	0.84	0.33	1.8	8.4	-[c]	-[c]	-[e]	-[e]
	Nickel	µg/L	2.8	6.0	2.5	1.5	4.0	20	-[c]	-[c]	-[e]	-[e]
	Zinc	µg/L	2.0	15	2.2	1.5	2.8	25	-[c]	-[c]	-[e]	-[e]
UO_2 Plant Cooling Water Return	Uranium	mg/L	0.003	0.008	0.02	0.0026	0.078	0.54	-[d]	-[d]	-[e]	-[e]
	Ammonia	mg/L as N	0.2	1.1	0.08	0.01	0.18	8.8	-[d]	-[d]	-[e]	-[e]
	Nitrate	mg/L as N	0.85	1.4	0.89	0.4	1.1	2.2	-[d]	-[d]	-[e]	-[e]
	TSS	mg/L	15	98	17	9.6	22	290	-[d]	-[d]	-[e]	-[e]

Note: [a] 2023 – Environmental Monthly Data.xls (provided by Cameco) from annual compliance report.
[b] 2024 – Environmental Monthly Data.xls (provided by Cameco) from annual compliance report.
[c] UF_6 plant cooling water return ceased operations in July 2023 and available data January -June not typical of the facility and excluded from assessment (see Section 2.2 for details)
[d] UO_2 plant cooling water return was not operational in 2023 (see Section 2.2 for details)
[e] - No data available since the full transition to closed loop cooling systems was completed in 2023 (see Section 2.2 for details).

Table 3-3 Comparison of routine sanitary sewer monitoring data from 2014-2024

Sampling Location	Constituent	Unit	2014[a]			2015 - 2022					2023[a]			2024[b]		
			Min	Avg	Max	Range of Annual Averages		8-Yr			Min	Avg	Max	Min	Avg	Max
						Min	Max	Min	Avg	Max						
Sanitary Sewer	Uranium	mg/L	0.0031	0.017	0.25	0.013	0.044	0.0014	0.039	3.0	0.0013	0.021	0.22	<DL[b]	0.0046	0.053
	pH	-	6.96	7.90	9.47	7.52	7.98	6.80	7.77	9.10	7.26	7.94	8.96	7.30	7.96	8.70

Note: [a] 2014 represents the dataset used in the 2016 ERA
[b] DL is detection limit of 0.0002 mg/L

The 2023 and 2024 discharges to the sanitary sewer are similar to those reported in both 2014 and 2015 to 2022. Similar to the 2024 ERA Review (Cameco 2024a), an assessment of the discharge to the sanitary sewer is completed and is provided in Section 3.2.2. As indicated in Section 2.2, the transition of production facilities to closed loop cooling systems took place between 2022 and 2023, so once-through cooling water return data was only available for the period January to July 2023. As reported by Cameco in their annual compliance reports, this data was influenced by the CNL's remedial work in the harbour and other factors and was therefore not included in this revalidation.

3.1.3 Other Environmental Monitoring Under the Environmental Protection Program

Under the PHCF's EPP various environmental media are monitored to assess the ambient environmental conditions in the vicinity of the PHCF. This monitoring may be used to further assess the potential impact of air and water emissions. Ambient air monitoring includes Hi-Vol (Section 3.3.4), dustfall (Section 3.3.4), lime candle (Section 3.3.4), soil (Section 3.3.3) and vegetation monitoring (Section 3.3.4). Ambient water monitoring includes storm water (Section 3.3.6), groundwater (Section 3.3.5), surface water (Section 3.3.7) and sediment sampling (Section 3.3.8).

Fenceline gamma is monitored in order to evaluate the potential dose to the public from licensed activities on the Site. Fenceline gamma measurement data were not included in this ERA review, as this was recently assessed in the 2025 Derived Release Limit report update (CanNorth and IEC 2025).

3.1.4 Off Site Environmental Monitoring Data – CNSC IEMP

CNSC conducts an independent environmental monitoring program (IEMP) for the PHCF. The results and conclusions of this IEMP are available online[4]. The 2024 IEMP sampling plan for the PHCF focused on hazardous substances and a site-specific sampling plan that was developed based on Cameco's approved environmental monitoring program and CNSC's regulatory experience with the Site.

The most recent IEMP was conducted in May 2024, and included the collection of air, water, soil and food samples in publicly accessible areas outside the perimeter of the PHCF. In addition to the 2024 IEMP, the CNSC has also conducted similar monitoring in 2014, 2015, 2017 and 2020. Therefore, monitoring data for all years available has been reviewed as part of this revalidation. The following data has been reviewed and analyzed:

- Uranium in air measurements (Figure 3-1),
- Uranium in soil measurements (Figure 3-2),
- Uranium in vegetation measurements (Figure 3-3),
- Uranium in food sample measurements (only 2024; Figure 3-3)
- Uranium in surface water measurements (Figure 3-4),
- Nitrate in surface water measurements (Figure 3-5),
- Fluoride in surface water measurements (Figure 3-6); and,
- Ammonia in surface water measurements (No Figure as only 1 measurement).

Figure 3-1 Uranium in air measurements

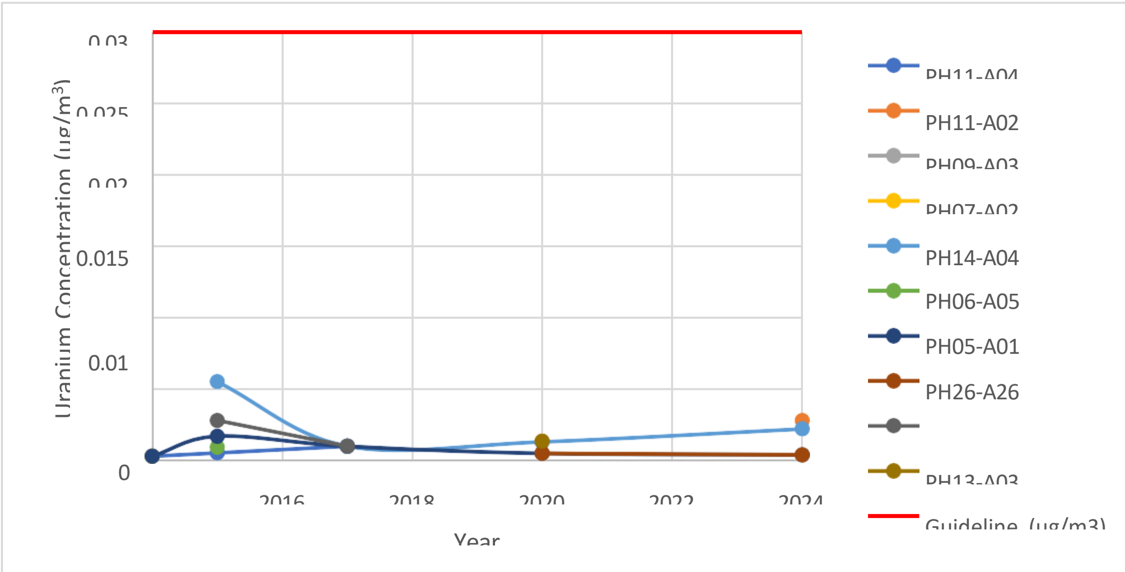


Figure 3-2 Uranium in soil (0 – 5 cm) measurements

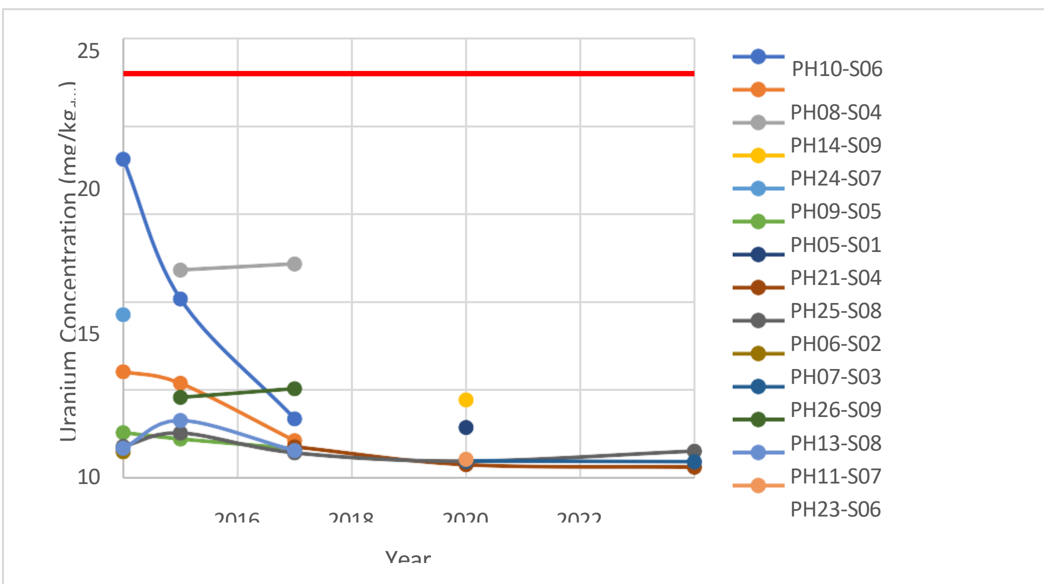
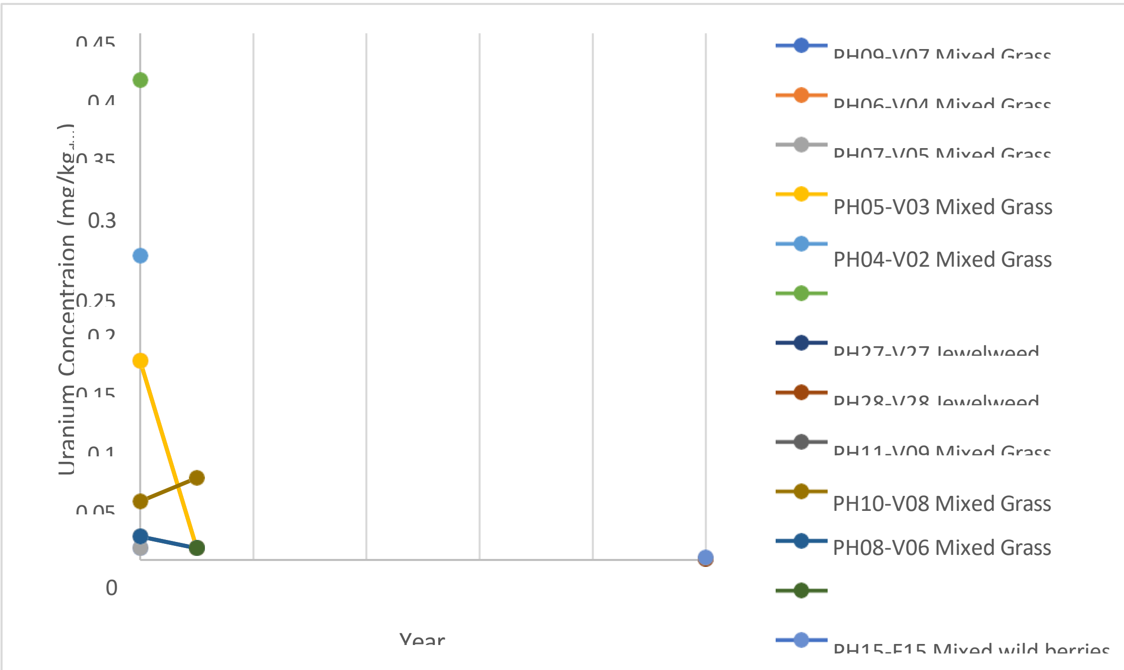


Figure 3-3 Uranium in vegetation measurements[1]



Note: [1]Jewelweed and mixed wild berries data (2024 only) are all reported at <0.01mg/kg$_{dw}$

Figure 3-4 Uranium in surface water measurements

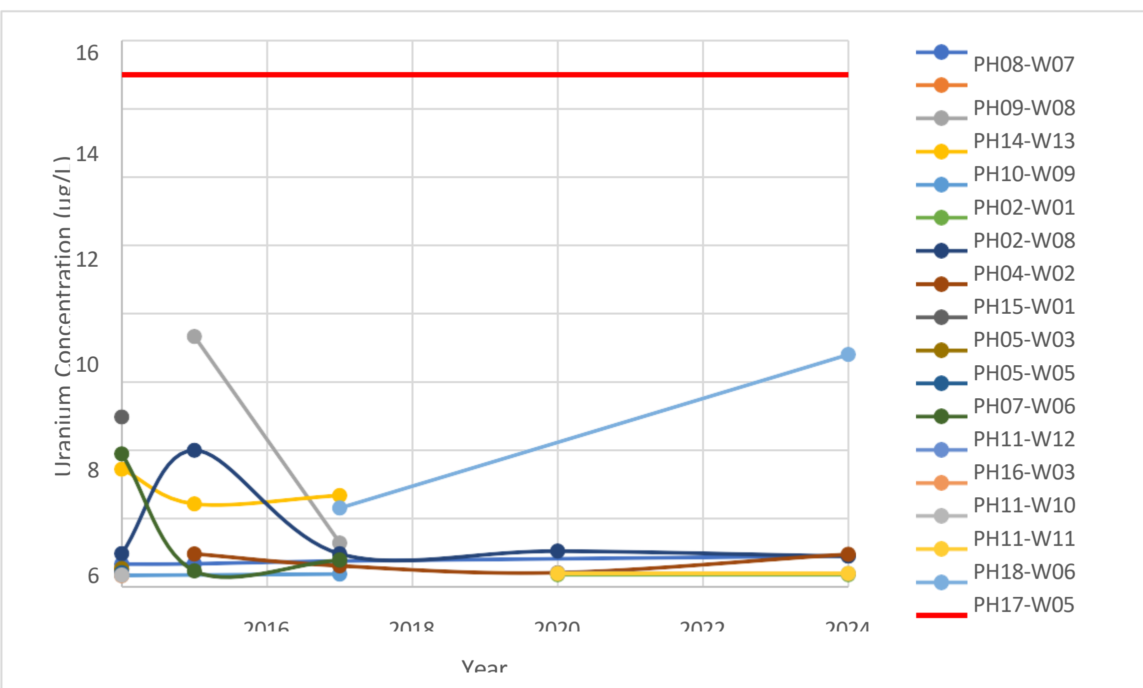


Figure 3-5 Nitrate in surface water measurements

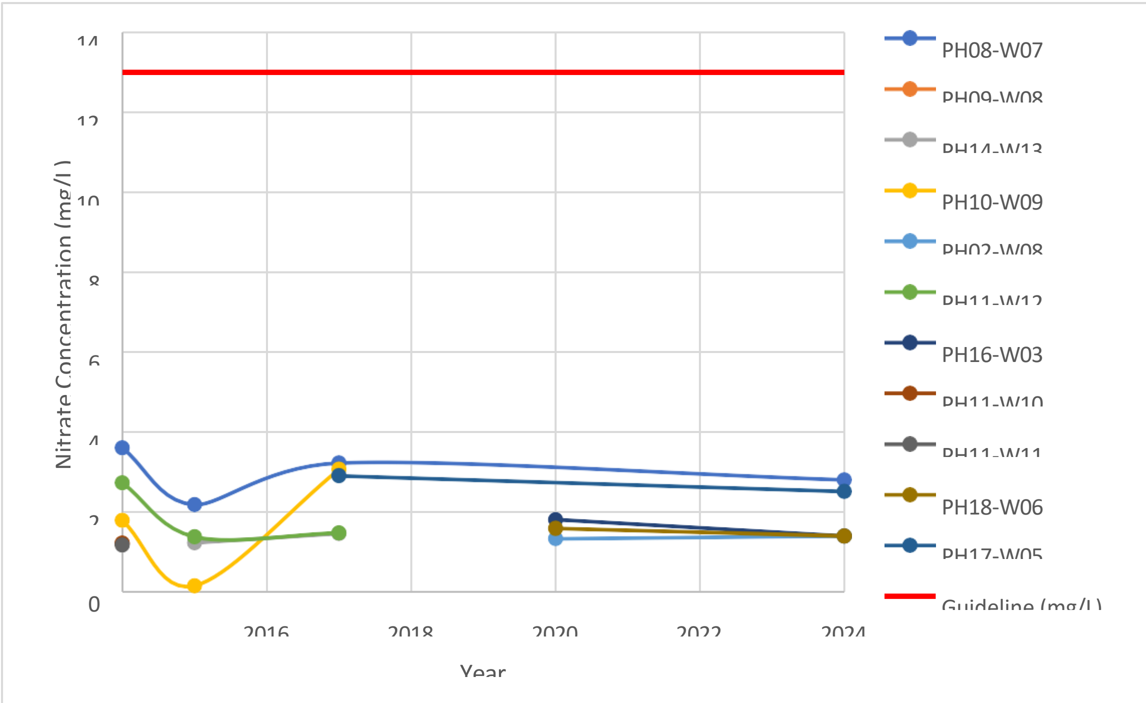
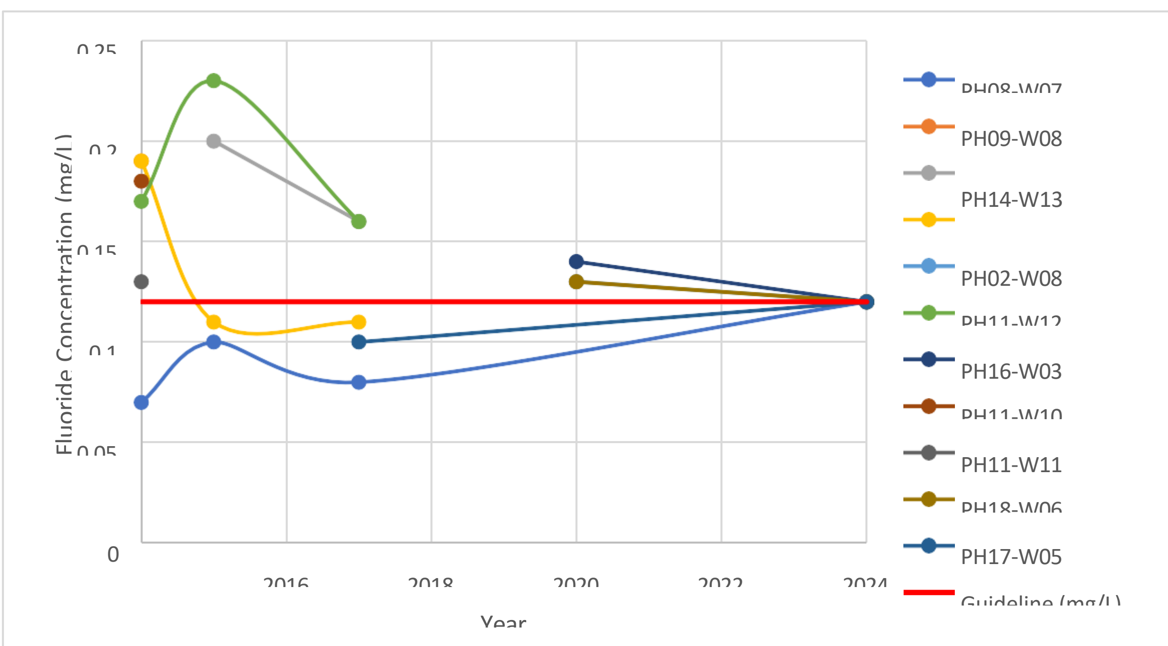


Figure 3-6 Fluoride in surface water measurements[1]



Note: [1]All 2024 data points were reported below the detection level of 0.12 mg/L

As shown in Figure 3-1, the uranium in air measurements collected since 2014 are all well below the 0.03 µg/m^3 air quality criteria for uranium (MECP 2023). Furthermore, as shown in Figure 3-2, Figure 3-4 and Figure 3-5, all the measurements from 2014 to 2024 for uranium in soil, uranium in surface water and nitrate in surface water, respectively, are also all below the corresponding guidelines. There is no guideline to compare the uranium in vegetation measurements; however, as shown in Figure 3-3 the uranium concentrations in vegetation samples remain low in the available data.

The only measurements in the CNSC IEMP that exceeded the corresponding guideline were the fluoride in surface water measurements. As shown in Figure 3-6, fluoride concentrations in surface water over the years have been measured both below and above the CCME guideline of 0.12 mg/L for the protection of aquatic life (CCME 2002). This guideline was derived in 2001 and was based on a LC_{50} value for caddisflies of 11.5 mg/L with a safety factor of 100 applied to that value. CNSC concluded that adverse effects are not expected because the CCME freshwater quality guidelines were derived on the basis of conservative assumptions and with the goal of protecting the most sensitive species over the long term. Since the CCME guideline was derived, additional toxicity data has become available. McPherson et al (2014) developed a chronic effects benchmark for fluoride based on a SSD approach, with a value of 1.94 mg/L F derived for fluoride. Therefore, if concentrations of fluoride exceed the WQG, a secondary step can be implemented to compare the measured concentrations to a value of 1.94 mg/L F. Based on this comparison, all measured fluoride concentrations are below the chronic effects benchmark. It is also noted that the measured fluoride concentrations are below the Health Canada drinking water guideline of 1.5 mg/L. Based on this, CNSC concluded that adverse effects to human health and aquatic life, including fish and benthic invertebrates, are not likely to occur at these levels of fluoride in surface water (CNSC 2025).

Overall, CNSC concluded that the IEMP results for the monitored years (2014, 2015, 2017, 2020 and 2024) add to the evidence that people and the environment in the vicinity of the PHCF are protected and that there are no anticipated adverse effects from the operation of the PHCF. These conclusions are consistent with those contained in the 2016 ERA.

3.2 Updated Modelling

3.2.1 Air Dispersion Modelling

As part of the 2024 review of the ERA (Cameco 2024a), updated air dispersion modelling was completed for uranium (IEC 2021a) using emissions data and model setup files from the 2020 Consolidated ESDM Report (IEC 2021b). The site-specific meteorological data set used in the ESDM Report was prepared from 2013-2017 data at the Cobourg surface by the Ontario Ministry of Environment, Conservation and Parks (MECP) using AERMET. A comparison of the wind roses for the 2021-2025 period to the AERMET 2013-2017 dataset was completed to validate the AERMET dataset. Using similar input data (i.e. calm hours removed as per MECP dataset preparation) the 2021-2025 average windspeed was 3.10 m/s compared to the AERMET 2013-2017 dataset being 3.19 m/s. The wind data used in the updated dispersion modelling was considered representative of long-term climate in the region, and of the current local wind conditions at the Site.

The results of the 2020 air dispersion modelling showed that predicted uranium concentrations are comparable to the results from modelling completed as part of the 2016 ERA. The summary of monitoring data on uranium deposition from the period 2016-2020 indicates lower deposition rates in comparison to the PHCF 2014 monitoring data.

Overall, the results of the updated air dispersion modelling in 2020 showed no significant changes in the air pathway that might affect the conclusions of the 2016 ERA. Based on this finding, and that air monitoring data is consistent with the data included in the 2024 ERA Review, no additional air dispersion modelling was carried out for the 2023/2024 time period and the conclusion from the 2016 ERA that uranium in air is not a concern for off-site receptors remains valid.

3.2.2 Liquid Effluent Release Modelling

Liquid effluent release modelling was completed as part of the 2016 DRL (ARCADIS 2016b) based on sanitary sewer quality data from 2014. The PHCF monitors the uranium released to the sanitary sewer which is processed at the municipal sewage treatment plant (STP). Following the processing in the STP, the treated water is released to Lake Ontario, via a diffuser located east of the PHCF and harbour.

In order to develop a dilution factor that accounts for dispersion between the STP outfall and the harbour, dispersion calculations were completed using the Cornell Mixing Zone Expert System (CORMIX). The CORMIX modelling demonstrated that a dilution of approximately 2090x is achieved between the STP diffuser and the Port Hope Harbour (ARCADIS 2016b) which results in a contribution of 0.0014 µg U/L from the discharge of the STP at the Port Hope harbour.

The CORMIX model was updated for the Port Hope STP outfall for work supporting the 2021 DRL for CFM (ARCADIS 2021). The 2021 modelling assessed concentrations are from the STP outfall at the public beach in Port Hope (1.5 km west of the STP outfall), the municipal drinking water intake (2.9 km west of the STP outfall) and at the STP outfall (ARCADIS 2021). The dilution factors from the CORMIX modelling are 2,260 times at the east beach, 4,219 times at the municipal drinking water intake and no dilution at the STP outfall (ARCADIS 2021). The 2021 CORMIX modelling is used in this review.

Since the PHCF sanitary discharge is released to the STP, this volume of wastewater is treated at the STP and needs to be considered. The derivation of the lowest dilution factor (8.8) to be used for the assessment of the impact of uranium discharges from the PHCF to the sanitary sewer is provided in Table 3-4. It is noted that the dilution factor derived from the 2024 data is lower than the dilution factors derived from 2017-2022.

Table 3-4 PHCF effluent dilution with municipal sewage

Year	PHCF Effluent		STP Effluent		Dilution Factor
	Concentration (µg/L)	Volume (m^3)	Volume (m^3)	Concentration (µg/L)	
2017	44	138,012	2,163,874	2.8	16
2018	37	131,589	1,857,391	2.6	14
2019	33	161,938	1,912,776	2.8	12
2020	13	140,029	1,665,680	1.1	12
2021	23[a]	121,476[b]	1,513,921[b]	1.9[d]	12[e]
2022	39[a]	154,543[b c]	1,535,762[b]	3.9[d]	10[e]
2023	21[a]	-[c]	1,607,097[b]	-	-
2024	4.6[a]	162,765[b c]	1,437,877[b]	0.52[d]	8.8[e]

Note [a] - Corresponding spreadsheet provided by Cameco (2021/2022/2023/2024 – Environmental Monthly Data.xls) from Annual compliance reports.

[b]- Sum of daily effluents in spreadsheet provided by Cameco (PHCF sewage and MPH WTP and STP data – 2020 to 2024.xls) from annual compliance reports.

[c]- Data from December 2022 to February 2024 was skewed high due to equipment failures. Therefore, all of 2023 PHCF effluent data is excluded, and the December 2022, January 2024 and February 2024 are skewed high (email from R. Fournier to R. Peters, July 23, 2025).

[d]- Calculated by dividing the concentration at PHCF by the corresponding dilution factor.

[e]- Calculated by dividing total STP effluent by total PHCF effluent.

For conservative purposes and for consistency with the 2024 ERA Review (Cameco 2024a), the maximum PHCF contribution to the STP effluent was calculated by using the minimum dilution factor (8.8) for the PHCF to the STP effluent and the maximum annual PHCF effluent concentration from 2017 to 2024 (44 µg/L). The maximum effluent concentration occurred in 2017. The predicted uranium concentrations at each of the receiving locations are provided in Table 3-5.

Table 3-5 Predicted concentrations of uranium from PHCF discharge to sanitary sewer

Receiving Location	PHCF Contribution to STP Effluent (µg/L)[a]	Dilution Factor from CORMIX	Predicted Concentration (µg/L)[b]
STP Outfall	5	1	5
Public Beach	5	2,260	0.0022
Drinking Water Intake	5	4,419	0.0011

Note [a] Calculated by dividing the maximum PHCF effluent concentration (44 µg/L) by the minimum dilution factor (8.8).

[b] Calculated by dividing PHCF contribution to STP effluent by dilution factor from CORMIX.

It is noted that this is a very conservative evaluation, since the maximum annual PHCF concentrations have been decreasing since 2017 and the CORMIX modelling is dated.

In summary, the predicted concentrations provided for each receiving location in Table 3-5 represent negligible contributions at all receptor locations and are well below the federal guideline of 33 µg/L for short term exposure and 15 µg/L for chronic exposure (CCME 2025). It is recommended that when the ERA is updated, that the CORMIX model be updated so that it provides a more accurate representation of the dilution factors occurring at the various receptor locations.

3.3 COPC Screening

The environmental monitoring data collected since the 2024 review (Cameco 2024a) were reviewed to determine whether additional constituents of potential concern (COPC) need to be considered.

Overall, the 2023 and 2024 data have not changed the results of the COPC screening since the 2024 ERA Review, as detailed below in the following subsections.

3.3.1 Air

COPC screening for air was completed as part of the emission summary and dispersion modelling report completed in 2023 (IEC 2023), as summarized in the 2024 review. This screening only identified uranium as a COPC due to its relevance to current site operations. No additional screening for air has been completed as uranium is still considered to be the only COPC from an air perspective. The 2023 and 2024 air quality results are consistent with the data presented in the 2024 ERA Review (Section 3.1.1), indicating that the air quality is consistent with the air quality modelling presented in the 2024 review (Cameco 2024a).

3.3.2 Sanitary Sewer

In addition to uranium and pH monitoring, a comprehensive sanitary sewer water quality monitoring program is implemented through an annual sampling campaign. In this program, sanitary sewer discharge samples are analyzed for a broad range of water quality constituents that reflect the different types of contributions entering the sanitary system. Table 3-6 presents the average sanitary sewer discharge water quality results for the 2023 and 2024 annual sampling campaigns, each of which consisted of five daily samples. As shown, the measured concentrations for the analyzed constituents were relatively low in comparison to groundwater concentrations and, where applicable, remained well below the applicable municipal sewer use by-law limits. Overall, the results indicate that the sanitary sewer discharge water quality is well characterized through the existing monitoring program and that the detected concentrations of the monitored constituents are not considered to represent a concern.

Constituents identified as COPC in groundwater are also identified in Table 3-6. The measured concentrations in the sanitary sewer discharge of these COPC are below measured concentrations in groundwater and groundwater screening criteria where applicable.

The comprehensive annual sanitary sewer monitoring program represents a good practice for ongoing sanitary sewer discharge characterization. All groundwater COPC measured in the sanitary sewer discharge as part of this program are well below applicable limits, guidelines and concentrations in groundwater. These observations indicate that the existing monitoring program is adequate to support ongoing characterization and assessment of sanitary sewer discharge quality. There are no constituents in the sanitary sewer discharge which require further assessment in the ERA.

Table 3-6 Comprehensive sanitary sewer discharge water quality results (2023–2024)

Constituent	Units	By-law 30-94 limits	2023 Average	2024 Average
Total Suspended Solids	mg/L	350	21	16
Biochemical Oxygen Demand (BOD5)	mg/L	300	17	17
pH	No unit	6.0 and 9.5	7.78	7.81
Conductivity	uS/cm	-	857	1748
Temperature @ pH	°C	-	22.8	21.7
Alkalinity	mg/L as $CaCO_3$	-	110	111
Carbonate	mg/L as $CaCO_3$	-	< 2	< 2
Bicarbonate	mg/L as $CaCO_3$	-	110	111
OH	mg/L as $CaCO_3$	-	< 2	< 2
Fluoride*	mg/L	-	0.31	0.37
Total Dissolved Solids	mg/L	-	484	957
Sulphate*	mg/L	1500	91	185
Chloride*	mg/L	1500	170	393
4AAP-Phenolics	mg/L	0.1	0.003	0.010
Nitrite (as N)	as N mg/L	-	0.17	0.19
Nitrate (as N)*	as N mg/L	-	1.35	1.08
Ammonia+Ammonium (N)	as N mg/L	-	3.0	5.5
Total Reactive Phosphorous (o-phosphate as P)	mg/L	-	0.24	0.29
Dissolved Organic Carbon	mg/L	-	5	6
Cyanide (total)	mg/L	-	< 0.01	< 0.01
Cyanide (free)	mg/L	2	< 0.005	< 0.005
Sulphide	mg/L	-	< 0.02	< 0.02
Hydrogen Sulphide	mg/L	2	< 0.02	< 0.02
Mercury (total)	µg/L	-	0.227	0.02
Hardness	mg/L as CaCO3	-	150	216
Silver (total)*	mg/L	-	0.000054	0.000144
Aluminum (total)*	mg/L	-	0.075	0.134
Arsenic (total)*	mg/L	-	0.0018	0.0020
Barium (total)	mg/L	-	0.0283	0.0383
Beryllium (total)	mg/L	-	< 0.000007	< 0.000007
Boron (total)	mg/L	-	0.043	0.044
Bismuth (total)	mg/L	-	0.00023	0.00016
Calcium (total)*	mg/L	-	42.8	60.6
Cadmium (total)	mg/L	3	0.000023	0.000042
Cobalt (total)	mg/L	-	0.000094	0.000131
Chromium (total)	mg/L	3	0.00064	0.00138
Copper (total)*	mg/L	3	0.0277	0.032
Iron (total)*	mg/L	50	0.098	0.149
Potassium (total)*	mg/L	-	4.40	6.69

Constituent	Units	By-law 30-94 limits	2023 Average	2024 Average
Magnesium (total)*	mg/L	-	10.47	15.7
Manganese (total)*	mg/L	-	0.0056	0.0076
Molybdenum (total)	mg/L	-	0.01823	0.0242
Sodium (total)*	mg/L	-	118.0	242.8
Nickel (total)	mg/L	3	0.0017	0.0021
Phosphorus (total)	mg/L	-	0.577	0.668
Lead (total)	mg/L	3	0.00066	0.00083
Antimony (total)	mg/L	-	< 0.0009	< 0.0009
Selenium (total)*	mg/L	-	0.00020	0.00026
Silicon (total)	mg/L	-	0.83	1.12
Strontium (total)*	mg/L	-	0.213	0.327
Titanium (total)	mg/L	-	0.00071	0.0018
Thallium (total)	mg/L	-	< 0.000005	0.0000060
Uranium (total)*	mg/L	-	0.00467	0.00681
Vanadium (total)	mg/L	-	0.00035	0.00046
Zinc (total)*	mg/L	3	0.073	0.089
Oil & Grease (total)	mg/L	-	3	4
Oil & Grease (animal/vegetable)	mg/L	100	3	4
Oil & Grease (mineral/synthetic)	mg/L	15	< 4	< 4

Note: For the calculation of five-day averages, results reported below the detection limit were assigned a value equal to one-half of the detection limit.
*Groundwater COPC from Table 3-11

3.3.3 Soil

The 2024 ERA Review included an updated soil screening from the 2016 ERA and is reproduced in Table 3-7.

Table 3-7 Soil: Screening presented in 2024 ERA Review

Constituent	Units	Screening Criteria MECP Table 3	2016 ERA Max Value	2016-2022 Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Aluminum	µg/g	NA	36300	No data	**Yes**	No	Not associated with PHCF operations
Antimony	µg/g	40	166	12	**Yes**	No	Below screening criteria
Arsenic	µg/g	18	1790	160	**Yes**	**Yes**	
Barium	µg/g	670	2020	3500	**Yes**	No	Not associated with PHCF operations
Beryllium	µg/g	8	1.6	1.1	No	No	
Bismuth	µg/g	NA	55	No data	No	No	No toxicity data
Boron (total)	µg/g	120	1790	13	**Yes**	No	Below screening criteria
Calcium	µg/g	NA	316000	No data	No	No	Part of Earth's crust
Cadmium	µg/g	1.9	9.8	0.24	**Yes**	No	Below screening criteria
Chromium	µg/g	160	114	0.35	No	No	
Cobalt	µg/g	80	2730	70	**Yes**	No	Below screening criteria
Copper	µg/g	230	8830	730	**Yes**	No	Not associated with PHCF operations
Iron	µg/g	NA	180000	No data	**Yes**	No	Part of Earth's crust
Lead	µg/g	120	30000	4000	**Yes**	No	Not associated with PHCF operations
Magnesium	µg/g	NA	84300	No data	**Yes**	No	Part of Earth's crust
Manganese	µg/g	NA	3600	No data	**Yes**	No	Not associated with PHCF operations
Molybdenum	µg/g	40	15	1	No	No	
Nickel	µg/g	270	5690	51	**Yes**	No	Below screening criteria
Phosphorus	µg/g	NA	44900	No data	No	No	Part of Earth's crust
Potassium	µg/g	NA	45000	No data	**Yes**	No	Part of Earth's crust
Selenium	µg/g	5.5	16	<0.5	**Yes**	No	Below screening criteria
Silicon	µg/g	NA	5800	No data	No	No	Part of Earth's crust
Silver	µg/g	40	40	67	No	No	Above screening criteria; recent data max from beneath a contaminated floor slab and does not represent an exposure pathway
Sodium	µg/g	NA	10000	No data	No	No	Part of Earth's crust
Strontium	µg/g	NA	3000	No data	**Yes**	No	Not associated with PHCF operations
Thallium	µg/g	3.3	0.94	0.22	No	No	

Constituent	Units	Screening Criteria MECP Table 3	2016 ERA Max Value	2016-2022 Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
Titanium	µg/g	NA	2100	No data	No	No	Part of Earth's crust
Uranium	µg/g	33	16800	1900	**Yes**	**Yes**	Above screening criteria; recent data max from beneath a contaminated floor slab and does not represent an exposure pathway
Vanadium	µg/g	86	150	55	**Yes**	No	Below screening criteria
Zinc	µg/g	340	5500	97	**Yes**	No	Below screening criteria
Radium-226	Bq/g	NA	32	No data	**Yes**	**Yes**	
Benzene	µg/g	0.32	<0.002	0.022	No	No	
Ethylbenzene	µg/g	9.5	0.012	0.021	No	No	
Toluene	µg/g	68	0.028	0.11	No	No	
Xylene (total)	µg/g	26	0.212	0.55	No	No	
Bromodichloromethane	µg/g	18	<0.002	<0.04	No	No	
Bromoform	µg/g	0.61	<0.002	<0.04	No	No	
Bromomethane	µg/g	0.05	<0.009	<0.04	No	No	
Carbon tetrachloride	µg/g	0.21	<0.002	<0.04	No	No	
Chlorobenzene	µg/g	2.4	<0.002	<0.04	No	No	
Chloroform	µg/g	0.47	<0.003	0.36	No	No	
Dibromochloromethane	µg/g	13	<0.002	<0.04	No	No	
1,1-Dichloroethane	µg/g	17	<0.002	<0.04	No	No	
1,2-Dichloroethane	µg/g	0.05	<0.002	<0.049	No	No	
1,1-Dichloroethylene	µg/g	0.064	<0.002	<0.04	No	No	
cis-1,2-Dichloroethylene	µg/g	55	0.003	<0.04	No	No	
trans-1,2- Dichloroethylene	µg/g	1.3	<0.004	<0.04	No	No	
1,2-Dichloropropane	µg/g	0.16	<0.002	<0.04	No	No	
cis-1,3-Dichloropropene	µg/g	0.18	<0.002	<0.03	No	No	
trans-1,3- Dichloropropene	µg/g	0.18	<0.002	<0.04	No	No	
Ethylenedibromide	µg/g	0.05	<0.002	0.021	No	No	
Dichloromethane	µg/g	1.6	0.021	<0.049	No	No	
1,1,1,2-Tetrachloroethane	µg/g	0.087	<0.002	<0.04	No	No	
1,1,2,2-Tetrachloroethane	µg/g	0.05	<0.004	<0.04	No	No	
Tetrachloroethylene	µg/g	4.5	<0.002	0.086	No	No	
1,2,4-Trichlorobenzene	µg/g	3.2	0.004	No data	No	No	
1,1,1-Trichloroethane	µg/g	6.1	<0.003	<0.04	No	No	
1,1,2-Trichloroethane	µg/g	0.05	<0.002	<0.04	No	No	

Trichloroethylene	µg/g	0.91	0.188	1	No	No	Above screening criteria; recent data max from beneath a contaminated

Constituent	Units	Screening Criteria MECP Table 3	2016 ERA Max Value	2016-2022 Data Max Value	2016 ERA COPC?	Updated COPC?	Comments
							floor slab and does not represent an exposure pathway
Vinyl Chloride	µg/g	0.032	<0.003	<0.019	No	No	
1,2-Dichlorobenzene	µg/g	6.8	<0.002	<0.04	No	No	
1,3-Dichlorobenzene	µg/g	9.6	0.005	<0.04	No	No	
1,4-Dichlorobenzene	µg/g	0.2	0.002	<0.04	No	No	
Trichlorofluoromethane	µg/g	4	<0.002	<0.04	No	No	
Dichlorodifluoromethane	µg/g	16	<0.002	<0.04	No	No	

Note: Reproduced from Table 11 (Cameco 2024a).
Recent data is based on November 2020 borehole sampling and annual off-site soil sampling for uranium from 2015-2022. Not all parameters considered in the 2016 ERA screening Table 4.2 were included here and constituents are limited to those included in recent data and/or relevant for assessment. The 2016 ERA used data from SENES (2013), as well as data from the 2014 off-site soil monitoring program for uranium.

The 2024 ERA review (Cameco 2024a) generally concluded that the concentrations of COPC were lower in the 2016-2022 dataset than the maximum concentrations considered in the 2016 ERA. Additional context for the maximum values in Table 3-7 for the 2016-2022 period was included in the assessment of the available on-site data. In this period there was not a comprehensive onsite characterization for soil. The available onsite data was collected in 2020 for planning purposes from beneath the floor of an on-site building which was known to have subsurface contamination and these samples do not represent an exposure pathway. The maximum uranium value of 1,900 µg/g in 2020 is much lower than the maximum value of 16,800 µg/g presented in the 2016 ERA.

Specific to off-site soil monitoring completed as part of the annual soil monitoring program, the 2024 ERA Review also noted that the PHCF monitoring program had undergone changes since the completion of the 2016 ERA. The soil sampling approach was modified in 2015 to focus on the sampling of 15 cm cores and the collection of 0-5 cm, 5-10 cm and 10-15 cm core segments for compositing. Since 2018, samples have been submitted to a contract laboratory, and analytical requests have been focused on uranium analysis. Due to impacts from PHAI remedial activities, active monitoring program locations have also been reduced from five to two locations since the 2016 ERA. The 2024 ERA Review reported that the maximum uranium measured in off-site soil from all depths was 15 µg/g. This 2016 result was at a location on the former Waterworks property west of the main PHCF parking lot which was last sampled in 2017. The maximum uranium concentrations measured in off-site soil from all depths for 2023 and 2024 were 5.9 µg/g and 5.1 µg/g, respectively and were recorded at the monitoring location within 500 m of the facility (Cameco 2024b, 2025). All off-site uranium in soil results are well below the CCME guideline of 23 µg/g for residential/park land use and therefore, uranium is not considered a COPC for soil.

For the ecological assessment, the 2024 ERA Review completed a secondary screening for soil which was presented in Table 12 of that report. This table has not been updated as there are no changes to the identified COPC of arsenic, uranium and radium-226, which was supported by the 2023/24 dataset.

3.3.4 Ambient Air

The 2016 ERA used selected ambient air monitoring data in air model validation but did not include an overview of these monitoring programs. A summary of the data for the 2014 to 2024 period has been included below for completeness of the report.

3.3.4.1Routine Monitoring

Table 3-8 summarizes the ambient air monitoring program associated with routine operations at the facility. With the exception of total suspended particulate (TSP) measured at the Hi-Vols, all parameters were below the applicable criteria. Due to the nature of the VIM project, dust (TSP) is attributed to the project and is further discussed with the VIM monitoring in Section 3.3.4.2.

The maximum fluoride in vegetation results shown in Table 3-8 are influenced by non-PHCF sources. The vegetation monitoring program was modified in 2017, including changes to the sampling approach (standardization of species and sampling of tree clusters) as well as revisions to the placement of monitoring locations. One of the new locations is situated adjacent to a foundry and consistently reports the highest fluoride concentrations in vegetation. For these reasons, direct comparison of monitoring results before and after the program changes is not appropriate.

No ambient air parameters associated with routine monitoring require further consideration as they do not represent a risk.

Table 3-8 Comparison of ambient air monitoring data from 2014 to 2024

Parameter / Constituent	Unit	Criteria[c]	2016 ERA		2015 – 2022 [a]				2023		2024	
			2014 Avg	2014 Max	8- Year Avg	Range of Annual Averages Min	Range of Annual Averages Max	8-Year Max	Avg	Max	Avg	Max
Hi-Vol / TSP	ug/m^3	120	N/A	N/A	24	22	28	910	29	228	28	217
Hi-Vol / Uranium	ug/m^3	0.3	0.002	0.033	0.002	0.001	0.003	0.221	0.004	0.409	0.003	0.238
Lime candle / Fluoride	µg/100 cm^2/30 days	40/80[d]	3	10	3	2	4	13	3	10	4	15
Dustfall / Uranium	mg/m^2/30 days	10	0.2	0.9	0.1	0.0	0.1	1.7	0.2	1.8	0.1	0.3
Dustfall / Fluoride	mg/m^2/30 days	20	1.1	13.8	0.8	0.4	1.2	13.7	0.9	7.0	1.2	9.6
Vegetation / Fluoride [b]	µg/g	-	3	4	4	3	11	23	4	13	7	32

Note:

a Hi-Vol / TSP data were unavailable for 2015–2017; therefore, the corresponding values are based on 2018–2022 data.

b Vegetation fluoride concentrations reported as below the detection limit were assigned a value equal to one-half of the detection limit for summary calculations.

c Hi-Vol and Lime Candle - Ontario Ambient Air Quality Criteria (MOE 2012); Dustfall – Cameco internal screening level; no criteria for vegetation

d Dependent upon growing season

3.3.4.2VIM Monitoring

The VIM project involves increased construction-related activity and associated potential for elevated dust. To support dust management and to evaluate whether dust levels show sustained change over time, Hi-Vol TSP monitoring was reviewed. Table 3-9 summarizes the available Hi- Vol TSP monitoring data for the VIM project.

Table 3-9 Summary of VIM TSP monitoring data

Parameter / Constituent	Unit	Criteria	2018 – 2022				2023		2024	
			5-Year Avg	Range of Annual Averages		5-Year Max	Avg	Max	Avg	Max
VIM Hi-Vol / TSP [a,b]	ug/m^3	120[c]	20.9	17.7	29.5	582	29.7	385	23.6	78.6

Note:

a Annual average values were calculated as the average of results measured at the Waterworks, Yacht Club, and Fish Cleaning monitoring locations.

b VIM TSP monitoring was initiated in 2018 and will cease at the conclusion of the project

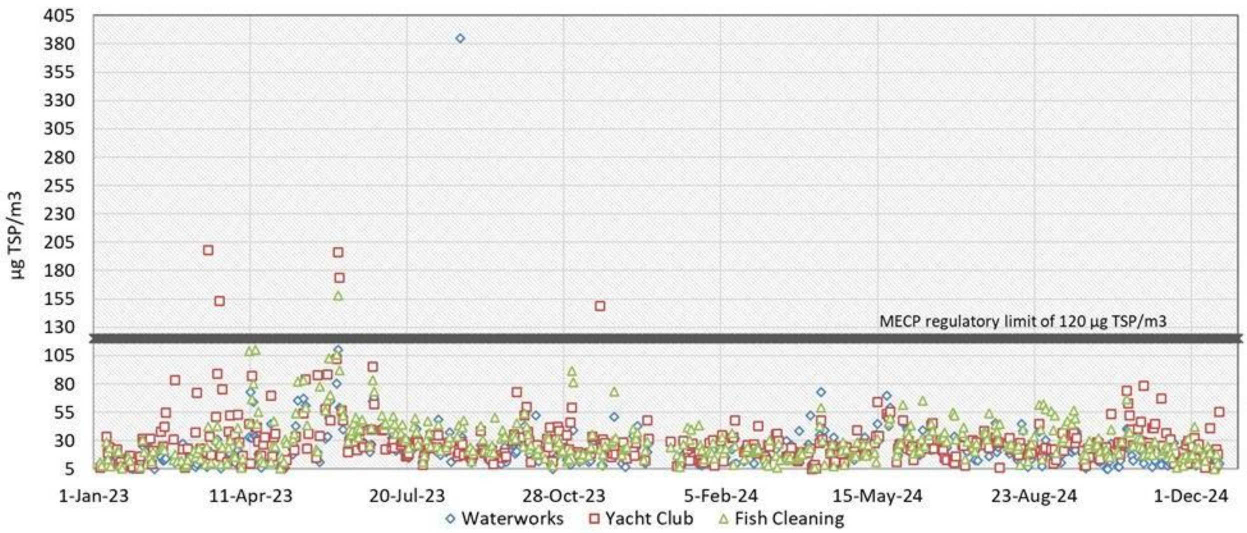
c Ontario Ambient Air Quality Criteria daily value

Table 3-10 summarizes the average and maximum TSP concentrations measured at the three VIM monitoring locations between 2020 and 2024 and shows that annual average TSP concentrations remained well below the MECP annual criterion of 60 µg TSP/m³ across the monitoring period, with averages generally stable over time. While the maximum values reported in Table 3-10 indicate that exceedances of the 120 µg TSP/m³ daily criterion occurred during the monitoring period, the 2023 and 2024 daily TSP results were plotted to better understand the frequency and duration of these events. As shown in Figure 3-7, review of the daily data indicates that exceedances were not observed in 2024. In 2023, a limited number of exceedances were observed; however, these were characterized as short-duration spikes, influenced by weather conditions, traffic levels and activities near PHCF carried out by the PHAI, rather than sustained elevated concentrations, which is supported by the annual average TSP concentrations being below the annual criteria. As the annual criterion is met, and there were no excursions in 2024, TSP does not require further consideration as it does not represent a risk.

Table 3-10 Particulate Concentration at VIM Hi-Vol Stations

Annual Particulate Concentration at VIM Hi-Vol Stations (µg TSP/m³)					
Year	**Result**	**Criteria**	**Waterworks**	**Yacht Club**	**Fish Cleaning**
2020	Average	60 µg TSP/m³ (Annual average)	23	20	18
	Maximum	120 µg TSP/m³ (24-hour average)	582	115	59
2021	Average	60 µg TSP/m³ (Annual average)	18	19	22
	Maximum	120 µg TSP/m³ (24-hour average)	68	45	62
2022	Average	60 µg TSP/m³ (Annual average)	19	29	22
	Maximum	120 µg TSP/m³ (24-hour average)	53	214	65
2023	Average	60 µg TSP/m³ (Annual average)	25	33	32
	Maximum	120 µg TSP/m³ (24-hour average)	385	198	158
2024	Average	60 µg TSP/m³ (Annual average)	20	25	26
	Maximum	120 µg TSP/m³ (24-hour average)	73	79	67

Figure 3-7 2023 and 2024 Daily Particulate Concentration at VIM Hi-Vol Stations



3.3.5 Groundwater

The 2024 ERA Review included an updated groundwater screening, which is reproduced in Table 3-11 . Groundwater concentrations in 2023 and 2024 are also provided in the table (WSP 2025). A detailed comparison of groundwater COPC data to the 2016 ERA is completed in the annual groundwater review.

Table 3-11 Groundwater: COPC screening

Constituent	Units	Screening Criteria[1]	2016 ERA Max Value	2017 - 2022 Data Max Value	2023 Max Value[a]	2024 Max Value[a]	2016 ERA COPC?
Fluoride	mg/L	NA	75	100	16	7	**Yes**
Ammonia	mg-N/L	NA	150	400	80	67	**Yes**
Calcium	mg/L	NA	12200	23200	25100	15300	**Yes**
Chloride	mg/L	1800	82000	130000	85000	85000	**Yes**
Magnesium	mg/L	NA	5190	5716	***8290***	***5720***	**Yes**
Nitrite	mg-N/L	NA	<0.3	0.32	0.31	***8***	No
Nitrate	mg-N/L	NA	115	140	30	17	**Yes**
Potassium	mg/L	NA	1080	1000	723	652	**Yes**
Sodium	mg/L	1800	23700	24200	29200	23200	**Yes**
Sulphate	mg/L	NA	1200	1500	350	880	**Yes**
Aluminum	µg/L	NA	220	6710	***6530***	147	**Yes**
Antimony	µg/L	16000	30	13.1	***104***	4	No
Arsenic	µg/L	1500	1150	1690	***1750***	303	**Yes**
Barium	µg/L	23000	6540	7320	***9370***	***6680***	No
Beryllium	µg/L	53	<0.007	0.3	0.03	0.02	No
Boron	µg/L	36000	1470	1360	***8610***	1240	No
Bismuth	µg/L	NA	<0.007	2.7	0.09	0.11	No
Cadmium	µg/L	2.1	<0.003	0.003	***0.15***	***0.11***	No
Cobalt	µg/L	52	20	17.3	***23***	10	No

Constituent	Units	Screening Criteria[1]	2016 ERA Max Value	2017 - 2022 Data Max Value	2023 Max Value[a]	2024 Max Value[a]	2016 ERA COPC?
Chromium	µg/L	640	20	68.4	***31***	16	No
Copper	µg/L	69	290	114	14.6	8	**Yes**
Iron	µg/L	NA	36700	32000	***43500***	***41700***	**Yes**
Lead	µg/L	20	20	15	1.62	1.1	No
Manganese	µg/L	NA	2600	2810	2290	***8470***	**Yes**
Molybdenum	µg/L	7300	230	572	36	72.9	No
Nickel	µg/L	390	100	54	19	44.2	No
Selenium	µg/L	50	538	608	100	7.28	**Yes**
Silicon	µg/L	NA	20400	21400	***22200***	***54300***	No
Silver	µg/L	1.2	30	22.6	0.22	0.28	**Yes**
Strontium	µg/L	NA	1090000	1300000	1525000	1160000	**Yes**
Thallium	µg/L	400	<0.005	3.2	***10***	0.028	No
Titanium	µg/L	NA	20	29.7	1.81	7.3	No
Uranium	µg/L	330	21000	21100	11700	13200	**Yes**
Vanadium	µg/L	200	20	64	20	6.45	No
Zinc	µg/L	890	2220	534	57	233	**Yes**
Radium-226	Bq/L	NA	0.89	12	***6.7***	***4.7***	**Yes**
Benzene	µg/L	44	277	277	279	282	**Yes**
Ethylbenzene	µg/L	1800	21.3	26	24	23.3	No
Toluene	µg/L	14000	275	286	***290***	***291***	No
Xylene (Total)	µg/L	3300	192	218	***208***	***205***	No
Bromodichloromethane	µg/L	67000	2	<0.5	***3.9***	***0.9***	No
Bromoform	µg/L	380	1	<0.5	< 0.5	< 0.5	No
Bromomethane	µg/L	5.6	<0.5	<0.5	< 0.5	< 0.5	No
Carbon tetrachloride	µg/L	0.79	1.2	<0.2	< 0.2	< 0.2	**Yes**
Chlorobenzene	µg/L	500	<0.5	1	< 0.5	< 0.5	No
Chloroform	µg/L	240	17	1.3	***54.9***	***45.8***	No
Dibromochloromethane	µg/L	65000	0.59	<0.5	1	< 0.5	No
1,1-Dichloroethane	µg/L	320	31.7	21	6.7	4.7	No
1,2-Dichloroethane	µg/L	1.6	<0.5	0.9	***279***	***282***	No
1,1-Dichloroethylene	µg/L	1.6	20.8	7.6	***24***	***23.3***	**Yes**
cis-1,2-Dichloroethene	µg/L	1.6	1020	1080	290	291	**Yes**
trans-1,2- Dichloroethene	µg/L	1.6	28.6	10.8	***208***	***205***	**Yes**
1,2-Dichloropropane	µg/L	16	<0.5	<0.5	***3.9***	***0.9***	No
cis-1,3-Dichloropropene	µg/L	5.2	<0.5	<0.5	< 0.5	< 0.5	No
trans-1,3- Dichloropropene	µg/L	5.2	<0.5	<0.5	< 0.5	< 0.5	No
Ethylenedibromide	µg/L	0.25	<1	<0.2	< 0.2	< 0.2	**Yes**
Dichloromethane	µg/L	610	2	<0.5	< 0.5	< 0.5	No
1,1,1,2-Tetrachloroethane	µg/L	3.3	<0.5	<0.5	< 0.5	< 0.5	No
1,1,2,2-Tetrachloroethane	µg/L	3.2	0.25	<0.5	< 0.5	< 0.5	No
Tetrachloroethylene (perchloroethylene)	µg/L	1.6	1.4	<0.5	< 0.5	< 0.5	No
1,2,4-Trichlorobenzene	µg/L	180	0.25	0.8	< 0.5	***0.8***	No
1,1,1-Trichloroethane	µg/L	640	15.1	3.9	11.5	14.2	No

1,1,2-Trichloroethane	µg/L	4.7	<1.2	1.2	0.6	1.2	No
Trichloroethylene	µg/L	1.6	1800	207	459	134	**Yes**

Constituent	Units	Screening Criteria[1]	2016 ERA Max Value	2017 - 2022 Data Max Value	2023 Max Value[a]	2024 Max Value[a]	2016 ERA COPC?
Vinyl Chloride	µg/L	0.5	613	911	233	186	**Yes**
1,2-Dichlorobenzene	µg/L	4600	<0.5	<0.5	< 0.5	< 0.5	No
1,3-Dichlorobenzene	µg/L	7600	<0.5	0.9	< 0.5	< 0.5	No
1,4-Dichlorobenzene	µg/L	8	0.6	1.4	< 0.5	0.8	No
Trichlorofluoromethane	µg/L	2000	<5	<5	< 5	< 5	No
Dichlorodifluoromethane	µg/L	3500	2.3	4.1	**3.2**	**4.7**	No

Note: NA – not available. For simplicity, not all constituents considered in the 2016 ERA screening Table 4.1 were included here (i.e., pH, conductivity, hardness and some general chemistry constituents like phosphorus and TDS). Data for PHCs and PCBs from 2009 considered in the 2016 ERA is not included in the comparison, because no recent data are available and data from 2009 are over 10 years old and no longer representative of concentrations at the site. The identification of maximum concentrations considered data from 2018 through 2020 for organic constituents.
[1]Table 9 Generic Site Conditions for use within 30 m of a water body
(MOE 2011) a – Data obtained from WSP (WSP 2025).
Bold and italics – indicates maximum concentrations in 2023 and 2024 that are above the 2016 maximum concentration used in the 2016 ERA.
Underline – indicates maximum concentrations in 2023 and 2024 that are below the 2016 maximum concentration used in the 2016 ERA.

Generally, the 2024 ERA Review concluded that the groundwater concentrations considered in the 2016 ERA are similar to the maximum values from the more recent data (2015 – 2020), with one notable difference for Ra-226. The 2016 ERA considered a concentration of 0.89 Bq/L, while the maximum concentration in the 2015 – 2020 data was 12 Bq/L. The 2024 ERA Review noted that both of these Ra-226 concentrations were measured from the same location (HW-18D), with the concentrations ranging from <0.01 Bq/L (2010) to 12 Bq/L (2017). It is noted that the Ra-226 concentration reported in 2020 was 0.02 Bq/L. Table 3-11 indicates that the Ra-226 concentration was 6.7 Bq/L in 2023 and 4.7 Bq/L in 2024 which is in the range of previous measured data.

Table 3-11 provides the maximum measured groundwater concentrations in 2023 and 2024. It is noted that the maximum concentrations in each year do not occur at the same well location and do not occur at the same well in the 2016 ERA. Concentrations that are higher than ones used in the 2016 ERA are in bold and italics. The table shows that in 2023, there were a number of constituents with maximum concentrations higher than the ones used in the 2016 ERA but that the screening remains unchanged. Nitrite and some VOC concentrations are quite a bit higher than what was used in the 2016 ERA. The occurrences of these increased concentrations are at pumping wells or monitoring wells adjacent to pumping wells and therefore within the zone of capture of the pump and treat system. These changes may be attributed to redistribution of these COPC in the plume as a consequence of the influence of groundwater extraction by the pumping wells. Additionally, these maximum results occurred in bedrock wells, where there is no identified exposure pathway. Concentrations of some constituents in groundwater were lower than what was used in the 2016 ERA. These were underlined in the table. Arsenic, selenium, silver and zinc concentrations in groundwater are lower than what was used in the 2016 ERA and are also below guidelines and would not be considered to be COPC in future risk assessments.

The 2016 ERA completed a secondary screening for groundwater for both humans and ecological receptors. However, as indicated in the 2024 ERA Review due to the recent data (2015 – 2020) and changes in approach outlined in the 2024 ERA Review, human receptors have no contact with groundwater and a secondary screen for human health was not necessary.

For ecological receptors, the secondary screening for groundwater in the 2016 ERA compared the maximum measured concentrations to the GW3 component of the Table 9 MOE (2011) criteria for groundwater within 30 m of a water body. These criteria are considered to be protective of aquatic biota in surface water bodies potentially affected by groundwater and are also considered protective of terrestrial species such as earthworms. As these criteria were used in the current COPC screening in addition to the generic Table 9 values, no additional COPC are identified.

Based on the 2024 ERA Review, it was recommended that arsenic should also be added to the groundwater COPC list for the ecological risk assessment as concentrations had increased and were above guidelines. It is noted that in 2024, the arsenic concentration has decreased below guidelines indicating that arsenic may not be identified as a COPC in future assessments.

3.3.6 Harbour Water – Inferred from Groundwater and Stormwater

The 2024 review (Cameco 2024a) compared the mass loadings used in the 2016 ERA (based on 2014 data) with mass loadings from 2016, 2018 and 2024 and found that the mass loadings to the harbour generally decreased. These decreases were attributed to the sustained operation of pumping wells resulting in the gradual decrease of COPC in groundwater. The most recent groundwater mass loadings from 2024 are compared to the previous groundwater mass loadings and site-specific performance objectives (SENES 2009) in Table 3-12.

Table 3-12 Comparison of estimated groundwater mass loading to Port Hope harbour

Constituent	Estimated Mass Discharge to Harbour (kg/yr[a])						Risk-Based Performance Objective (kg/yr)[c]
	2014	2016	2018	2020	2022	2024	
Arsenic	2.0	1.7	1.3	2.7	2.5	0.19	7.19
Fluoride	15	9.4	11	11	6.5	6.0	518
Ammonia (Total)	95	116	66	42	30	47	866
Nitrate	3.8	3.4	2.0	2.3	1.2	1.8	N/A
Radium-226[b]	657[b]	1,216[b]	1,812[b]	1,829[b]	1,345[b]	1,047[b]	18,700[b]
Uranium	5.1	4.2	3.9	3.2	2.6	1.5	262
cis-1,2- Dichloroethene	0.02	0.02	0.01	0.04	0.03	0.02	N/A
Trichloroethylene	0.01	0.01	0.01	0.01	0.01	0.01	N/A
Vinyl Chloride	0.03	0.01	0.01	0.05	0.01	0.02	N/A

Note: Based on average pumping scenario from Table 7 of Golder (2021), WSP (2023) and WSP (WSP 2025).

[a] – As specified in Table 7 of Golder (2021), WSP (WSP 2023) and WSP (WSP 2025). Represents the average pumping rate condition.

[b] – Radium-226 is reported in kBq/yr [c] – As specified in SENES (2009)

As seen in Table 3-12, the 2024 loadings have decreased for arsenic, fluoride, radium-226, and uranium compared to 2022 loadings. Loadings of ammonia and nitrate have increased between 2022 and 2024, however, remain within the range of loadings for these parameters since 2014. Trichloroethylene, vinyl chloride and cis-1,2-dichloroethylene loadings are similar between 2022 and 2024 and are within the range of estimated loadings since 2014. All loadings are below the site-specific risk-based performance objectives for discharges to the Port Hope harbour, where available.

The most recent stormwater concentrations (2023 and 2024) are provided in Table 3-13 for comparison with previous years, including the stormwater concentrations used in the 2016 ERA (based on 2010 data).

As shown in Table 3-13, the concentrations considered for stormwater in the 2016 ERA modelling are generally similar to the 2023 and 2024 average stormwater concentrations with the exception of ammonia in 2023 and radium-226 in 2024. However, as noted by Cameco in the 2023 Annual Compliance report (Cameco 2024b), storm water quality is routinely highly variable and influenced by factors such as precipitation event duration and intensity, infrastructure deficiencies and biological sources.

Maximum ammonia concentrations recorded between 2023 to 2024 were from Outlet 13. Waste droppings from gulls, and to a lesser extent geese, influence Outlet 13 water quality. Despite reported variances in stormwater quality for selected constituents, the individual grab samples generally passed their respective *Daphnia magna* and rainbow trout single concentration toxicity tests. Between 2016 and 2024, 93 tests have been completed for *Daphnia magna*, using EPS 1/RM/14 (EC 2000a) and 93 tests have been completed for rainbow trout, using EPS 1/RM/13 (EC 2000b), with one *Daphnia magna* failure (2019 – Outlet 13) and two rainbow trout failures (2021 – Outlet 11 and 2023 – Outlet 13). Ecological risk assessment endpoints are typically defined at the population or community level, and spatial considerations are included in the assessment (CSA 2022). Stormwater is one of several discharges to the Port Hope harbour and over a nine-year period, less than 2% of toxicity tests have failed. Preceding the October 2023 sampling event, the summer and early fall season was fairly dry, leading to accumulation of gull droppings in the Outlet 13 catchment area. Laboratory analysis identified un-ionized ammonia as the primary cause of the October 2023 toxicity test failure. As the sample *E.coli* count was also elevated and the total coliform count could not be reported due to coliform overgrowth, a biological source was assigned to the rainbow trout mortality. Discussion of toxicity testing results are provided in the Annual Compliance Reports in cases where single concentration test failures are recorded.

The maximum radium-226 concentration was recorded at Outlet 8 in April 2024. This outlet is typically dry at the time of stormwater sampling events as the catchment area primarily consists of granular surface cover. In relation, the outlet has only been sampled on three occasions between 2016 and 2024. Circumstances pertaining to the collection of this sample indicate that this is an isolated result and is not indicative of an emerging issue. This Outlet is located north of former Building 27 in a VIM work area. At the time of sampling, the yard area granular cover (which consisted of historic fill to be remediated) was unstable due to area VIM traffic, and inactive laterals from the former Building 27 had not yet been abandoned. Catch basin inlet controls had to be temporarily removed to facilitate sampling, and water quality was skewed as a result. Based on the factors identified, the sample most likely reflects contributions from known legacy contamination in this area and does not represent contributions from existing operations. The former Building 27 lateral services have subsequently been abandoned and the immediate area has been regraded and resurfaced with clean granular fill. This outlet will ultimately be abandoned as part of future VIM civil works and in association, the yard area in question will be subject to further grading and surface cover changes.

Table 3-13 Comparison of stormwater concentrations

Year	Stormwater Concentration					
	Uranium (mg/L)	Fluoride (mg/L)	Ammonia (mg/L)	Arsenic (mg/L)	Radium (Bq/L)	Zinc (mg/L)
2010 (2016 ERA) Average	0.195	0.69	0.38	0.067	0.09	0.24
2010 (2016 ERA) Maximum	0.43	9.5	0.6	0.026	0.14	0.84
2015-2020 Average	0.19	0.22	0.44	0.01	0.08	0.28
2015-2020 Maximum	1.5	0.63	5.3	0.11	0.73	0.95
2022 Average	0.05	0.14	0.45	0.003	0.021	0.1
2022 Maximum	0.15	0.32	2.4	0.01	0.064	0.2
2023 Average[a]	0.28	0.54	3.8	0.052	0.1	0.61
2023 Maximum[b]	0.56	1.12	29.1[c]	0.53	0.85	1.7
2024 Average[a]	0.16	0.36	0.95	0.0084	0.15	0.37
2024 Maximum[b]	0.36	0.86	7.9	0.03	1.3[d]	0.91

Note: [a] - Calculated using data from “Combined stormwater – 2016 – 2024.xls” from annual compliance report and didn’t include duplicate samples.

[b] - Extracted from “Combined stormwater – 2016 – 2024.xls” from annual compliance report and didn’t include duplicate samples.

[c] - Location where this sample was collected is influenced by gull and geese droppings which impact ammonia concentration and biological activity

[d] - Result from a location that is typically dry during stormwater events, there is limited data for comparison at this location

The exposure point concentrations (EPCs) for surface water were primarily based on measured data in the 2016 ERA. The results of the harbour surface water modelling, which incorporated stormwater and groundwater loadings, were only considered in the 2016 ERA for the calculation of incremental concentration for arsenic, uranium and radium-226. Therefore, based on the groundwater mass loading and stormwater concentrations comparisons, which includes the 2023 and 2024 data, the modelling for the 2016 ERA remains valid and likely is an overestimation.

3.3.7 Surface Water

At the time of the 2016 ERA, the surface water sampling program consisted of thirteen sampling locations distributed along the perimeter of the Port Hope harbour turning basin and approach channel. However, this sampling program was suspended in August 2018 due to the CNL's harbour remediation work; sampling will resume when remediation work is complete. Therefore, the COPC presented in the 2024 review (Cameco 2024a) are unchanged and are arsenic, uranium and radium-226. As concluded in the 2024 ERA Review, once the harbour remediation and VIM project are completed, monitoring and remodelling will be required for the new Site conditions. It is recommended that prior to re-establishing a surface water monitoring program, that a review of the monitoring locations be completed to ensure their appropriateness given the substantial changes at the Site (e.g. transition to closed-loop cooling, changes to the harbour walls and turning basin by CNL, changes to PHCF's stormwater outlets).

3.3.8 Sediments

As discussed in the 2024 ERA Review (Cameco 2024a), the potential for future re-contamination of sediments from stormwater and groundwater loadings was assessed in 2010. Based on the hydro-geochemical model predictions, dredging of sediments will result in improved water and sediment quality even with continued groundwater and stormwater loadings into the Harbour. Based on 2010 stormwater quality, dredging the sediment would result in the Harbour water meeting Provincial Water Quality Objectives (PWQOs) and sediment quality meeting Lower Exposure Limits (LELs) for the COPC. Implementation of VIM remedial work will further improve both surface water and sediment quality and further reduce the discharges to the harbour which will contribute to sediment loading in the future (SENES 2010). These assumptions will be validated in the ERA to be completed after the VIM project.

3.3.9 Comparison of EMP with 2016 ERA Predictions

The 2023 and 2024 data demonstrate that concentrations and loadings from activities at the PHCF seem to be consistent with the 2016 ERA. Screening of air, sanitary sewer, soil, and ambient air in the current ERA review did not identify any constituents which represent a new risk.

As the Port Hope Harbour was under active remediation by the PHAI during the review period, sediments and surface water could not be assessed in the current ERA review, but are expected to be lower than the 2016 ERA results once these monitoring programs are re-established. It's important to note harbour sediments were dredged as part of CNL harbour remedial works.

For the majority of COPC, concentrations and loadings in stormwater and groundwater are generally decreasing in comparison to those utilized in the 2016 ERA. The current ERA review represents a conservative estimate of exposure for these media as the use of the maximum measured value may not spatially or temporally represent realistic exposure from these pathways.

For constituents in groundwater with measured concentrations in the review period above those in the 2016 ERA, they were either identified as COPC in the 2016 ERA and/or concentrations in the current ERA review period are within the GW3 component of the Table 9 criteria (MOE 2011) which is the component applicable for the protection of aquatic biota. Contaminated groundwater is actively being managed at the Site. Redistribution of COPC in groundwater, and increased concentrations at pumping wells or in wells in proximity to pumping wells may be observed because of the influence of groundwater extraction. COPC migration in groundwater and fluctuations in groundwater quality are expected to persist through to site decommissioning.

As such, groundwater recovery and treatment system operations are expected to be maintained for the long-term.

The groundwater and stormwater loadings to the harbour remain within the risk-based performance objectives (SENES 2009) established for the Site.

Therefore, the 2016 ERA is still considered to reflect a conservative assessment of the potential risks from the PHCF.

4.0 REVIEW OF CHANGES TO SCIENTIFIC AND REGULATORY INFORMATION

A review of potential changes to the scientific and regulatory frameworks was undertaken to determine if there were any substantial changes since the 2024 review (Cameco 2024a).

4.1 Scientific Advances

Since the 2024 review, guidelines provided by the federal and/or provincial agencies have not changed and thus the results of the 2016 ERA remain valid and are over-estimated.

4.2 Regulatory Requirements

Similarly, there have been no significant changes to environmental legislation applicable to PHCF operations since the 2016 ERA. Therefore, the 2016 ERA still adheres to regulatory requirements.

4.3 Concordance with N288.6-22

The 2016 ERA was completed in accordance with CSA N288.6-12. Since the 2024 review was submitted to the CNSC, N288.6 was updated in 2022. This section compares the 2016 ERA (ARCADIS 2016a) to the revised N288.6 (CSA 2022), as detailed in Table 4-1. Standard N288.6 addresses the design, implementation, and management of an environmental risk assessment program at nuclear facilities and uranium mines and mills. N288.6 defines ERA as environmental risk assessment, which include a HHRA and an EcoRA. In general, the 2016 ERA is in agreement with N288.6-22. Additional receptors will be considered in the future ERA, as well as updated modelling and toxicity values.

Table 4-1 Aspects of comparison with N288.6-22

N288.6		Comment
Clause	Component	
Introduction		
0.1.1	Environmental risk assessment (ERA)	The 2016 assessment included a human health risk assessment and an ecological risk assessment.
0.1.2	Need for an ERA	The 2016 assessment has been completed under N288.6 for the purpose of risk-based environmental management and serves as an update to the 2009 ERA, taking into account operational changes.
0.1.3	Human health risk assessment (HHRA)	The 2016 assessment included a HHRA.
0.1.4	Ecological risk assessment (EcoRA)	The 2016 assessment included an EcoRA

0.1.5	Risk-based recommendations	The 2016 assessment recommends addressing the contamination in the grass patch along the Harbour walls in coordination with VIM and the PHAI due to exposure to earthworms. However, the results of the assessment determined that earthworm populations were not at risk. Shallow/risk-based soil remediation is planned between the Cameco fence line and the harbour to 0.5 m.

N288.6		Comment
Clause	**Component**	
0.2	Levels of complexity	The 2016 assessment builds on the database of environmental and operations data, while also, to the extent possible and where appropriate, maintaining consistency with past assessments.
0.3.1	Radiation dose limits	The assessment used dose limits set by the Canadian Nuclear Safety Commission (CNSC) for people and UNSCEAR for ecological receptors.
0.3.2	Benchmark values	The assessment followed the guidance for benchmark values. See Clause 6.4.4 and Clause 7.4.3 for more details.
0.3.3	Receptors	The assessment followed the guidance for receptors. See Clause 6.2.3 and Clause 7.2.3 for more details.
0.3.4	Conceptual models	Conceptual models were provided for the HHRA and EcoRA.
0.3.5	Assessment and measurement endpoints	The assessment used the appropriate assessment and measurement endpoints.
Scope		
1.1.1	Types of facilities	The facility considered in the current assessment is described in the 2016 assessment
1.1.2	Facility lifecycle	The 2016 assessment was completed for the current operations at the PHCF.
1.2	Operating conditions	The 2016 assessment considered the release of low-level emissions of nuclear and hazardous substances to the environment for the normal operations at the facility.
1.3	Releases	The 2016 assessment was completed for routine releases expected for the current operating conditions.
1.4	Fate and transport	The air dispersion model, the soil deposition and leaching model, the groundwater and stormwater discharge model, and the gamma model used in the 2016 assessment incorporated fate and transport concepts. Fate and transport of contaminants in the environment were addressed by calculations of estimated exposure concentrations using transfer-factors from literatures.
1.5	Contaminants and physical stressors	Non-radioactive contaminants and radioactive contaminants were considered in the 2016 assessment.
1.6	Receptors	Human and non-human biota were considered in the 2016t assessment.
1.7	Risk management	The 2016 assessment was carried out to identify potential risks from current operations of the facility and provided recommendations to address the risks.
1.8	Reporting	N/A
1.9	Terminology	N/A
Reference Publications		
2.	Reference publications	N/A
Definitions and abbreviations		

3.	Definitions and abbreviations	N/A

N288.6		Comment
Clause	**Component**	
Environmental Risk Assessment Objectives and Report Format		
4.1	Environmental risk assessment objectives	The assessment was completed for the purpose of evaluating potential risks from the PHCF, within the context of the potential impacts and estimated exposures to human health and ecological receptors.
4.2	Environmental risk assessment report format	The 2016 report included the results of both the HHRA and the EcoRA. This report uses a different table of contents from Annex A of N288.6; however, the topics included in the suggested table of contents in Annex A of N288.6 are all covered in the 2016 report.
Environmental Risk Assessment Framework, Tiers, and Timelines		
5.1	Types of ERAs	The 2016 assessment evaluated the current conditions and used an extensive record of existing monitoring information.
5.1	Framework	The 2016 assessment included the suggested technical components.
5.2	Tiers of the assessment	The 2016 assessment incorporated Tier 1 and Tier 2 assessments, which builds on the database of environmental and operations data, while also, to the extent possible and where appropriate, maintaining consistency with past assessments.
5.3	Risk assessment updates	This assessment was completed for the purpose of evaluating potential risks related to effluent discharge and air emissions from the PHCF.
Human Health Risk Assessments		
6.1	General	The HHRA presented in the 2016 assessment included the suggested components.
6.2.1	Problem formulation, General	The problem formulation for the 2016 HHRA included the suggested components.
6.2.2	Site characterization	Section 2 provided the site characterization, including detailed description of existing site and its operations.
6.2.3	Receptor selection and characterization	Section 5.1.1 provided descriptions of the receptor selection and characterization. Specific aspects relevant to N288.6 are discussed within the text.
6.2.4	Assessment and measurement endpoints	The assessment was based on the protection (no meaningful health risks) of individual human receptors.
6.2.5	Selection of chemical, radiological and other stressors	Section 4 and 5.1.2 provided the selection of COPC included in the assessment.
6.2.6	Selection of exposure pathways	Section 5.1.2 described the various pathways of exposure considered in the assessment. Specific aspects relevant to N288.6 are discussed within the text.
6.2.7	Human health conceptual model	Section 5.1.4 provided the conceptual model for the HHRA.
6.3.1	Exposure assessment, General	Section 5.2 presented the exposure assessment for the HHRA.

N288.6		Comment
Clause	Component	
6.3.2	Exposure locations	Section 5.2.1 presented the exposure locations assumed for the HHRA.
6.3.3	Exposure frequency, duration, and averaging	Section 5.2.2 presented the exposure frequency, duration, and averaging factors assumed for the HHRA. A more conservative approach that what is recommended by N288.6 was used.
6.3.4	Dose calculation methods	The calculation approach was provided in Section 5.2.4 and Section 5.2.5.
6.3.5	Transfer factors, exposure factors, and dose coefficients	Transfer factors were provided in Table 6.24, exposure factors were provided in Section 5.2.2, and dose coefficients were provided in Section 5.2.6.
6.3.6	Modelled versus measured exposure concentrations	The assessment was completed using measured exposure concentrations from the site. Air concentrations at exposure locations were estimated using the air dispersion model, encompassing emissions data from the site. It is uncertain how some of the modelling was used in the evaluation.
6.3.7	Models	The 2016 assessment used the air dispersion model AERMOD for air quality and transport through the site as well as for the pathways assessment and ecological and human health risk assessments. Details of the air modelling are presented in Appendix A. Off-site soil concentrations of uranium were predicted using the Arcadis soil deposition and leaching model, which is presented in Appendix B. Influences of the stormwater and groundwater discharges were predicted through the Port Hope Harbour model. Details of the stormwater and groundwater modelling are included in Appendix C. Influences of gamma radiation on human receptors were predicted through the MicroShield modeling as detailed in Appendix D.
6.3.8	Exposure point concentrations and doses	Sections 5.2.3 and 5.4.3 provide the exposure point concentrations (EPCs) and the doses calculated for the HHRA. Multiple tiers of assessment were used to address the over conservatism in the EPCs
6.4.1	Toxicity assessment, General	The toxicity data used as the basis for the toxicity assessment were provided in Section 5.3.
6.4.2	Radiological toxicity assessments	The dose limit selected for the toxicity assessment was provided in Section 5.3.2
6.4.3	Non-radiological toxicity assessments	The evaluation of non-radiological COPC for toxicological action is presented in Section 5.3.1.
6.4.4	Reference concentrations, reference doses, and slope factors (non-radiological)	Section 5.3 presented the TRVs selected for use in the HHRA.
6.4.5	Radiation dose limits and targets	The radiological HHRA considered the Government of Canada's *Radiation Protection Regulations* for effective dose limits.

N288.6		Comment
Clause	**Component**	
6.4.6	Other criteria (air quality and noise)	Air quality was assessed using the available benchmarks presented in Section 5.3.1. A noise assessment was also completed as part of the 2016 assessment.
6.5.1	Risk characterization, general	The results of the risk characterization for the HHRA are provided in Section 5.4.
6.5.2	Risk estimation	The results of the risk estimates for the HHRA are provided in Section 5.4.3.
6.5.3	Other lines of evidence	The 2016 assessment referred to an arsenic risk study done during the 2010 follow-up assessment for comparison with the results.
Ecological Risk Assessments		
7.1	Ecological risk assessments, General	The EcoRA presented in the 2016 assessment included the suggested components.
7.2.1	Problem formulation, General	Section 2 provided the characterization of the site, Section 6.1.1 identified the ecological receptors for the assessment, Section 6.1.2 provided the endpoints for the assessment, Sections 4 and 6.1.3 identified the environmental stressors as COPC for the assessment, and Section 6.1.5 provided the conceptual model.
7.2.2	Site characterization	Section 2 provides the site characterization, including detailed description of existing site and its operations.
7.2.3	Receptor selection and characterization	Section 6.1.1 identified the ecological receptors considered in the assessment. Receptors were based on previous assessments.
7.2.4	Assessment and measurement endpoints	Section 6.1.2 provided the endpoints for the assessment. Specific aspects relevant to N288.6 are discussed within the text.
7.2.5	Selection of chemical, radiological, and other stressors	Section 4 and Section 6.1.3 provided the selection process for COPC included in the assessment. Specific aspects relevant to N288.6 are discussed within the text.
7.2.6	Selection of exposure pathways	The pathways of exposure for ecological receptors were identified in Section 6.1.
7.2.7	Ecological conceptual model	The conceptual model for the EcoRA was provided in Section 6.1.5.
7.3.1	Exposure assessment, General	Sections 6.2.4 and 6.4.5 provided the exposure point concentrations for soil, water, groundwater and sediment, as well as the gamma doses. Concentrations for other environmental compartments (e.g. aquatic invertebrates, aquatic plants) were not provided.
7.3.2	Exposure points/locations	Section 6.2.1 provided the exposure points and locations considered for the assessment.
7.3.3	Exposure frequency, duration, and averaging	Section 6.2.3 presented the exposure frequency, duration, and averaging factors assumed for the EcoRA.

7.3.4	Dose calculation methods	Dose calculations were provided in Sections 6.2.5 and 6.2.6. Specific aspects relevant to N288.6 are discussed within the text.

N288.6		Comment
Clause	Component	
7.3.5	Transfer factors, exposure factors, and dose coefficients	Transfer factors were in Section 6.2.7, exposure factors were provided in Table 6.8, and dose coefficients are provided in Section 6.2.6.4.
7.3.6	Modelled versus measured exposure concentrations	The 2016 assessment was completed using measured exposure concentrations from the site. Air concentrations at exposure locations were estimated using the air dispersion model, encompassing emissions data from the site. The updated 2016 ERA provided additional discussion in Section 3.3.1.1 to address CNSC comments on lack of calibration and validation for the groundwater model.
7.3.7	Models	The 2016 assessment used the air dispersion model AERMOD for air quality and transport through the site as well as for the pathways assessment and ecological and human health risk assessments. Details of the air modelling were presented in Appendix A. Off-site soil concentrations of uranium were predicted using the Arcadis soil deposition and leaching model, which was presented in Appendix B. Influences of the stormwater and groundwater discharges were predicted through the Port Hope harbour model. Details of the stormwater and groundwater modelling were included in Appendix C. Influences of gamma radiation on human receptors were predicted through the MicroShield modeling as detailed in Appendix D.
7.3.8	Exposure point concentrations and doses	Sections 6.2.4 and 6.4.5 provided the exposure point concentrations for soil, water, groundwater and sediment, as well as the gamma doses Concentrations for other environmental compartments (e.g., aquatic invertebrates, aquatic plants) were not provided. Section 6.2.8 provided the external gamma radiation dose.
7.4.1	Effects assessment, General	Sections 6.3.1 and 6.3.2 provided the benchmarks used for the effects assessment.
7.4.2	Radiological benchmarks	The radiological benchmarks were provided in Section 6.3.2. The assessment used dose limits set by UNSCEAR for ecological receptors (Table 6.30).
7.4.3	Toxicological benchmarks	The benchmarks for non-radiological COPC were provided in Section 6.3.1. Specific aspects relevant to N288.6 are discussed within the text.
7.4.4	Thermal benchmarks	Section 7.2 discussed thermal effects on fish and how thermal benchmarks were derived.
7.5.1	Risk characterization	The results of the risk characterization for the EcoRA were provided in Section 6.4.
7.5.2	Risk estimation	The results of the risk estimation for the EcoRA are provided in Section 6.4.

7.5.3	Other lines of evidence	Summaries were provided for previous studies. Toxicity tests and field survey results completed following the 2009 ERA were referred to in the discussion.

N288.6		Comment
Clause	**Component**	
7.5.4	Thermal effects	Section 7.2 discusses the thermal effects on fish.
7.5.5	Wildlife-vehicle and bird-structure mortalities effects	Not applicable to the 2016 assessment; roadkill and bird strikes were not components of the scenarios being assessed.
Evaluation of Uncertainty		
8.1	Evaluation of uncertainty	Uncertainties present in the assessment were identified in Sections 5.5 and 6.5.
8.2	Identifying and evaluating uncertainty	Uncertainties in the assessment were identified in Sections 5.5 and 6.5.
8.3	Probabilistic risk assessment	The 2016 assessment was not a probabilistic assessment. However different Tiers of assessment were evaluated.
Risk-based Recommendations		
9.1	Risk-based recommendations	The information in the assessment can be used for risk-based decisions.
9.2	Recommendations for monitoring	The information in the assessment can be used for further monitoring decisions.
9.3	Recommendations for risk management or remediation	The information in the assessment can be used for risk-management or remediation.
Quality Assurance and Quality Control		
10.	Quality assurance and quality control	All data used in the assessment are from Cameco's EMP and were subject to their data quality requirements.
Periodic Review of the ERA		
11.	Periodic review of the ERA	A review was completed and submitted to CNSC in 2024.

5.0 UNCERTAINTIES

A risk assessment is inherently subject to uncertainty due to assumptions required to address data gaps, environmental fate complexities, and the generalization of receptor characteristics. Conservative assumptions are applied to ensure that the potential for adverse effects is not underestimated.

The ERA Review focuses on available monitoring data from 2023 to 2024 and compares these results with both the criteria used in the 2016 ERA and the maximum concentrations assessed in the 2016 ERA. Uncertainties associated with this approach include data gaps resulting from the temporary cessation of surface water and sediment monitoring during Port Hope Harbour remediation by PHAI, as well as the reduced number of soil monitoring locations within the Municipality of Port Hope during the PHAI remediation activities. Surface water, sediment, and soil are all receiving environments for site-related emissions. As part of this ERA Review, an updated COPC screening was completed for the relevant pathways to these receiving environments, including air, groundwater, and stormwater, and determined that current emissions remain within the bounds of the 2016 ERA. A more detailed assessment of these receiving environments will be undertaken as part of the full ERA planned following completion of the VIM project.

An additional source of uncertainty is the potential influence of temporary activities associated with the VIM project or the PHAI. To address this, Cameco implemented a supplemental monitoring program for the VIM project and these data were included in the scope of this ERA review.

The use of maximum measured concentrations in COPC screening represents a reasonable worst-case exposure scenario and helps address uncertainties associated with spatial and temporal variability in constituent concentrations.

6.0 CONCLUSION

The 2016 ERA was completed pursuant to CSA N288.6-12 using the available toxicity information at that time. The assessment was extremely conservative. In addition, the approach to the evaluation of aquatic receptors has evolved and some toxicity values have changed.

Since the completion of the 2016 ERA, additional monitoring has been completed and the most recent 2023/2024 data continue to demonstrate that, in general, concentrations of COPC continue to decrease. The changes in monitoring data, together with changes in toxicity values and approaches to evaluation of aquatic receptors are likely to result in lower risks than were predicted in the 2016 ERA, confirming that the 2016 ERA still represents a conservative estimation of risk associated with the PHCF operations.

Physical changes underway at the site as part of ongoing operations and the VIM project will continue to reduce or eliminate potential risks identified in the 2016 ERA. For example, the migration to production facility closed loop cooling systems and remediation of subsurface infrastructure and contamination would result in a reduction of exposure and consequently risks. These changes have improved environmental performance and reduced the overall impact of PHCF operations on the environment.

The results of the 2016 ERA indicated that there were negligible risks to human health and the environment from exposure to contaminants associated with activities from the PHCF. These results are validated by IEMP results from the CNSC for the monitored years (2014, 2015, 2017, 2020 and 2024) which indicate that people and the environment in the vicinity of the PHCF are protected and that there are no anticipated adverse effects from the operation of the PHCF.

6.1 Recommendations

Based on this review completed in accordance with Clause 11.1 of N288.6-22, there are no identified risks that have emerged since the 2024 ERA review. In fact, the 2023/2024 data indicate that conditions are improving at the site resulting in several potential risks becoming less significant. The changes under the VIM project will require a full update of the ERA to establish a new baseline of environmental performance on which to revise the site Environmental Protection Program. It is important that this full update be undertaken once the site remediation and harbour remediation are largely complete and there are no remaining activities such as building demolition or soil excavation which could skew the operational monitoring data required for the ERA update. As part of this update, CORMIX modelling and Air Quality modelling will also need to be conducted.

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20 Record of Proceedings, Including Reasons for Decision, Comprehensive Study Report for Cameco Corporation's Proposed Redevelopment of the Port Hope Conversion Facility (Vision 2010), dated May 30, 2012

Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Record of Proceedings, Including Reasons for Decision

In the Matter of

Proponent	Cameco Corporation
Subject	Comprehensive Study Report for Cameco Corporation's Proposed Redevelopment of the Port Hope Conversion Facility (Vision 2010)
Hearing Date	May 30, 2012

Canada

RECORD OF PROCEEDINGS

Proponent:	Cameco Corporation
Address/Location:	One Eldorado Place, Port Hope, Ontario L1A 3A1
Purpose:	Comprehensive Study Report for Cameco Corporation's Proposed Redevelopment of the Port Hope Conversion Facility (Vision 2010)
Application received:	June 22, 2006
Date of hearing:	May 30, 2012
Location:	Canadian Nuclear Safety Commission (CNSC), 280 Slater St., Ottawa,
Ontario	
Members present:	M. Binder, Chair
Secretary:	K. McGee
Recording Secretary:	M. Young

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Introduction

1. Cameco Corporation (Cameco) has notified the Canadian Nuclear Safety Commission[1] (CNSC) of its intention to redevelop its Port Hope Conversion Facility (PHCF), the Vision 2010 Project. The project includes:
   - the cleanup and demolition of a number of old or underutilized buildings;
   - the removal of contaminated soils, building materials and historic wastes at the PHCF; and
   - additions or modifications to existing buildings with associated landscaping and infrastructure.

2. The authorization of this activity requires a licence amendment to the existing Fuel Facility Operating Licence for the PHCF, FFOL-31.00/2017, pursuant to subsection 24(2) of the *Nuclear Safety and Control Act*[2] (NSCA). The issuance or amendment of a licence under this authority is a "trigger" under the *Law List Regulations*[3] established under the CEAA, therefore, there is a "trigger" for this proposal pursuant to paragraph 5(1)(d) of the CEAA. The proposed Vision 2010 Project is an undertaking in relation to a physical work and thus, is a "project" as defined in section 2 of the *Canadian Environmental Assessment Act*[4] (CEAA). The project is of a type listed in the *Comprehensive Study List Regulations*[5], therefore, in accordance with the CEAA, a federal environmental assessment (EA) in the form of a comprehensive study is required for this project.

3. Before the Commission can amend or issue a licence, the Commission must, in accordance with the requirements of the CEAA, make a recommendation to the Minister of the Environment on the Comprehensive Study EA for the proposed project. The Commission is the sole responsible authority[6] (RA) for the EA. Fisheries and Oceans Canada (DFO), Transport Canada (TC), Natural Resources Canada (NRCan) Environment Canada (EC) and Health Canada (HC) identified themselves as federal authorities (FAs) for the purpose of providing expert assistance to CNSC staff during the EA.

4. The EA decision for a comprehensive study EA rests with the Minister of the Environment. The Canadian Environmental Assessment Agency (CEA Agency) will initiate a public comment period after the CNSC provides the Proposed Comprehensive Study Report (CSR) to the Minister of the Environment and the CEA Agency. The Minister of the Environment will consider the information in the Proposed CSR, the views of the RA and federal authorities (FAs) and any comments received during the public comment period initiated by the CEA Agency and will issue an EA decision statement under section 23 of the CEAA. If the Minister decides that the Project is not

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[1] The *Canadian Nuclear Safety Commission* is referred to as the "CNSC" when referring to the organization and its staff in general, and as the "Commission" when referring to the tribunal component.
[2] Statutes of Canada (S.C.) 1997, chapter (c.) 9.
[3] Statutory Orders and Regulations (SOR)/94-636.
[4] S.C. 1992, c. 37.
[5] SOR/94-638.
[6] Responsible Authority in relation to an EA is determined in accordance with subsection 11(1) of the CEAA.

likely to result in significant adverse environmental effects taking into account the implementation of mitigation measures identified in the Proposed CSR, the CNSC may proceed to the licensing process under the NSCA.

5. The *Environmental Assessment Guidelines (Scope of Project and Assessment) for the Proposal by Cameco Corporation for the Redevelopment of its Port Hope Conversion Facility (Vision 2010) Port Hope, Ontario)* (the Guidelines) described the basis for carrying out the comprehensive study and were approved by the Commission on December 5, 2008. The Commission recommended to the federal Minister of the Environment that the EA for the Vision 2010 Project proceed as a comprehensive study. On March 24, 2009, the federal Minister of the Environment announced that the comprehensive study was the most appropriate type of EA for the proposed project.

6. The Guidelines were used in delegating the conduct of technical studies to Cameco, pursuant to section 17 of the CEAA. Cameco provided the technical studies which underwent a review by experts at the CNSC and other relevant government departments. The resulting Environmental Impact Statement (EIS) was then used by CNSC staff for the preparation of the draft EA CSR. Stakeholders, including the FAs, were provided an opportunity to review the draft CSRprior to its finalization and submission to the Commission for this hearing and decision.

7. The Comprehensive Study EA for the Vision 2010 Project was started in 2006 prior to the amendments to the latest amendments to the CEAA which came into force in 2010 under the *Jobs and Economic Growth Act*[7]. Therefore, in accordance with the applicable transitional provisions, the Comprehensive study for the Project was continued and completed as if the CEAA amendments had not come into force.

8. This *Record of Proceedings* describes the Commission's consideration of the *Proposed Comprehensive Study Report for Cameco Corporation's Proposed Redevelopment of the Port Hope Conversion Facility (Vision 2010)* and its reasons for decisions on the results. The CSRof Cameco's proposal for the Vision 2010 Project is attached as an appendix to CMD 12-H110.

<u>Issue</u>

9. In considering the Comprehensive Study Report, the Commission was required to decide:

   a) whether the Proposed Comprehensive Study Report is complete; that is, whether all of the factors and instructions set out in the approved EA Guidelines and subsection 16(1) of the CEAA were adequately addressed;

   b) whether the project, taking into account the mitigation measures identified in the Proposed Comprehensive Study Report, is likely to cause significant adverse environmental effects;

[7] S.C. 2010, c. 12.

c) whether the project must be referred to the federal Minister of the Environment for referral to a review panel or mediator, pursuant to paragraph 20(1)(c) of the CEAA; and

d) whether the Commission can proceed with its consideration of an application for a licence amendment under the *Nuclear Safety and Control Act*, consistent with paragraph 20(1)(a) of the CEAA.

<u>Hearing</u>

10. Pursuant to section 22 of the NSCA, the President of the Commission established a Panel of the Commission to review the application. The Commission, in making its decision, considered information presented for a hearing held on May 30, 2012 in Ottawa, Ontario. During the hearing, the Commission considered written submissions from CNSC staff (CMD 12-H110) and Cameco (CMD 12-H110.1).

Decision

11. Based on its consideration of the matter, as described in more detail in this *Record of Proceedings,* the Commission decides that:

a) the Proposed Environmental Assessment Comprehensive Study Report appended to CMD 12-H110 is complete; that is, the scope of the project and assessment were appropriately determined in accordance with section 15 and 16 of the *Canadian Environmental Assessment Act*, and all of the required assessment factors were addressed during the assessment;

b) the project, taking into account the mitigation measures identified in the Proposed Environmental Assessment Comprehensive Study Report, is not likely to cause significant adverse environmental effects;

c) it will not refer the project to the federal Minister of the Environment for his referral to a federal Environment Assessment review panel or mediator;

12. With this decision, the Commission provides the Proposed Environmental Assessment Comprehensive Screening Report to the federal Minister of the Environment for Ministerial Decision.

Issues and Commission Findings

13. The findings of the Commission are based on the Commission's consideration of all the information and submission available for reference on the record for the hearing.

Completeness of the Comprehensive Study Report

14. In its consideration of the completeness of the Comprehensive Study Report, the Commission considered whether the assessment had adequately addressed an appropriately defined scope of project and assessment factors.

15. Based on the Commission's review of the EA Guidelines and Comprehensive Study Report, the Commission concludes that the scope of the project and the scope of the factors for the assessment are appropriate and that all of the required factors were addressed during the assessment.

16. The Commission also concludes that the EA CSRis complete and compliant with the requirements of the CEAA.

Likelihood and Significance of Environmental Effects

17. This section contains the Commission's findings with respect to whether the project is likely to cause significant adverse environmental effects, taking into account the identified mitigation measures.

Adequacy of the Assessment Methods

18. The assessment methodology was described in the EA Guidelines, attached as Appendix A to the Comprehensive Study Report. The EA Guidelines outlined the scope of the project, the scope of the assessment and the scope of the factors to be assessed.

19. Based on its review of the CSR and the above information, the Commission concludes that the EA methods were acceptable and appropriate.

Effects of the Project on the Environment

20. The effects of the project on the environment include effects on the following components of the environment:
    - the atmospheric environment;
    - the geological and hydrogeological environment;
    - the aquatic environment;
    - the terrestrial environment;
    - the human health environment; and
    - the socio-economic environment.

21. The CSR includes a description of interactions between the project and the environment, and the residual effects of the project. Each potential interaction was assessed to determine which of the potential interactions were likely to result in a measurable change to the environment. Residual adverse effects that were considered were assessed for significance.

Atmospheric Environment

22. CNSC staff further stated that some project activities have the potential to produce airborne dust that may contain low levels of radioactivity. CNSC staff noted that the level of radionuclides associated with airborne dust is predicted to be quite small, of limited duration and spatial extent and unlikely to result in significant adverse environmental effects. CNSC staff stated that the emissions are expected to remain within provincial and federal limits, and have a negligible effect on terrestrial and aquatic habitat and biota. CNSC staff further stated that noise effects from project activities were considered minor and not significant.

23. CNSC staff noted that one minor residual adverse effect on the valued ecosystem component, the nearest residential or recreational receptor, was identified due to the potential infrequent exceedance of the 1-hour NO_2 ambient air quality criteria. CNSC staff stated that the effect on air quality is considered minor and not significant because it is highly unlikely that the predicted, conservative, worst-case scenario would exceed the 1-hour NO_2 criteria.

24. CNSC staff stated that, with the proposed mitigation measures, the Vision 2010 Project is not likely to cause significant adverse environmental effects to the atmospheric environment.

Geological and Hydrogeological Environment

25. CNSC staff stated that excavation of soil, water management and the construction of new buildings and additions or modifications to existing buildings have the potential to interact with the hydrogeology of the site. CNSC staff noted that the scope of the project includes the collection and treatment of all contaminated groundwater arising from project excavations.

26. CNSC staff stated that the excavation of soils and construction of new buildings are not expected to have a noticeable effect on the site's hydrogeology. CNSC staff noted that although some temporary dewatering may occur during these activities, no mitigation measures are required for these localized and temporary events.

27. CNSC staff further stated that no adverse effects on local soil quality are anticipated. CNSC staff explained that although the excavation and disposal of contaminated soils is one of the major project activities of the Vision 2010 project, incremental soil concentrations associated with excavation and demolition activities are a very small

fraction of the uranium in soil, based on estimates of ongoing deposition from plant operations. CNSC staff noted that no mitigation measures were deemed necessary because the excavation and disposal of contaminated soils would produce a beneficial and desirable effect.

28. As monitoring will be conducted and contingencies implemented, if required, the CSR concludes that the residual effects from changes to groundwater levels and lake levels are considered not significant.

Aquatic Environment

29. The CSR contained information concerning hydrology, surface water quality, sediment quality and aquatic habitat. CNSC staff stated that design, mitigation and compensation measures would be incorporated into the Vision 2010 Project to minimize the potential adverse effects of project interactions with the aquatic environment. Regarding hydrology, CNSC staff stated that no significant effects are anticipated. CNSC staff noted that stormwater would be managed by existing system of catch basins and storm sewers, and that coffer dams and water treatment would be used.

30. Regarding surface water quality, CNSC staff stated that there would be no untreated liquid effluent discharges during demolition, excavation and construction activities for the Project, and that treated effluent would only be discharged once the effluent discharge criteria are met. CNSC staff stated that no adverse residual effects are expected.

31. CNSC staff stated that no adverse residual effects are expected on sediment quality. CNSC staff noted that sediment control measures, including silt fences and the stabilizing of exposed areas as quickly as possible, would be incorporated as part of the Project design.

32. CNSC staff stated that no residual adverse effects are anticipated on aquatic biota or habitat as a result of the project. CNSC staff noted that measures to preserve surface water quality and sediment quality were incorporated into the project design to ensure that aquatic species and their habitats would not be adversely affected.

33. With the implementation of the proposed mitigation measures, the CSR concludes that the potential environmental effects on the aquatic environment are not likely significant. The CSRconcludes that, with the implementation of the proposed mitigation measures, the Vision 2010 Project is not likely to cause significant adverse effects on surface water and sediment quality and aquatic biota and habitat.

Terrestrial Environment

34. CNSC staff stated that the Vision 2010 Project does not involve any clearing of natural areas or successional vegetation; however, local vegetation may be exposed to contaminants from the deposition of particulate matter resulting from project activities. CNSC staff stated that the air

quality assessment indicated that the Vision 2010 Project would not result in a measurable increase of suspended particulate matter and, as such, no measurable effects on terrestrial vegetation communities and species were anticipated. CNSC staff stated that no specific mitigation measures were required for this environmental component.

35. CNSC staff stated that, due to the limited nature of wildlife communities and species in the vicinity of the PHCF, the primary mechanism through which effects can occur is through aerial transport and deposition of contaminated particulate matter to soil, water and plants. CNSC staff stated that the air quality assessment indicated that the project would not result in a measurable increase of suspended particulate matter, and that measures taken to preserve surface water quality and sediment quality would further ensure that wildlife habitat, communities and species are not adversely affected.

36. The CSR concludes that with the application of appropriate mitigation measures, no significant adverse effects to the terrestrial environment are expected.

Human Health Environment

37. CNSC staff stated that the CSR included a human health risk assessment on the environmental effects from air and effluent emissions on the human health of workers and residents at the nearest locations from the Vision 2010 Project. CNSC staff stated that the assessment indicated that no effects were expected from either radiological or non-radiological contaminants of concern from the project. CNSC staff noted that radiation doses for workers and the general public would continue to be below regulatory dose limits.

38. The CSR concludes that there are no adverse effects on human health anticipated from the Vision 2010 Project.

Socio-Economic Environment and Sustainability of Resources

39. The socio-economic environment includes land use and transportation, renewable and non-renewable resources, within and surrounding the Vision 2010 Project area.

40. Regarding land use, CNSC staff stated that no interactions were identified, and therefore no residual effects were anticipated. Regarding the landscape and visual setting, CNSC staff noted that although there would be a temporary change to the landscape due to the presence of construction equipment at the PHCF during excavation, demolition and construction activities, the project will result in an improved landscape and visual setting, and as such, no mitigation measures are required.

41. Regarding transportation, CNSC staff stated that no adverse residual effects on traffic or members of the public are anticipated. CNSC staff included information regarding emergency response to transportation incidents that may occur during transport activities for the project. CNSC staff noted that mitigation measures to address potential transportation-related effects that could occur as a result of Vision 2010 works and activities were identified following a review of the mitigation measures proposed for the Port Hope Area Initiative project, and that

no further improvements were required.

42. CNSC staff stated that the CSR concluded that the Vision 2010 Project would not diminish the capacity of renewable resources to meet the needs of present and future generations. CNSC staff noted that the Vision 2010 Project will require non-renewable resources, including construction materials and fuels, but not in a substantial amount compared to resource availability.

43. CNSC staff stated that no interactions were identified for the physical and cultural resources, and there are no listed archaeological sites or registered heritage buildings (under the Ontario Heritage Act) on the main site of the PHCF or on Centre Pier. CNSC staff noted that, due to community concerns, the Municipality of Port Hope established the "Centre Pier Development Task Force" to identify costs and potential risks associated with possible future development of the Centre Pier. On October 25, 2011, the Task Force released a report recommending that the Port Hope Area Initiative project restore the Centre Pier property to its full use either by retaining or replacing the buildings on the Pier.

44. Regarding the population and economic base, CNSC staff stated that no long-term residual adverse indirect socio-economic effects were predicted, and that the project may result in positive effects on population, employment, business activity, tourism, and property values. Furthermore, CNSC staff stated that no undue stress is anticipated on approved facilities for the disposal of waste destined for landfill or recycling, or on underground municipal services, although some services will be altered at the PHCF. CNSC staff noted that Cameco does not anticipate the need to draw increased levels of water from the treatment plant, nor to increase its loading on the sewage system during project works and activities. CNSC staff also stated that no residual adverse effects are expected on community services.

45. Regarding residents and communities, CNSC staff noted that mitigation measures are required to address the potential for adverse effects of the project on residents' use and enjoyment of property, including keeping residents informed of activities on and off the PHCF site that might be a disruption to their daily lives. CNSC staff noted that noise attenuation measures would also be implemented to limit the effects of noise. CNSC staff stated that no long-term significant adverse effects on residents and communities are anticipated.

46. CNSC staff stated that the proposed Vision 2010 Project is not likely to cause significant adverse effects on the socio-economic environment, taking into account the implementation of mitigation measures outlined in the Comprehensive Study Report.

<u>Conclusion on Effects of the Project on the Environment</u>

47. Based on its review of the CSR and the above-noted information and considerations, the Commission concludes that the proposed project, taking into account the identified mitigation measures, is not likely to cause significant adverse environmental effects. Furthermore, the Commission concludes that the proposed project is not likely to cause significant adverse effects regarding the sustainability of resources.

Effects of the Environment on the Project

48. Non-routine environmental events are defined as naturally occurring events that can produce extreme conditions that can affect the performance of project activities. Hazards that have the potential to damage the Vision 2010 Project can, in turn, cause adverse effects on the environment.

49. CNSC staff stated that the CSR included consideration of naturally-occurring events that can produce extreme conditions that have the potential to affect the Vision 2010 Project activities, including seismic activity, severe weather (tornadoes, ice storms, severe precipitation) and flooding. CNSC staff noted that the probabilities of occurrence of such events are low, and that design and operational measures are in place to reduce the potential effects of such events.

50. CNSC staff stated that the environment is not likely to cause significant adverse effects on the Vision 2010 Project, taking into account design and operational measures to prevent or reduce potential effects.

51. Based on the above information, the Commission concludes that the environment is not likely to cause significant adverse effects on the project.

Effects of Accident and Malfunction Events

52. The objective of the assessment of possible environmental effects of accidents and malfunctions is to ensure that:
    - abnormal events and/or upset conditions relating to the proposed Vision 2010 Project are considered;
    - credible accident scenarios are assessed;
    - available means to prevent or mitigate the possible effects of the event are identified; and
    - the significance of any residual effects are determined.

53. CNSC staff stated that the CSR included consideration of a range of credible malfunction and accident scenarios. CNSC staff stated that, based on this assessment, the postulated credible malfunction and accident scenarios are not likely to cause significant adverse environmental effects, taking into consideration the prevention measures and the contingency plans to prevent, eliminate or minimize the occurrence or effects arising from these malfunctions and accidents.

54. Based on the above information and considerations, the Commission concludes that accident and malfunction events are not likely to cause significant adverse effects on the environment.

Cumulative Effects

55. A cumulative effects assessment involves consideration of the effects of the Vision 2010 Project together with other proposed and existing projects and activities in the area that may cause environmental effects that would overlap with effects caused by the Vision 2010 Project. Other projects and activities included normal operations of the PHCF, normal operations at Cameco's

fuel manufacturing facility, the operation of the municipal sewage treatment plant, and the Port Hope Area Initiative.

56. CNSC staff stated that the cumulative effects assessment in the CSR includes the potential cumulative effects identified for the Vision 2010 Project and builds on the analysis of the residual effects of an EA. CNSC staff noted that malfunctions and accidents were not considered in the cumulative effects assessment. Based on the cumulative effects assessment, CNSC staff stated that no significant cumulative effects were expected from the Vision 2010 Project.

57. Based on the information received, the Commission concludes that, taking into account the identified mitigation measures, significant adverse cumulative effects are not expected to occur as a result of the project.

Follow-Up Program

58. A follow-up program under the CEAA verifies the accuracy of the EA predictions for a project and determines the effectiveness of any measures taken to mitigate adverse environmental effects of the project. The implementation of a follow-up program is required for all comprehensive studies.

59. CNSC staff stated that the CSR included a proposed follow-up program for the Vision 2010 Project to be implemented by Cameco, unless otherwise directed by the CNSC or the Minister of the Environment. CNSC staff further stated that the CSR describes the follow-up program for the Vision 2010 Project. The preliminary follow-up plan gives consideration to all possible effects of the project, including effects to groundwater, surface water, sediment quality, and air quality.

60. CNSC staff noted that Cameco currently has an existing environmental monitoring program (EMP) in place at the PHCF to maintain operational performance standards and determine operational related effects. CNSC staff further noted that many of the monitoring program requirements for the Vision 2010 Project would be captured by the existing PHCF EMP, which was also described in the Comprehensive Study Report.

61. The Commission is satisfied that the proposed scope of the follow-up program will be adequate for verifying and, if necessary, identifying where additional mitigation measures may be required during the project implementation.

Conclusions on the Likelihood and Significance of Adverse Environmental Effects

62. Based on the considerations and reasons noted above, the Commission concludes that the proposed project is not likely to cause significant adverse environmental effects, taking into account the identified mitigation measures.

63. The Commission is satisfied that the likelihood and significance of the effects have been identified with reasonable certainty.

Public and Aboriginal Consultation

Crown-led Consultation

64. The Commission examined whether the public had sufficient opportunity to become informed about the project and the EA[8], and express their views on it. The Commission examined the nature and level of concern expressed by the public.

65. CNSC staff stated that public notices of commencement for the EA for the proposed Vision 2010 Project were posted on the CNSC website and the Canadian Environmental Assessment Registry (CEAR) on October 19, 2006.

66. CNSC staff indicated that the public, Federal Authorities (FAs), and First Nations and Métis Nations were invited to comment on the Draft EA Guidelines from March 5, 2008 to April 11, 2008.

CNSC staff stated that seven submissions were received from the public, with comments concerning cumulative effects, including integration with the PHAI, the scope of the project and the contamination and remediation of Building 50. CNSC staff noted that the comments were incorporated into the Draft EA Guidelines, as appropriate. CNSC staff further stated that it held a public consultation meeting on March 18, 2008 in Port Hope to allow the public to ask questions to CNSC and CEA Agency staff on the Draft EA Guidelines.

67. CNSC staff described the one-day CNSC public hearing that was held regarding the proposed EA Guidelines for the Vision 2010 Project in November 2008. CNSC staff noted that no interventions were received and the Proposed EA Guidelines were approved on December 5, 2008.

[8] Section 7, Comprehensive Study Report for the Proposed Midwest Mining and Milling Project, April 2012.

68. CNSC staff also provided information regarding the participant funding available regarding the project. CNSC staff explained that the CEA Agency made available

$34,000 through the federal Participant Funding Program (PFP), with two phases of funding opportunities, to assist in the participation in the Vision 2010 Project. CNSC staff noted that an additional $10,000 in participant funding was awarded due to the addition of the Centre Pier buildings within the assessment.

69. CNSC staff stated that the Draft EIS was made available for public comment from March 7, 2011 to June 15, 2011 and a 30-day public review on the federal draft CSR started on September 22, 2011. CNSC staff noted that a public Open House on the project was held in Port Hope on the same day. CNSC staff further noted that comments from PFP participants, as well as members of the public, were considered during the drafting of the final Comprehensive Study Report.

Aboriginal Consultation

70. The common law Duty to Consult with Aboriginal communities and organizations applies when

the Crown contemplates actions that may adversely affect established or potential Aboriginal or treaty rights. Following the whole-of-government approach to uphold the honour of the Crown, federal departments involved in the review of the Vision 2010 Project have integrated Aboriginal consultation into the EA review process to the extent possible to address potential adverse impacts to potential or established Aboriginal or treaty rights pursuant to section 35 of the *Constitution Act, 1982*[9].

71. CNSC staff stated that, early in the review process, the CNSC conducted research that lead to a preliminary list of Aboriginal groups that may have an interest in the Project. A distribution list was created.

72. CNSC staff stated that requests for comments on the Draft EA Guidelines from Aboriginal groups were sent on March 3, 2008. CNSC staff noted that Aboriginal groups were also sent Project updates, including the inclusion of the Centre Pier in the Vision 2010 Project, which was sent in February 2010. CNSC staff further stated that, in April 2010, the Métis Nation of Ontario (MNO) was identified as having a potential interest in the Project and were then added to the distribution list and provided with the relevant information. The MNO have been kept informed of the Project since this date.

73. CNSC staff stated that notification letters and a CD of the Draft EIS were sent to Aboriginal groups on January 13, 2011. CNCS staff further stated that no comments were received from any of the identified groups. CNSC staff noted that an e-mail was sent out on September 1, 2011 informing Aboriginal groups of the Open House in Port Hope, Ontario on September 22, 2011 and, on September 23, 2011 a letter was sent to Aboriginal groups with a CD of the Draft CSR.

[9] *The Constitution Act, 1982*, being Schedule B to the Canada Act 1982 (U.K.), 1982, c. 11.

74. CNSC staff stated that none of the Aboriginal groups or organizations requested Participant Funding from the CEA Agency to participate in the review, nor have any raised concerns with the Project or identified any adverse impacts that this proposed Project may have on any potential or established Aboriginal or treaty rights.

75. CNSC staff stated that, to ensure that the CNSC upholds the honour of the Crown prior to making a decision that may cause adverse impacts to potential or established Aboriginal or treaty rights, Aboriginal consultation will continue through the remainder of the EA, including a public comment period initiated by the CEA Agency on the Proposed CSR and through the subsequent licensing review process.

Conclusion on Public and Aboriginal Consultation

76. Based on the information provided in the CSR and during the hearing, the Commission is of the view that there was sufficient opportunity for the public to be informed and express its views on the project. The Commission is satisfied that the public concerns raised during the EA process have been adequately addressed. The Commission is of the view that the concerns are of a nature that do not warrant a referral of the project to the Minister of the Environment for his referral to a

review panel or mediation. The Commission is satisfied that the remaining issues can be addressed in the follow-up program and future consideration of the licence amendment application. The Commission therefore decides not to refer the project to the Minister of the Environment for referral to a review panel or mediator under paragraph 20(1)(*c*) of the CEAA.

77. Furthermore, the Commission is satisfied that no concerns have been raised and that no adverse impacts that the Vision 2010 Project may have on any potential or established Aboriginal or treaty rights have been identified. The Commission is satisfied that, based on all the information received, any obligations related to the Duty to Consult have been met for the Vision 2010 Project to date. The Commission is also satisfied that consultation with Aboriginal communities and organizations will continue, as appropriate, to ensure Duty to Consult obligations are met during subsequent regulatory phases of the Vision 2010 Project.

Conclusion

78. The Commission concludes that the environmental assessment CSR attached to CMD 12-H110 is complete and meets all of the applicable requirements of the *Canadian Environmental Assessment Act*.

79. The Commission concludes that the project, taking into account the appropriate mitigation measures identified in the Comprehensive Study Report, is not likely to cause significant adverse environmental effects.

80. Furthermore, the Commission also concludes that, at this time, it will not request the federal Minister of the Environment to refer the project to a review panel or mediator in accordance with the provisions of the CEAA.

81. Therefore, subject to the Ministerial Decision on the Comprehensive Study Report, the Commission, pursuant to paragraph 20(1)(a) of the CEAA, can proceed with the consideration of a licence application under the *Nuclear Safety and Control Act* which, if approved, would allow the project to proceed.

M. Binder

MAY 3 0 2012

Michael Binder
President,
Canadian Nuclear Safety Commission

Date

21 Cameco. Port Hope Conversion Facility Preliminary Decommissioning Plan 2022, September 2022

The information in this reference document is subject to a request for confidentiality under rule 12 of the *Canadian Nuclear Safety Commission Rules of Procedure*.

22 CSA Group, CSA N292.0-19, *General principles for the management of radioactive waste and irradiated fuel*

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

23 CSA Group, CSA N293.3-14, *Management of Low and Intermediate Level Radioactive Waste*

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

24 CSA Group, CSA N294-19, *Decommissioning of Facilities Containing Nuclear Substance*

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25 Cameco, 2017 Licence Renewal Application for the Port Hope Conversion Facility, Supplemental VIM Submission, dated February 1, 2016

CAMECO CORPORATION
FUEL SERVICES DIVISION

2017 LICENCE RENEWAL APPLICATION
FOR THE
PORT HOPE CONVERSION FACILITY

Supplemental VIM Submission

February 1, 2016

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1.0 INTRODUCTION

1.1 Vision in Motion Project

In the upcoming licence term, Cameco Corporation (Cameco) is proposing to undertake a major site cleanup and renewal of its Port Hope conversion facility (PHCF), which is located in the Municipality of Port Hope (MPH), Ontario. This undertaking is known as the Vision in Motion (VIM) project. The VIM project will be implemented during the applied-for licence period. A 10-year licence term will provide sufficient flexibility to address potential delays to the project due to internal or external factors.

This project is a unique and timely opportunity that has been made possible because of the Port Hope Area Initiative (PHAI). The PHAI Port Hope project is being undertaken by Canadian Nuclear Laboratories (CNL) and includes the construction of a long-term waste management facility (LTWMF) in the Municipality of Port Hope. VIM will require effective co-ordination with the PHAI to ensure the success of both projects.
Remediation activities in the Port Hope Harbour area as well as the transfer of drummed waste and soil that meet the waste acceptance criteria (WAC) to the LTWMF are among the activities where effective coordination is paramount. A framework for coordination of activities between PHAI and Cameco is in place to link the teams in each organization working on similar aspects of the project such as Centre Pier remediation, regulatory activities, public outreach and communication and environmental monitoring. A senior management coordination team regularly reviews the progress of the project teams at a joint meeting.

VIM entails an extensive remediation and redevelopment of much of the PHCF and includes:

- the clean-up and demolition of a number of old or underutilized buildings;
- the removal of contaminated soils, building materials and stored wastes; and
- the proposed construction of new replacement buildings, additions or modifications to existing buildings at the PHCF with associated landscaping and infrastructure.

Proposed changes at the PHCF will result in modifications in the ongoing management of the site related to uranium trioxide (UO_3), uranium dioxide (UO_2) and uranium hexafluoride (UF_6) storage as well as wastewater treatment. Overall, VIM will allow for environmental remediation, improved site operations, enhancement of site safety and security through site design, and improved aesthetics.

1.1.1 Current Licensing Basis

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

CUP activities are ongoing and consist of routine work and clean-up projects. Planning for CUP activities incorporates an assessment of the relevant safety and control areas from a demolition, decontamination and waste management perspective. This assessment determines whether project-specific programs or procedures are required to supplement existing site programs to ensure the objectives of the licensing basis are maintained.

1.1.2 Project Overview

VIM is a specific project to carry out clean-up and renewal activities at the PHCF and will be completed in accordance with WMP-02. The original project description was submitted to the Canadian Nuclear Safety Commission (CNSC) in 2006 under the name Vision 2010 Project. The project was rebranded as Vision in Motion when it became clear that work would not begin until well after the original project timelines anticipated for both completion of the environmental assessment for Vision 2010 and the PHAI.

VIM will facilitate environmental remediation at the PHCF site, improve the operational efficiency and environmental performance of the PHCF and enhance site safety and security through site design. VIM also presents an opportunity for Cameco to make the PHCF more visually appealing, return the Centre Pier to the MPH and improve public access to the waterfront. The project consists of removing several old or underutilized buildings; removing contaminated soils, building materials and stored wastes; transporting those soils and wastes to the LTWMF; and constructing associated new infrastructure and building modifications. The layout of the current PHCF Main Site and the site post VIM are provided in Figures 1 and 2, respectively.

1.1.3 Project Timeline

VIM is progressing with design activity based on the defined scope. The resulting plans will cover aspects such as engineering, procurement, project execution (including environmental monitoring, risk management, site-project interactions) and the construction strategy and schedule. It is anticipated that the current planning phase of the project will be completed in the summer of 2016.

The implementation of most VIM activities is dependent on when the LTWMF is able to accept wastes from Cameco. It is anticipated that most aspects of VIM, particularly building demolition, soil remediation, groundwater treatment program expansion, and transfer of wastes will occur over a four to five year period after the LTWMF is open to receipt of wastes.

Figure 1 – Port Hope Conversion Facility Existing Site Layout

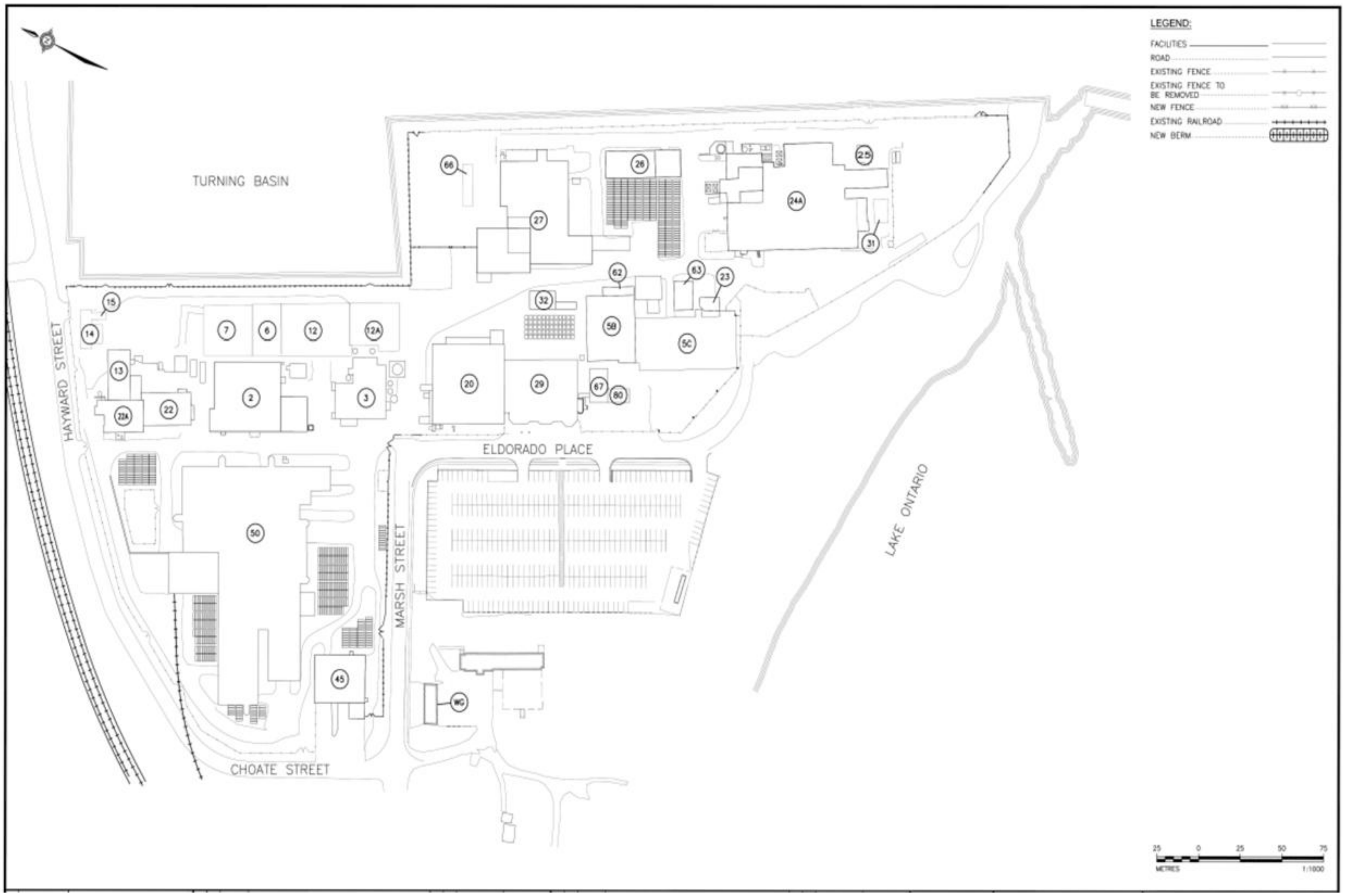

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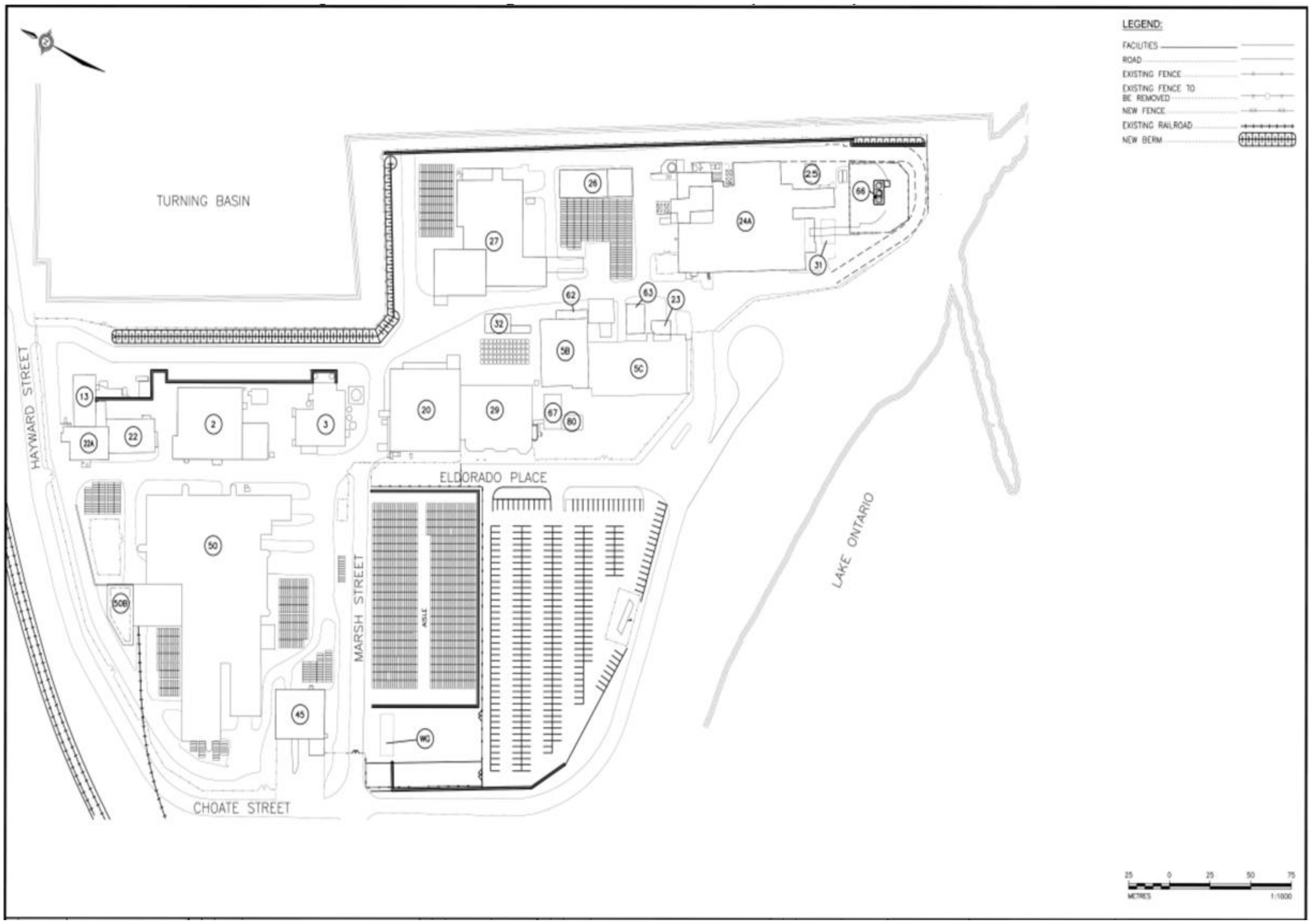
Figure 2 – Port Hope Conversion Facility Site Layout Post VIM



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1.2 Application for Licence Renewal Related to VIM

Within the requested licence period of 10 years, the PHCF expects to continue with current licensed operations including carrying out its VIM project to clean up and renew the facility. A licence renewal application was submitted to the CNSC on November 20, 2015 and this follow-up document outlines the objective of the licensing basis for the ongoing CUP operations including the VIM project.

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

In support of increased clean-up, decontamination, demolition and remediation activities, including discharge of treated groundwater at the PHCF, Cameco completed a federal environmental assessment (EA) pursuant to section 5(1)(d) of the *Canadian Environmental Assessment Act* (*CEAA*). Cameco prepared an Environmental Impact Statement (EIS) for Vision 2010 (Cameco 2010) (now VIM) in accordance with the EA requirements under *CEAA* and the project specific EA Guidelines developed by the CNSC in 2009.

The EIS was submitted to the CNSC in December 2010 and the Comprehensive Study Report (CSR) (CNSC 2012) was accepted by the Commission in May 2012. In December 2012, Canada's Environment Minister announced that this proposed project for PHCF is not likely to cause significant adverse environmental effects and the project was referred back to the CNSC for appropriate action.

Acronyms and abbreviations used throughout this document are found in Appendix 1.

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2.0 VIM PROJECT DESCRIPTION

The VIM project provides Cameco with an opportunity to deliver an allowance of qualifying waste materials to the LTMWF and to remediate and redevelop the PHCF. The VIM project is a large CUP project under WMP-02 and is expected to be implemented within the next 10 years in conjunction with the PHAI Port Hope project being implemented by Canadian Nuclear Laboratories (CNL).

2.1 History

The 2001 federal/municipal agreement establishing the PHAI specifies that approximately 150,000 m^3 of Cameco decommissioning waste materials arising at the PHCF and other specified locations are to be accommodated in the LTWMF, which is to be located in the MPH. This agreement provides Cameco with a limited window of opportunity, during the time that the LTWMF is receiving wastes, in which to transport waste for long term management at the LTWMF.

Since 2001, the scope of the VIM project has been evolving and, during this period, Cameco has promoted the project through various forums and with a variety of stakeholders (including local government, regulatory agencies, Aboriginal and community groups and the general public). In late 2005/early 2006, prior to completion of the Project Description, Cameco engaged in an extensive public consultation involving more than 600 local residents and other stakeholders, including the Municipality of Port Hope and non-governmental organizations. The results of these consultations provided direction to Cameco as it explored options for site redevelopment that considered the input received.

Cameco continued to both formally (public meetings, workshops) and informally (phone calls, one-on-one conversations) consult with the public throughout the EA process. The community was also informed about project developments through its community forums, newsletters, website and other public information activities. This dialog with the community has been ongoing since that time.

Cameco has worked very closely with the Municipality of Port Hope to ensure that VIM is as consistent with community planning objectives for waterfront redevelopment as possible.

One of the areas in which the direction from both the community and MPH was clear from both early and ongoing consultations was a desire to see the facility move away from the harbour, wherever possible. With the Centre Pier becoming publically accessible following completion of VIM and the PHAI, there was a desire to open up that area of the waterfront for increased public use.

The CSR was the subject of a CNSC public hearing in May 2012, and as noted above, the EA's conclusions for Vision 2010 were accepted by the Federal Minister of the

-

Environment in December 2012. The project was subsequently rebranded Vision in Motion (VIM). Work was then undertaken to refine the scope of the project. In January 2014, Cameco engaged in consultation with its three primary regulators, the CNSC, Environment Canada (EC) and the Ontario provincial Ministry of the Environment (now Ministry of the Environment and Climate Change (MOECC)) and provided an overview of the scope for VIM at a joint regulatory meeting in Port Hope. In February 2014, the three regulatory agencies provided Cameco with letters supporting the further development of the VIM project as outlined at the January meeting.

2.1.1 EA for Vision 2010 as it Applies to VIM

The EA for Vision 2010 that was the subject of the CSR issued in May 2012, evaluated four different alternative means to carrying out the project. Although a preferred alternative was identified at the time, the effects assessment evaluated the activities that would potentially lead to the maximum environmental effects associated with all of the alternatives.

In general, the scope of the VIM project has refined the original Vision 2010 activities to include a greater re-purposing of existing buildings. Consequently there will be fewer demolition and construction activities than were considered in the original assessment.
Ultimately this reduced level of activity will ensure that the effects associated with VIM remain within the bounds of the assessment in the 2012 CSR.

Similarly, for activities associated with remediation, a more targeted approach to remediation will be undertaken, focusing on removing the most contaminated material. This remediation will significantly reduce the source of groundwater contaminants at the PHCF site, and thereby greatly reduce the potential for groundwater contamination.
Despite the fact that environmental risk assessments (SENES, 2009a; SENES 2009b; SENES 2010; Arcadis, 2015) completed for the current facility conclude that no additional groundwater management is required to remain protective of the environment, the VIM project involves the installation of additional groundwater collection wells.
These wells are intended to further reduce the flux of contaminated groundwater discharging to the Port Hope Harbour and will be operated under the existing permit from the MOECC. This activity will more than offset the groundwater loading due to PHCF soil contamination evaluated in the CSR.

Further, because of this refinement in remediation activities, less soil excavation and backfill will be involved, reducing the potential environmental effects (airborne dust, etc.) evaluated in the Vision 2010 EA (and CSR). Consequently, the effects evaluated as part of the CSR will bound the potential effects associated with the VIM project.

Overall, the VIM project will not increase the radiological, human health or environmental hazards that were evaluated in the CSR and does not change the decision that the project is not likely to result in significant adverse environmental effects.

2.2 Facility Location and Layout

Detailed descriptions of the PHCF site are provided in the 2017 License Renewal Application and are not repeated herein. The VIM Project will take place within the three PHCF sites, including the PHCF Main Site, the Centre Pier and the Dorset Street East site. The Site Study Area illustrations in Figures 3 and 4 from the original EIS for the Vision 2010 project illustrate the area assessed in the EA, which includes property within the PHCF fenceline, as well as adjacent land that is accessible to the public. An element of the project involves relocating drums and low level radioactive waste (LLRW) from all three PHCF properties to the PHAI LTWMF. The transportation route is illustrated in Figure 5.

Figure 3 – Port Hope Conversion Facility Site Study Area – PHCF Main Site and Centre Pier

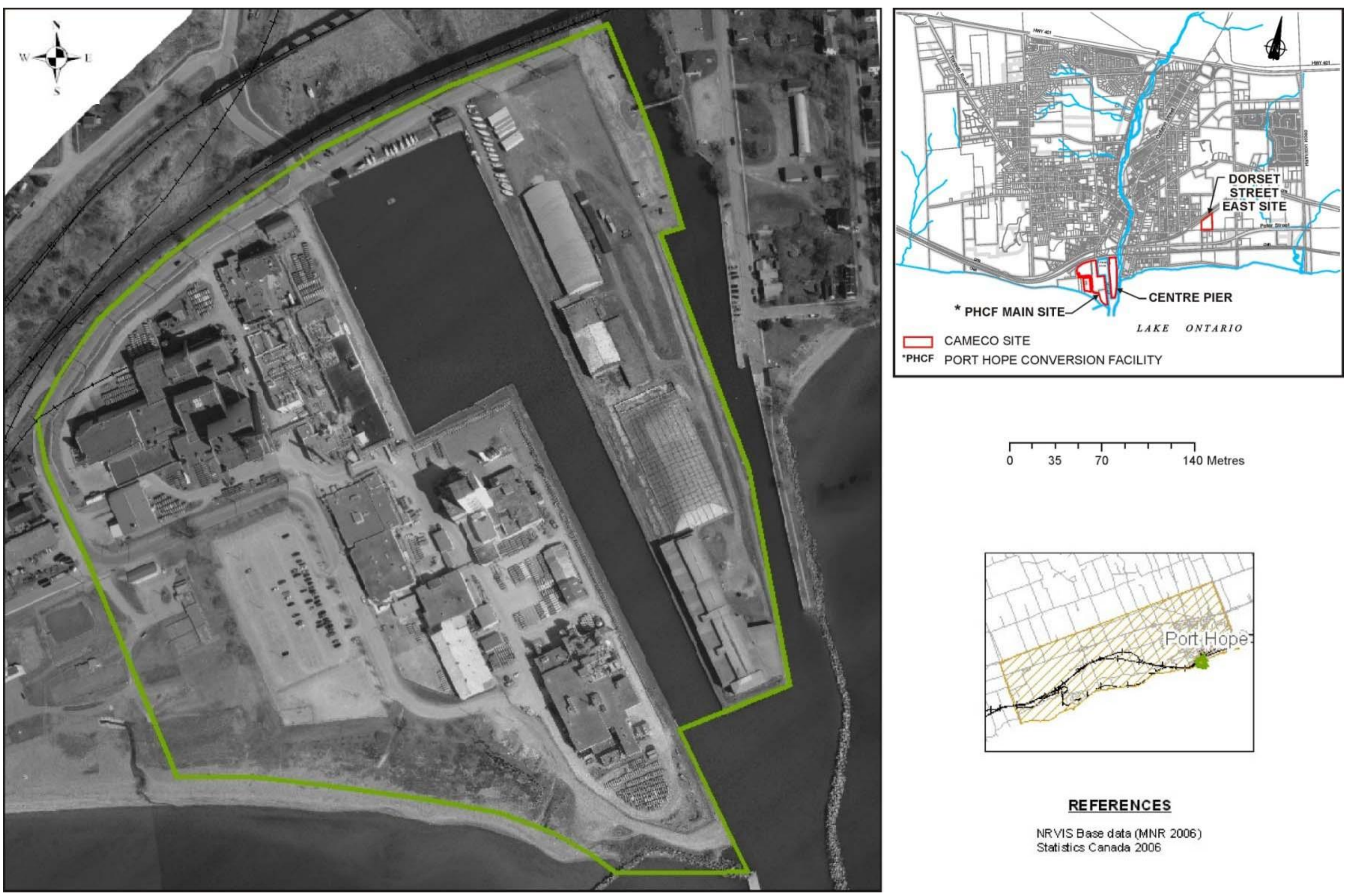


Figure 4 – Port Hope Conversion Facility Site Study Area – Dorset Street East Site

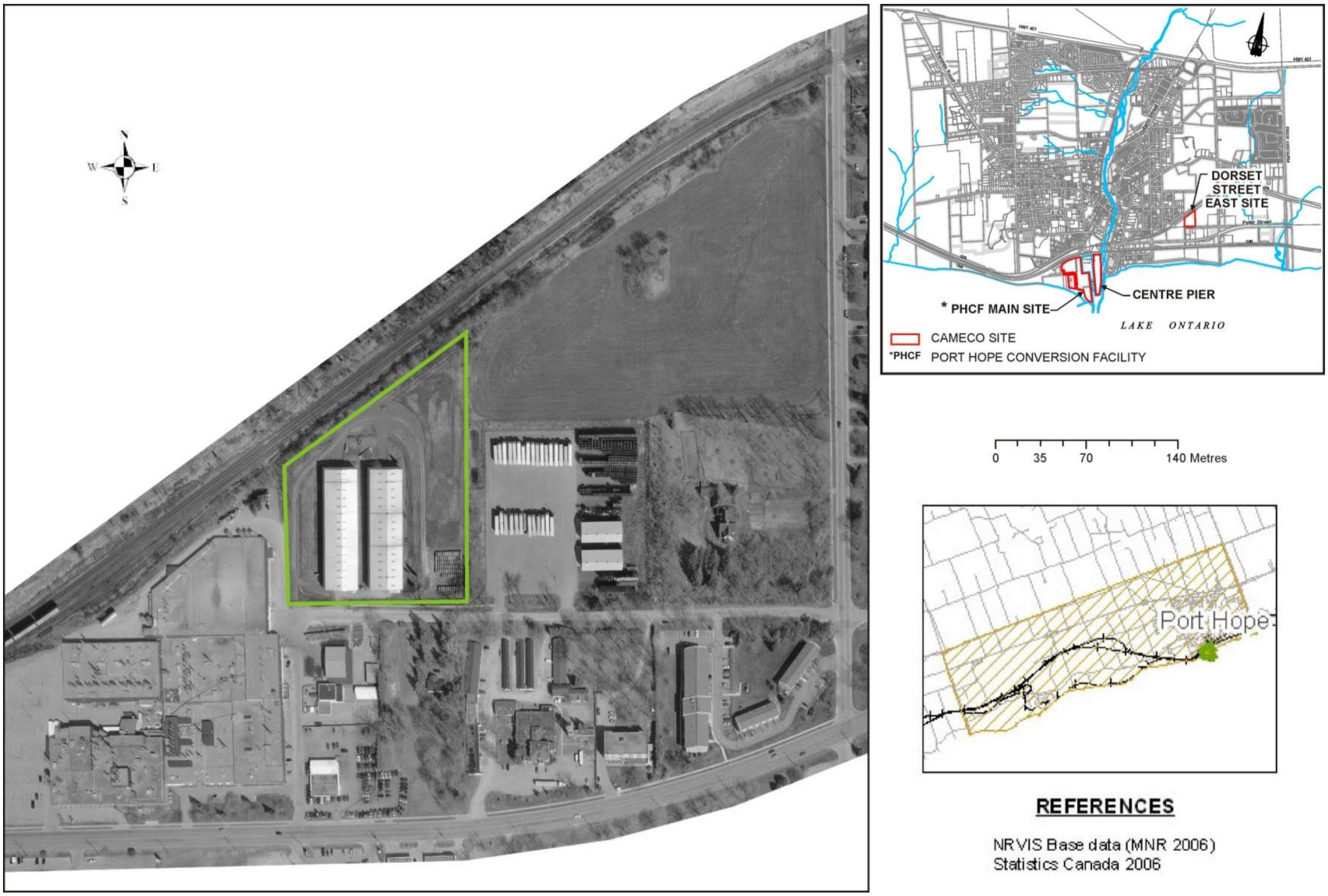
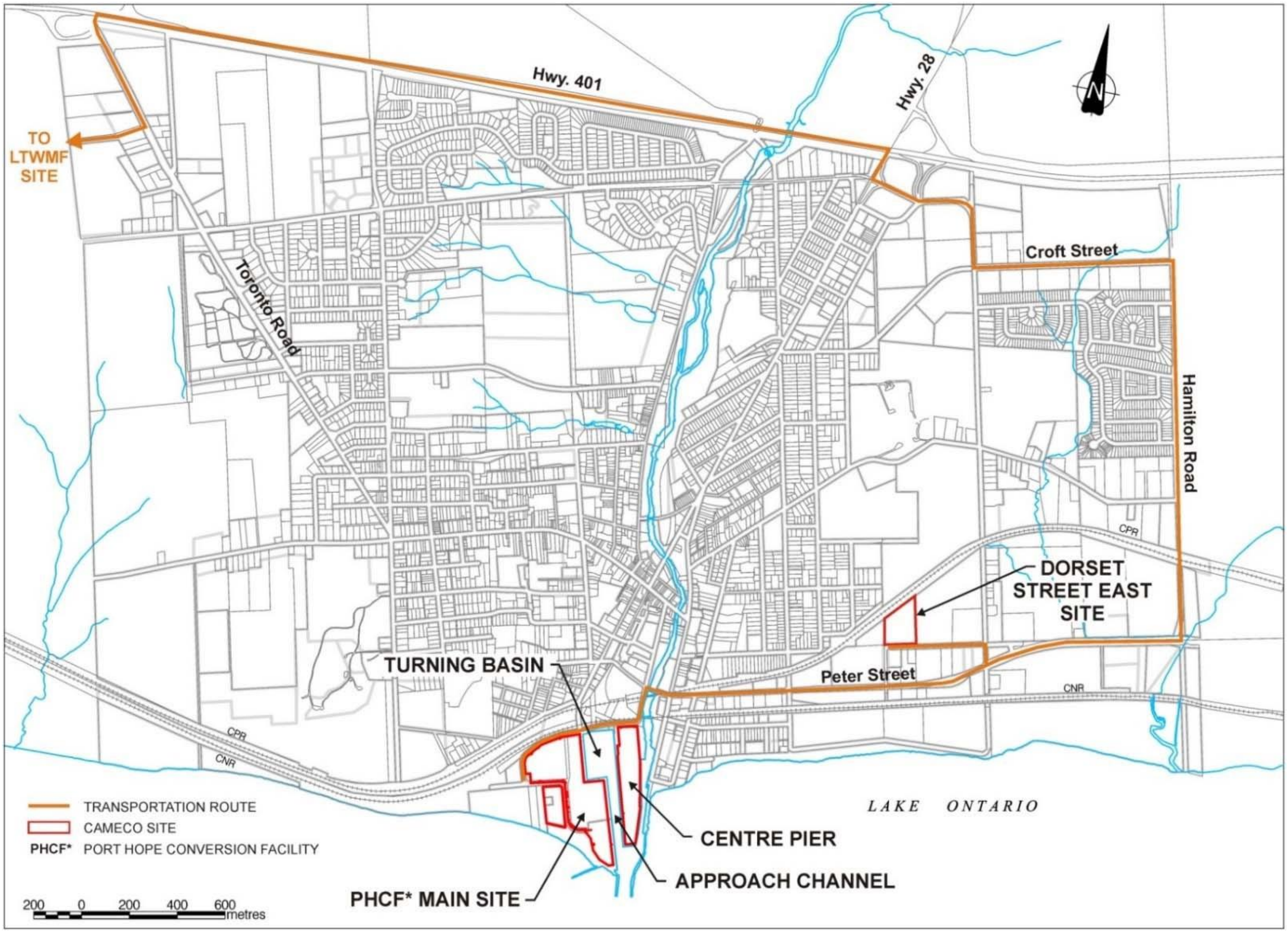


Figure 5 – VIM Transportation Route to LTWMF



2.3 VIM Project Scope

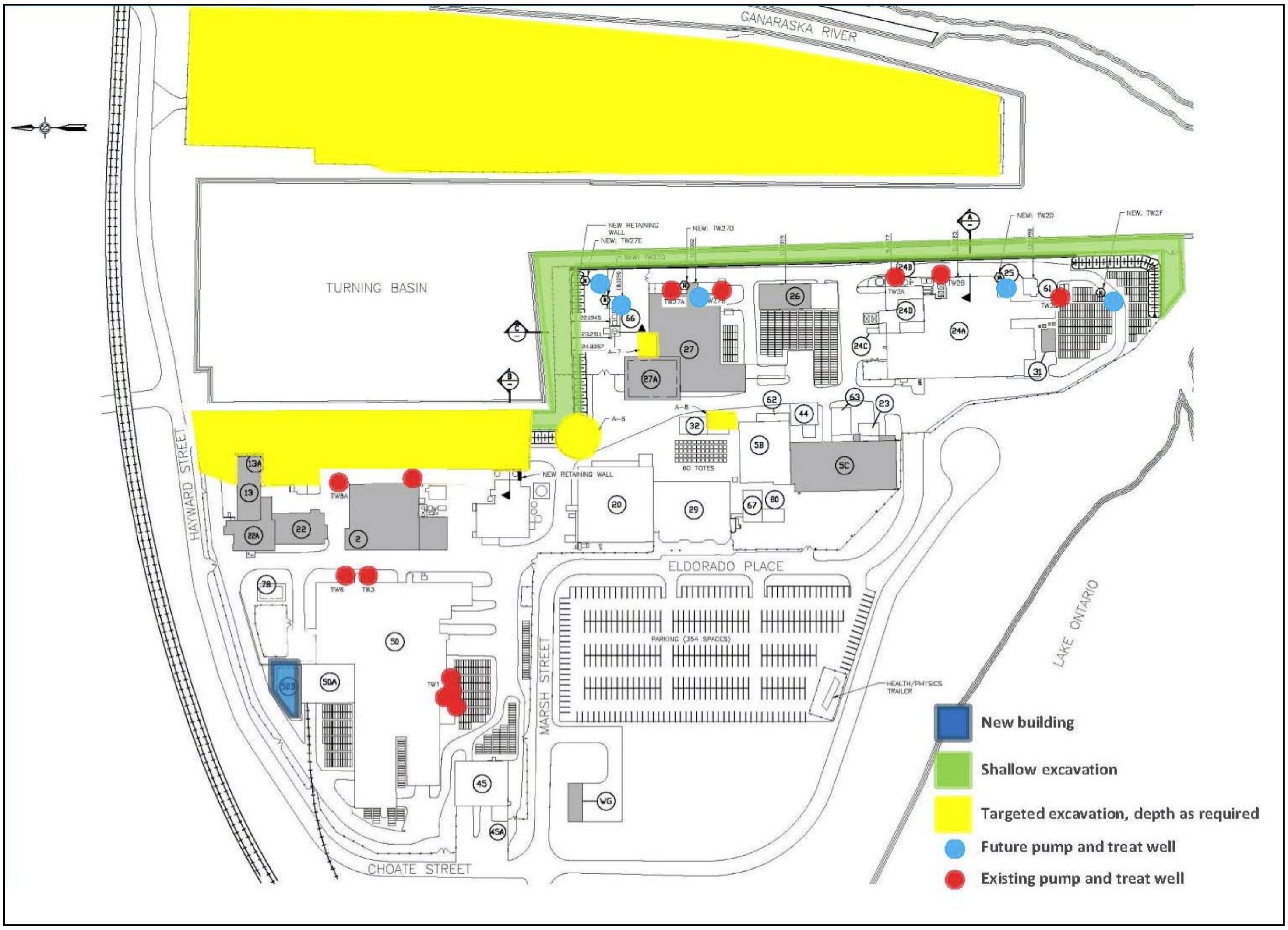
The VIM project is a relatively straight-forward project with distinct boundaries for remediation and defined activities. Specific tasks that will be undertaken as part of the VIM project at the PHCF Main Site, Centre Pier and the Dorset Street East Site include:

- Drums identified to be part of the VIM project (eligible for the LTWMF) will be sent to the LTWMF (including drums at Centre Pier, Cameco's Dorset Street East Site and the PHCF Main Site)
- Fenceline shift in accordance with land-transfer agreements (as shown in Figure 8)
- Parking lot modifications;
- Installation of flood protection barriers which will also provide gamma, noise and visual shielding as needed along the eastern fenceline;
- Improvements to stormwater management infrastructure including installation of new oil-grit separators and upgrades to existing underground piping to prevent groundwater intrusion into the stormwater system;
- Building demolition (Figure 6, illustrated on the redeveloped Main Site):
  - Main Site - Buildings 6, 7, 12, 12A, 14, 15 and 27 tower;
  - Centre Pier Buildings 40, 41, and 43;
- Equipment removal from buildings that will not be demolished:
  - Buildings 2, 5B, 5C and 31
  - Portions of Building 27 that will be repurposed
- Modifying buildings on Main Site:
  - Building 5C improved for CUP and waste management;
  - Building 26 façade improvements;
  - Building 27 repurposed for UO_2 product drum storage and shipping on the ground floor and varied storage on the second floor;
- New Building Construction on Main Site:
  - Building 50B constructed, housing the new waste water treatment facility;
  - Building 66 (Liquid Hydrogen Storage Compound) relocated to south of Building 24;
- Soil remediation for the VIM project on the Main Site is being targeted to specific areas (Figure 7, illustrated on the existing Main Site). The scope is based on modelled improvements to groundwater; and
- Five new pump and treat wells installed.

At the completion of the VIM project, Cameco will have successfully reduced the PHCF operational footprint to two licensed properties in the MPH, safely transferred wastes to the LTWMF and markedly improved the environmental performance of the site through the targeted removal of heavily contaminated soils and enhancement of the groundwater treatment system. Complete remediation of the site is not required as part of the VIM project because Cameco will continue to operate the PHCF under a CNSC licence following the project. This will ensure that appropriate regulatory oversight will be provided to confirm that Cameco continues to safely operate the facility and manage the subsurface contamination. This includes ongoing environmental monitoring, annual reporting of the performance of the groundwater management program, waste management, the periodic review of the ERA, and the periodic review of the facility preliminary decommissioning plan (PDP) and associated financial guarantee.

Figure 6 – Demolition and Construction Plan – PHCF Main Site

Figure 7 – VIM Remediation Plan



2.4 Demolition, Excavation, Construction and Waste Management Activities Carried Out Through the Clean-Up Program

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

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

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

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

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

2.5 Past Remediation Activities at Port Hope Conversion Facility

Following the discovery of subsurface contamination beneath the UF_6 plant in July 2007 and the discovery of subsurface contamination beneath the UO_2 plant in October 2008, Cameco undertook extensive investigations, which indicated that the contamination had moved beyond the building footprints.

Environmental management plans that included soil removal, rehabilitation of the plant and groundwater management to prevent the further movement of contamination from beneath the building footprint were developed to address the subsurface contamination and were implemented in numerous phases between 2008 and 2011. All of these activities were successfully completed and similar activites are included in the VIM project. The data collected as part of an enhanced groundwater and surface water monitoring program continues to demonstrate the effectiveness of these remediation activities.

2.6 Community Support

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

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

One of the methods Cameco uses to measure the success of its PIP is annual polling of Port Hope residents. Over the past 10 years, support for Cameco's operations has been measured at 80 percent or higher, with the community consistently indicating high levels of trust in the company and employees.

During the Vision 2010 EA, public surveys showed a high level of awareness and support of the Vision 2010 Project. The large majority of respondents who were aware of the project thought that it was "very important" or "somewhat important" for Cameco to undertake this initiative. There was a sense in the community that the Vision 2010/VIM project is needed, will benefit the community, and will help push forward other initiatives to improve the waterfront and the community as a whole.

Since the project was first announced to the public in late 2002, Cameco has recognized the importance of VIM as it relates to municipal and community plans for waterfront redevelopment after the PHAI is completed. Extensive public consultions were involved prior to and during the EA process and Cameco has attempted to accommodate community planning objectives wherever possible.

As the project has evolved, MPH and the public have been kept apprised through presentations to local groups, community forums, newsletters and the FSD website. Cameco will continue to reach out to the community during the relicensing process by making licensing documents publicly available, meeting with key stakeholders and providing additional information through its usual communication vehicles such as community forums, newsletters, the FSD website, advertisements and social media postings.

2.7 Aboriginal Consultation

Cameco is committed to provide opportunities to engage with First Nation and Métis communities regarding the PHCF's ongoing operations and Cameco's VIM project. The five First Nations identified as potentially being interested in the PHCF licence renewal and the VIM project are:

- Alderville First Nation
- Hiawatha First Nation
- Mississaugas of Scugog Island
- Mohawks of the Bay of Quinte
- Curve Lake First Nation

These five First Nations were all identified as being potentially interested in the Vision 2010 (now VIM) project and were notified of public outreach activities and key milestones during the environmental assessment process.

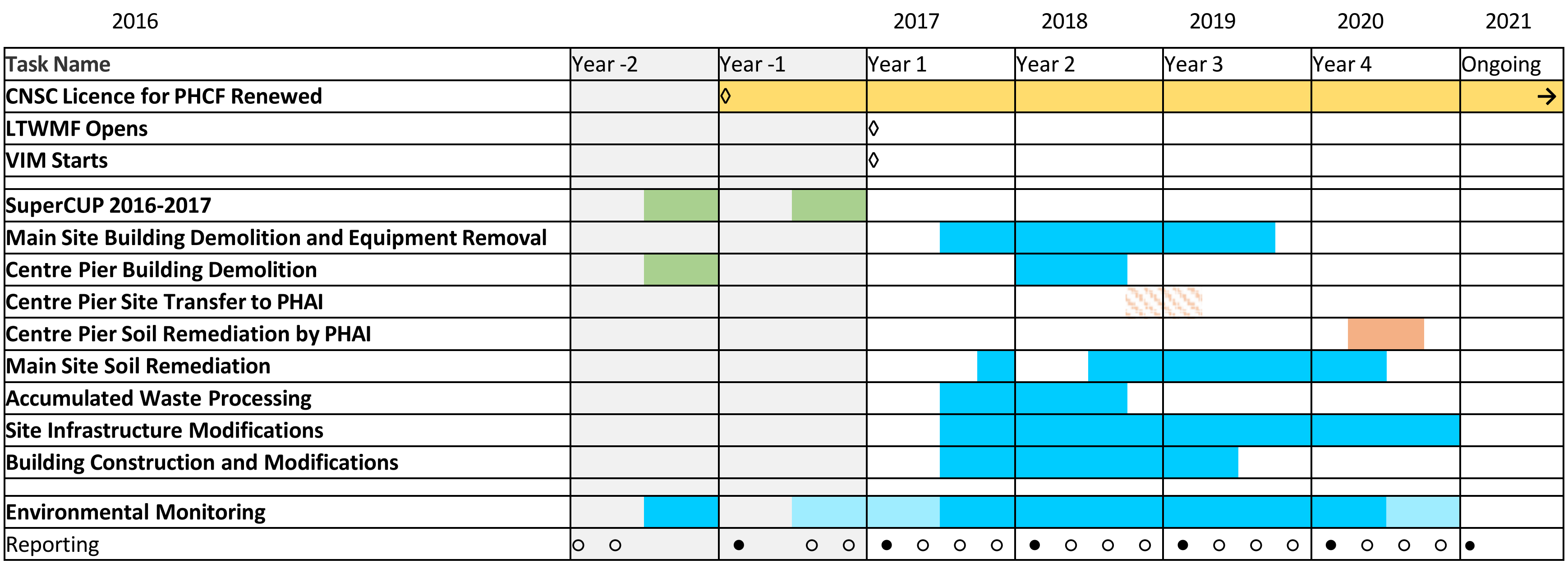
Cameco includes the chiefs (or designate) of the five identified First Nations and the Métis Nation of Ontario (MNO) on our mailing list to ensure that the First Nations and MNO are aware of all community forums and other community events. No concerns were raised regarding Vision 2010 during the previous or current licence period when we reached out to the identified First Nations. Cameco will continue outreach to the local First Nations and MNO throughout the licensing process and subsequent licence period.

As part of our pre-licensing consultation, Cameco will be sending a letter to the identified Aboriginal groups outlining our request for a new licence, significant planned activities and the length of the licence term. The letter will also include an invitation for a meeting. The letter will be followed up to confirm the letter receipt and to confirm whether there is interest in a meeting. Cameco anticipates the letters will be sent during the first quarter of 2016.

3.0 PROJECT SCHEDULE

The preliminary VIM Project Schedule is provided in Figure 8. This schedule is contingent on the PHAI LTWMF being available to receive LLRW in mid-2018. This schedule shows the general timeframe expected for each of the primary tasks outlined in Section 2.3. Also provided in Figure 9 is an illustration outlining some of the the major tasks and changes to the PHCF site over time, such as relocation of cylinder storage and fenceline shifts.

Figure 8 – Preliminary VIM Project Schedule

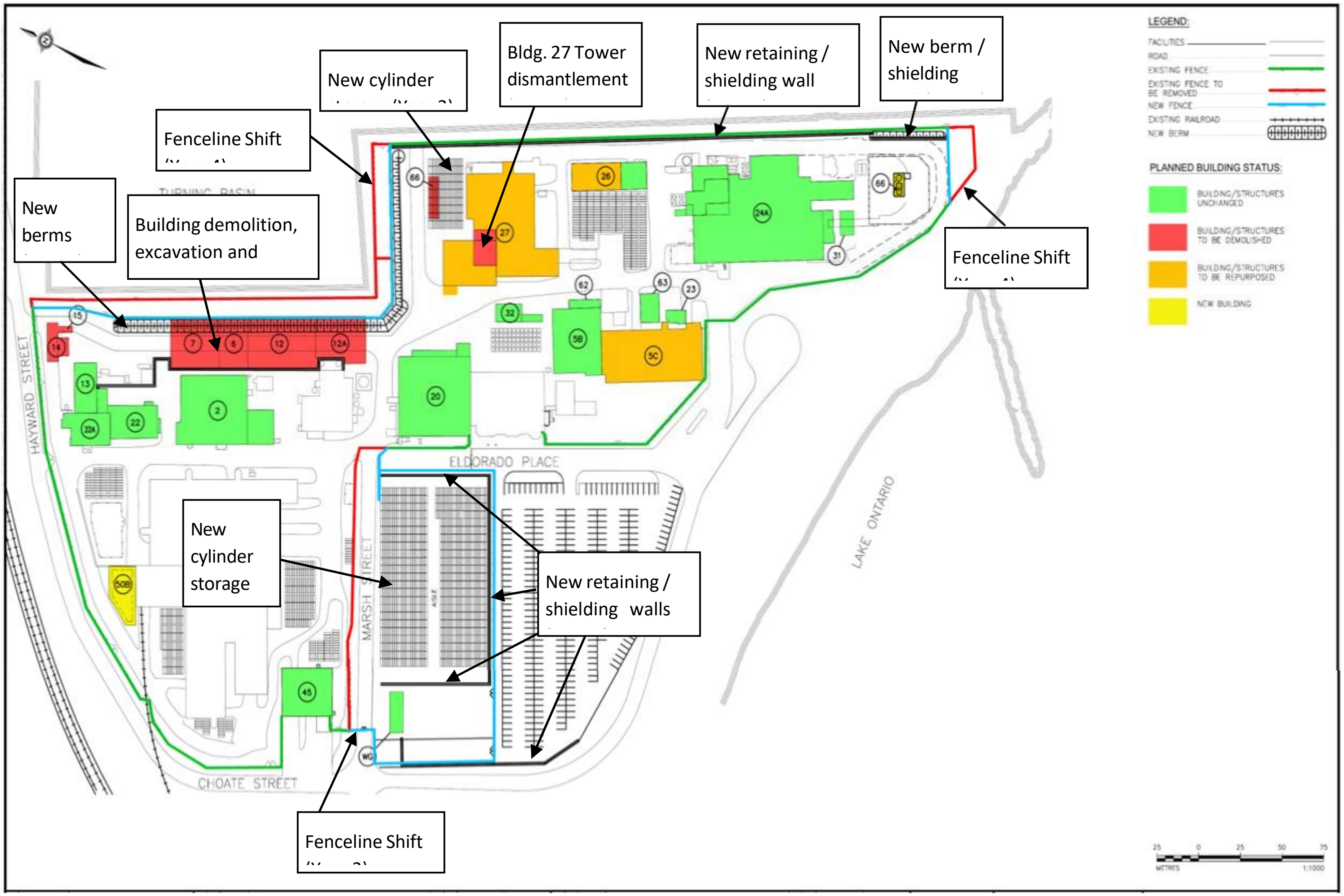


Notes

◊ Milestone
● Annual Compliance Report
○ Quarterly Compliance Report
Preliminary PHAI Activity PHAI Activity

VIM Activities
Preliminary / Follow-up VIM Activities
Current CUP Projects

Figure 9 – VIM PHCF Site Changes



4.0 PROJECT RESOURCES

Cameco has commited the resources to ensure the successful implementation of VIM. Cameco has the in-house expertise to undertake many of the specific technical tasks associated with the VIM project as well as oversight of contractors.

While resource planning is still in progress, Cameco expects that the majority of work undertaken by this project will be carried out by contractors with Cameco oversight. For example, demolition activities will be undertaken by a contactor with expertise in the demolition of industrial buildings. However, some aspects of the project, such as support services for work execution may be provided by Cameco employees or suitably qualified contractors.

All personnel involved in the project will follow existing site processes for work planning and contractor management to ensure that hazards are identified and that mitigation or controls are in place for radiation protection, health and safety including industrial hygiene, fire protection, environmental protection and quality. Wherever practicable, procedures or work instructions will developed for frequent activities and existing non- routine work control processes (i.e. JHA, TASC and/or radiation protection work permit) will be used where appropriate to ensure that worker and public safety will be maintained at or above the standard of the current programs. Cameco will ensure that VIM is planned and executed in a safe manner with oversight consistent with the requirements of the facility QMPM.

5.0 REGULATORY FRAMEWORK

Cameco operates under Nuclear Fuel Facility Operating Licence (FFOL-3631.00/2017). Cameco's Licence Renewal Application fully demonstrates the adherence of the PHCF's operations to the *Nuclear Safety and Control Act* (NSCA) and associated regulations.
Further, to meet the CNSC's stringent regulatory requirements, Cameco is responsible for implementing and maintaining environmental protection programs that identify, control and monitor all releases of radioactivity and hazardous substances and effects on the environment, including the public, from the PHCF. Cameco maintains programs, plans and procedures as described in the Facility Licensing Manual that meet the regulatory requirements for its on-going operations.

With the current request to specifically provide in the operating licence, the on-going authorization to engage in clean-up, decontamination, demolition and remediation activities (including VIM), this submission provides an overview of how existing programs, plans and procedures encompass these activities, and where project-specific documentation is required.

5.1 VIM Project Regulatory Oversight

The CNSC regulates nuclear facilities and activities in Canada to prevent unreasonable risk to the environment in a manner that is consistent with Canadian environmental policies, acts (including the NSCA) and regulations, and with Canada's international obligations.

Cameco submits quarterly and annual compliance reports to the CNSC which detail the results of the environmental protection programs related to the operations of the PHCF. VIM project specific monitoring will be reported to the CNSC through these reports.

5.2 PHCF Environmental Risk Assessment

The updated ERA to meet the requirements of Canadian Standards Association (CSA) standard N288.6-12, Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills is the most recent ERA completed for the site and includes a screening for contaminants of potential concern, a Human Health Risk Assessment (HHRA), Ecological Risk Assessment and additional studies regarding physical stressors such as temperature and entrainment. This recently completed work has been provided to the CNSC and a summary will be made publically available. The ERA made the following recommendations, which will be taken into consideration during the planning, implementation and follow-up to the VIM project:

- Contamination in the grass patch along the harbour walls needs to be addressed, in coordination with VIM and PHAI;
- Cameco should ensure that decision-making during VIM is risk-informed where appropriate; and,

- Once remediation activities under VIM are complete, Cameco should review its soil monitoring program to ensure that it is adequate for the new conditions.

5.3 Environmental Assessment Reviews

The comprehensive study EA for the Vision 2010 project was completed in 2011 under CEAA. The CNSC was the only Responsible Authority for the project with Federal Authorities including Health Canada, Fisheries and Oceans Canada, and Natural Resources Canada with EC providing technical expertise during the review process. As previously outlined, the CSR was the subject of a CNSC public hearing in May 2012, and the EA for Vision 2010 was accepted by the Federal Minister of the Environment in December 2012.

5.3.1 EA Follow-up Monitoring Program

The preliminary scope of the EA Follow-up Monitoring Program focused on the potential environmental effects of the project, namely airborne particulate, radioactive constituents associated with the particulate (uranium and ^{226}Ra) and noise. Appendix 2 provides the EMP-VIM.

Throughout the VIM and PHAI Port Hope projects, PHCF will carry out its Environmental Monitoring Plan (EMoP) to the extent practicable. Certain aspects of the plan may require partial or full suspension to accommodate the activities of the two projects. Examples include:

- Soil monitoring results during VIM and PHAI will be inconclusive with respect to differentiating the impact of PHCF or VIM activities due to influence from other projects (i.e. PHAI). If the soil monitoring locations in the current program remain accessible, Cameco will continue to collect soil samples on an annual basis, with the caveat that interpretation of the results will not be feasible during this time.
- The surface water monitoring program will be suspended during the period of time that the PHAI has the harbour isolated and is carrying out harbour remediation activities.
- In order to facilitate different parts of VIM, some groundwater wells (monitoring and/or collection wells) may require abandonment or may be inaccessible due to adjacent activity. This may result in temporary deviation from the groundwater monitoring and/or collection programs.

All deviations from the EMoP would be documented in the quarterly compliance reports with an explanation of the rationale, expected timeframe and mitigative measures (if required) that are in place. Section 6.3 provides a summary of the Follow-up Verification or Changes to EMoP related to VIM.

Post-VIM/PHAI, Cameco will re-evaluate the site operations, potential impacts and determine what modifications may be required to the programs, following the guidance of the applicable standards and regulatory documents listed in the PHCF Licence Conditions Handbook (LCH). These potential changes to the EMoP will require prior notification to CNSC staff.

6.0 PROJECT HAZARDS AND CONTROLS

From an environmental, radiological and health and safety perspective, the activities associated with the tasks described in section 3.0 can be grouped as follows:

- Transfer of accumulated wastes: These activities include the preparation and transfer of drummed and bagged wastes from storage to the LTWMF.
- Demolition activities: These activities include removal of hazardous materials from interiors; removal of equipment, material and building services; cleaning of building interiors; building dismantlement; and management of removed demolition waste.
- Excavation activities: These activities include the targeted removal of soil at both the Main Site and the Centre Pier. The excavation method to be used will depend on the subsurface soil and groundwater conditions, the depth of excavation, and the proximity to facilities. Excavation will include shallow excavations above the groundwater table and excavations that extend to or below the groundwater table.
- Construction activities: These activities include modifications to existing buildings, potential construction of a new building or building addition and upgrades to site infrastructure, such as pipe racks, underground utilities as well as on-site roads, parking, fencing and lighting and finished grading.
- Transportation and disposal of contaminated and non-contaminated materials: Contaminated wastes will be transported to the LTWMF. Non-contaminated waste materials may be transported to other waste outlets. Materials to be transferred to the LTWMF include drummed wastes, contaminated soils, demolition debris, and asbestos-containing material.

The VIM project will be undertaken within the general framework of the programs and plans currently in place at the PHCF, with project-specific documentation put in place where required. From the activities described above, the following Safety and Control Areas (SCAs) may be affected:

- Management System
- Human Performance Management – Training
- Safety Analysis
- Physical Design
- Radiation Protection
- Conventional Health and Safety
- Environmental Protection
- Emergency Management and Fire Protection
- Waste Management
- Security
- Safeguards
- Handling, Storing, Packaging and Transport

- Facility Specific
    - Public Information Program
    - Aboriginal Engagement

6.1 VIM Project - Management Systems

The VIM project will be executed through the existing PHCF CUP (WMP-02) framework and site management system (QMPM). Consequently the programs and procedures defined in the QMPM and WMP-02 are applicable to VIM. Planning for CUP projects incorporates an assessment of the relevant safety and control areas. Further discussion is provided in Table 2.

Appendix 2 of this document provides the Supplemental Environmental Monitoring Plan for VIM (EMP-VIM). This plan was developed to augment Cameco's existing EMoP, which monitors the effects of Cameco's on-going operations. The Environmental Monitoring Plan (EMP-VIM) for the VIM project is focused on monitoring for the expected demolition, construction, remediation and radiological effects that are possible as a result of VIM activities and will only be applied for the period of the VIM project.

6.2 PHCF Programs, Plans and Procedures

The following table outlines the existing site documentation that fulfil these requirements, and where applicable, what supplemental plans/assessments may be required.

Table 1: Summary of PHCF Environmental and Health and Safety Programs, Plans and Procedures

Area of Interest	Relevant Site Program/Plan/Procedure	Non-routine Process or Supplemental Plan Required
Management System	The PHCF Quality Management Program Manual (QMPM) and all requirements therein apply to the VIM project.	N/A
Human Performance Management - Training	No change to existing training measures are needed for this project. The existing training/orientation requirements for this work are defined in WMP-02 and contractor training is managed as per the requirements of the Contractor Safety Management Plan.	Any specialized contractor requirements would be defined through the procurement process, and the appropriate documentation provided for Cameco review and acceptance prior to work commencing.
Safety Analysis	The EA provided a comprehensive assessment of the project and any potential impacts. Additional assessments have been completed as part of the project planning, including a screening-level risk assessment and gamma modelling.	All work will require a Job Hazard Analyses (JHA), procedure or other work instruction that will identify potential hazards and controls for specific tasks within the project.
Physical Design	All CUP-type projects require adherence to the Process and Design Change Control Procedure (CQP-113).	N/A
Radiation Protection	The project work areas have potential for radiation exposure. Radiation protection for employees and contractors involved in the project will follow the current practices described in the Radiation Protection Program Manual (RPPM). All workers with the potential for a dose greater than the public dose limit will be trained and designated as Nuclear Energy Workers (NEWs). All NEW workers will be monitored through the internal and external dosimetry programs described in the RPPM and associated procedures. Other measures described in the RPPM pertaining to zone control, contamination control and work planning are also applicable.	Radiation Protection Work Permits (RPWP) will be issued if specific activities have the potential for increased radiation exposure. A combination of operational controls and limited work duration may be necessary to ensure that the potential dose is kept as low as reasonably achievable.
Conventional Health and Safety	Conventional health and safety, including industrial hygiene will be managed in accordance with the Occupational Health and Safety Management Program Manual and the Contractor	The following risk mitigation tools may be used to augment the JHA and TASC assessments to ensure work is completed as safely as possible.

Area of Interest	Relevant Site Program/Plan/Procedure	Non-routine Process or Supplemental Plan Required
	Safety Management Plan. Activities under the VIM project will require the use of procedures, work instructions, JHA and/or Task Analysis Safety Card (TASC) assessments to identify and manage potential hazards.	The specific risk mitigation tool requirement(s) for each will be determined during the development and approval of the JHA for each job. - Notification and Safety Clearance - RPWP - Confined Space Entry Permit - Hot Work Permit - Safety Clearance for High Voltage Equipment and Hazardous Electrical Work - Exception to Zero Energy State Permit - Excavation Permit
Environmental Protection	The existing EMoP is primarily designed to monitor the ongoing impacts of the current production operations. While ambient monitoring programs will continue, and will provide data that may be relevant to the project, supplemental monitoring will be required that is appropriate to the project tasks. Existing operational controls such as designated processing areas with emission and noise controls, and contamination control practices will support the environmental protection aspects of the project.	A supplemental EMP for VIM will be implemented during the VIM project. This plan outlines monitoring appropriate to specific activities and is not intended to be applied in its entirety for the duration of the project, rather used to define the specific monitoring parameters (i.e. ambient air and acoustical measurements) to be applied to each work package.
Emergency Management and Fire Protection	No change to existing emergency preparedness measures are needed for this project. The existing Emergency Response Plan, Fire Safety Plan and Fire Protection Plan and associated work controls such as hot work permits will be used to prevent and/or mitigate an emergency during the project.	Project sequencing will take into consideration accessibility for the emergency response vehicles to different areas of the facility during VIM to ensure that areas of the facility are not isolated/stranded.
Waste Management	All materials removed during the VIM project will be processed in accordance with WMP01 – Waste Management Plan and WMP02 – Clean-Up Program. This will involve segregation at source (where practical) into recyclable,	Special handling is required for wastes identified to contain depleted uranium or enriched uranium; to be polychlorinated biphenyl (PCB)-contaminated; and asbestos or other hazardous

Area of Interest	Relevant Site Program/Plan/Procedure	Non-routine Process or Supplemental Plan Required
	contaminated combustible, contaminated non-combustible and uncontaminated waste. Processing of materials will occur in designated areas. The VIM project includes transfer of materials meeting the WAC to the LTWMF being constructed by the PHAI.	material (ie. hydrogen fluoride) –containing. Any of these wastes would be segregated and managed as per the WMP-01.
Security	The security of the licensed site will be maintained as per the Facility Security Plan for the duration of the project.	Temporary deviations from existing security measures (i.e. during fenceline shift or licence transfer of Centre Pier) will be completed in a manner to ensure an equivalent measure of security.
Safeguards	All transfers of stored wastes and/or wastes generated during the VIM project will be managed in accordance with Cameco's existing safeguards practices, including inventory and reporting as per RD-336 Accounting and Reporting of Nuclear Material.	N/A
Handling, Storing, Packaging and Transport	Existing site procedures for handling, storing, loading, transporting and receipt of nuclear substances and other dangerous goods are sufficient to cover the aspects of this project.	N/A
Facility-Specific	The tools within the Public Information Program for the facility are sufficient to provide ongoing information to interested members of the public as well as outreach to First Nations, municipal officials and other key stakeholders.	N/A

6.3 VIM Hazards and Mitigation

The VIM specific plans that will be developed to guide VIM specific activities include:

- environmental monitoring plan (EMP-VIM) (Appendix A); and
- building-specific equipment removal and demolition plans

Table 2 provides a summary of the potential environmental effects (hazards) associated with the VIM Project and commitments to mitigate the effects as identified in the CSR for the Vision 2010 Project. A summary of any VIM monitoring will be included in Cameco's quarterly and annual compliance reports.

Table 2: Summary of Potential Environmental Hazards and Mitigation for the VIM Project

Potential Environmental Effects (Hazards)	Project Activities	Mitigation and Monitoring During VIM	Follow-up Verification or Changes to EMoP
Radiation and Radioactivity - Potential public and worker exposure to elevated dose levels	On-going site activities (totes, drums and cylinder storage)	a. soil berm or concrete barrier b. fenceline gamma monitoring (ongoing) c. worker dosimetry program	1. Post-VIM follow-up fenceline gamma monitoring and final report to confirm effectiveness
Air Quality - Generation of airborne particulate and associated contaminats of concern	Demolition, soil excavation and construction activities	a. employing effective dust mitigation techniques b. ensuring that all mobile equipment used on site is in good repair c. air monitoring as part of EMP-VIM	1. Soil monitoring program scope and objectives to be reviewed post-VIM and deposition during the project should be considered.
Air Quality - Generation of airborne particulate and vehicle exhaust	Transportation activities	a. ensuring that all dump trucks travelling to and from the PHCF site are in good repair and fitted with functioning mufflers b. dump trucks will be appropriately covered when transporting contaminated soils	N/A – only applicable during project.
Noise - Elevated levels at sensitive receptors	Demolition activities	a. prohibiting the use of explosives b. limiting demolition activities to daytime hours to the greatest extent possible c. ensuring that all mobile equipment used on site is in good repair, fitted with functioning mufflers and comply with the noise emission standards outlined in MOECC guidelines d. ensuring that all dump trucks travelling to and from the PHCF site are in good repair and fitted with functioning mufflers e. complying with the time and place restrictions stipulated for construction activities in the local noise by-law f. noise monitoring as part of EMP-VIM	N/A – only applicable during project.
	Excavation activities	a. limiting excavation activities to daytime hours to the greatest extent possible	N/A – only applicable during project.

Potential Environmental Effects (Hazards)	Project Activities	Mitigation and Monitoring During VIM	Follow-up Verification or Changes to EMoP
		b. ensuring that all mobile equipment used on site is in good repair, fitted with functioning mufflers and comply with the noise emission standards outlined in MOECC guidelines c. complying with the time and place restrictions stipulated for construction activities in the local noise by-law d. noise monitoring as part of EMP-VIM	
	Construction activities	a. ensuring that all mobile equipment used on site is in good repair, fitted with functioning mufflers and comply with the noise emission standards outlined in MOECC guidelines b. limiting construction activities to daytime hours, to the greatest extent possible c. maximizing the separation distance between the construction staging areas and nearby receptors to the greatest extent possible d. maintaining on-site construction haul roads to prevent pot holes and ruts thereby avoiding the loud noises caused by construction vehicles travelling over uneven road surfaces e. complying with the time and place restrictions stipulated for construction activities in the local noise by-law f. noise monitoring as part of EMP-VIM	N/A – only applicable during project.
	Transportation of waste	a. ensuring that all dump trucks travelling to and from the PHCF site are in good repair and fitted with functioning mufflers b. limiting on-site truck traffic to daytime hours to the greatest extent possible	N/A – only applicable during project.
Surface Water Quality - Runoff during storm events - also protects aquatic habitat	Demolition and excavation activities	a. construction of diversion dykes to channel runoff around the excavation areas b. covering of stockpiles and excavated soil with secured tarps or plastic sheeting during significant storm events c. placing sand bags, water-filled bags or equivalent to prevent surface water escape	1. Stormwater and surface water monitoring programs to be re-evaluated post-VIM.

Potential Environmental Effects (Hazards)	Project Activities	Mitigation and Monitoring During VIM	Follow-up Verification or Changes to EMoP
		d. allowing surface water inside disturbed work areas to drain to open excavations to be collected for treatment, as required e. protecting catch basin inlets using filter fences, geotextiles or an excavated sediment trap f. implementing of velocity controls and temporary water holding areas g. flood diversion capability through emergency response plan	
Sediment Quality - Runoff during storm events - also protects aquatic habitat	Demolition, excavation and construction activities	During severe precipitation events, the following may be implemented to restrict work: a. evaluating the safety of haulage to the LTWMF b. evaluating the excavation along the harbour wall and securing equipment and materials, if necessary c. covering stockpiles to minimize runoff d. covering all bins and roll-off containers e. filling excavations in advance, if possible, when flood warnings are given f. flood diversion capability through emergency response plan	N/A – only applicable during project.
Groundwater	On-going operation	a. contaminated soil remediation; b. installation of five new groundwater treatment wells c. groundwater monitoring program d. water treatment through waste recovery e. potential treatment and release of treated groundwater	1. Groundwater treatment system risk-based performance objectives to be developed and implemented. 2. Groundwater monitoring program to be reviewed and revised where appropriate to assess (annually) objectives from 1.
Severe Precipitation and Climate Change	Excavation activities	a. improvements to storm water management, (i.e. grit separators)	1. Storm water control study to be completed post-VIM to establish a new baseline.

Potential Environmental Effects (Hazards)	Project Activities	Mitigation and Monitoring During VIM	Follow-up Verification or Changes to EMoP
		b. adaptive mangement (review stormwater management capacity if severe storm intensity have increased in severity due to climate change) c. flood diversion capability through emergency response plan	2. Stormwater monitoring program to be reviewed and revised where appropriate based on 1.
Malfunctions and Accidents	Contaminant spill resulting in harbour contamination	a. existing plans and proceedures for safe operations b. spill containment practices c. emergency response plan d. event-specific sample collection and analysis	N/A – only applicable during project.
	Release of anhydrous HF (AHF), UF_6 or other hazardous material during removal of piping and equipment	a. existing plans and procedures for safe handling of hazardous materials b. project specific plans including: i. dismantlement, decontamination and demolition plan ii. safety clearances for hot work iii. adequate training and use of personal protective equipment (PPE) iv. sequencing of demolition and equipment removal activities v. portable fume collection c. spill containment practices d. emergency response plan e. event-specific sample collection and analysis	N/A – only applicable during project.
	Transportation accident involving release of uranium into the Ganaraska River	a. existing plans and procedures for the safe handling of these materials b. spill containment c. emergency response plan d. event-specific sample collection and analysis	N/A – only applicable during project.

Following VIM, the following facility assessments will need to be updated to reflect the changes to the facility:

1. Safety Report
2. Environmental Risk Assessment
3. Preliminary Decommissioning Plan
4. Emission Summary Dispersion Model Report
5. Derived Release Limit and Operating Release Levels

The results of this work will then need to be incorporated into the Environmental Management Program and the EMoP modified as necessary. It is anticipated that the following aspects of the EMoP may require changes post-VIM:

1. Ambient air monitoring
2. Soil monitoring
3. Groundwater monitoring
4. Surface water monitoring
5. Stormwater monitoring
6. Fenceline gamma monitoring

7.0 CONCLUSION

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

- Waste materials at the PHCF within the defined remediation scope will have been transferred to the LTWMF (or other waste outlets as appropriate).
- New or modified infrastructure will have been commissioned as needed to support the project objectives for building modifications and new infrastructure.
- The environmental objectives of the project will have been achieved.
- Improvements to the PHCF, which are consistent with the community planning objectives for development of the lands around the Port Hope harbour will have been completed, including the transfer of the Centre Pier property back to the MPH.

The VIM project will be executed within the CUP program framework which permits Cameco to remove obsolete buildings, equipment and materials for the purpose of reducing environmental obligations, creating useable space and improve the appearance of the facility. As described in sections 2.4 and 2.5 Cameco has demonstrated the robustness of this program in recent years through the safe completion of CUP projects with activities similar to the VIM project.

As part of licence renewal activities occurring in 2016, Cameco requests that the operating licence for the PHCF specifically provide the authorization through a site-specific licence condition for PHCF to engage in clean-up, decontamination, demolition and remediation activities (including VIM) that are currently part of the licensing basis through the Facility Licensing Manual, Waste Management Plan and Clean-Up Program.

8.0 REFERENCES

Canadian Nuclear Safety Commission. 2012. *Proposed Comprehensive Study Report for Cameco Corporation's Proposed Redevelopment of the Port Hope Conversion Facility (Vision 2010)*; CEAR 06-03-22672. May.

Cameco Corporation. 2010. *Cameco Vision 2010 Environmental Impact Statement – December 2010*

ERA Documents

SENES Consultants Limited. 2009a. *Port Hope Conversion Facility Site-Wide Risk Assessment: Human Health and Ecological Risk Assessment.* Prepared for Cameco Corporation.

SENES Consultants Limited. 2009b. *UPDATE - Port Hope Conversion Facility Site-Wide Risk Assessment: Human Health and Ecological Risk Assessment*, Prepared for Cameco Corporation.

SENES Consultants Limited. 2010. Follow Up – *Port Hope Conversion Facility Site- Wide Risk Assessment: Human Health and Ecological Risk Assessment.* Prepared for Cameco Corporation.

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Appendix 1 – List of Acronyms Used in the Supplemental VIM Submission

Cameco	Cameco Corporation
CEAA	*Canadian Environmental Assessment Act*
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CSA	CSA Group - internationally-accredited standards development and testing & certification organization
CSR	Comprehensive Study Report
CUP	Clean-Up Program
EA	Environmental Assessment
EC	Environment Canada
ECA	Environmental Compliance Approval
EIS	Environmental Impact Statement
EMoP	Environmental Monitoring Plan
ERA	Environmental Risk Assessment
FFOL	Fuel Facility Operating Licence
HF	Hydrogen fluoride
HHRA	Human Health Risk Assessment
JHA	Job Hazard Analysis
LCH	Licence Conditions Handbook
LTWMF	Long-term waste management facility
MOECC	Ontario Ministry of the Environment and Climate Change
NEW	Nuclear Energy Worker
NSCA	*Nuclear Safety and Control Act*
PCB	Polychlorinated biphenyl
PHAI	Port Hope Area Initiative
PHCF	Port Hope Conversion Facility
PIP	Public Information Program
QMPM	Quality Management Program Manual
RPPM	Radiation Protection Program Manual
SCA	Safety and Control Area
Centre Pier	Property at 1 Hayward Street used for storage
PHCF Main Site	Property at 1 Eldorado Place used for operations and storage

Dorset Street East	Property at 158 Dorset Street East used for storage
UO_3	uranium trioxide
UO_2	uranium dioxide
UF_6	uranium hexafluoride
VIM	Vision in Motion Project
VIM EMP	Vision in Motion Environmental Monitoring Plan
WAC	Waste Acceptance Criteria
WMP-01	Waste Management Plan
WMP-02	Clean-Up Program

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Port Hope Conversion Facility

Addendum to Supplemental VIM Submission

December 2024

Vision in Motion Activities Completed 2018-2024 and Plan for 2025-2030

1.0 Vision in Motion Project

The Vision in Motion (VIM) project is a unique opportunity made possible due to the Port Hope Area Initiative (PHAI). The PHAI Port Hope project is being undertaken by Canadian Nuclear Laboratories (CNL) and includes the construction of a long-term waste management facility (LTWMF) in the Municipality of Port Hope (MPH). A framework for coordination of activities between PHAI and Cameco is in place to link the teams in each organization working on similar aspects of the project such as regulatory activities, public outreach and communication and environmental monitoring.

VIM entails an extensive remediation and redevelopment of much of the Port Hope Conversion Facility (PHCF) and includes:

- the clean-up and demolition of a number of old or underutilized buildings;
- the removal of contaminated soils, building materials and stored wastes; and
- the construction of new replacement buildings, additions, or modifications to existing buildings at the PHCF with associated landscaping and infrastructure.

Overall, the VIM project is facilitating environmental remediation, improved site operations, enhancement of site safety and security through site design, and improved aesthetics. Changes at the PHCF will result in modifications in the ongoing management of the site related to storage of uranium trioxide (UO_3), uranium dioxide (UO_2) and uranium hexafluoride (UF_6).

2.0 Vision in Motion Project

The 2001 federal/municipal agreement which established the PHAI specifies that approximately 150,000 m^3 of Cameco decommissioning waste materials arising at the PHCF and other specified locations are to be accommodated in the Long-Term Waste Management Facility (LTWMF), which is located in the MPH. This agreement provides Cameco with a limited window of opportunity, during the time that the LTWMF is receiving wastes, in which to transport waste for long term management at the LTWMF.

The scope of the VIM project has evolved since 2001 and throughout its development, Cameco has promoted the project through various forums and with a variety of stakeholders (including local government, regulatory agencies, Indigenous and community groups and the public). In late 2005/early 2006, prior to completion of the Project Description for the Environmental Assessment, Cameco engaged in an extensive public consultation involving more than 600 local residents and other stakeholders, including the Municipality of Port Hope and non-governmental organizations. The feedback received during these consultations provided direction to Cameco as it explored options for site redevelopment.

Cameco continued to both formally (public meetings, workshops) and informally (phone calls, one-on-one conversations) consult with the public throughout the EA process. The community was also informed about project developments through its community forums, newsletters, website, and other public information activities. This dialog with the community has been ongoing since that time.

Cameco has worked very closely with the Municipality of Port Hope to ensure that VIM is as consistent with community planning objectives for waterfront redevelopment as possible.

One of the areas in which the direction from both the community and MPH was clear from both early and ongoing consultations was a desire to see the facility move away from the harbour, wherever possible. With the Centre Pier becoming publicly accessible following completion of VIM and the PHAI, there was a desire to open that area of the waterfront for increased public use.

The EA's conclusions for Vision 2010 (now rebranded as Vision in Motion) were accepted by the Federal Minister of the Environment in December 2012. Work was then undertaken to refine the scope of the project. In January 2014, Cameco engaged in consultation with its three primary regulators, the Canadian Nuclear Safety Commission (CNSC), Environment Canada (EC) and the Ontario provincial Ministry of the Environment (now Ministry of the Environment, Conservation and Parks (MECP)) and provided an overview of the scope for VIM at a joint regulatory meeting in Port Hope. In February 2014, the three regulatory agencies provided Cameco with letters supporting the further development of the VIM project as outlined at the January meeting.

The VIM project is authorized by Nuclear Facility-Specific Licence Condition 16.1, which authorizes Cameco to implement and maintain a program to carry out clean-up, decontamination, demolition, and remediation work at PHCF. This licence condition was included in FFOL-3631.00/2027, issued in 2017 as part of the 10-year operating licence for the PHCF.

3.0 VIM Project Progress by Year

The following sections outline the key milestones completed each year of the project

2016

- Licence renewal including request for site specific licence condition to carry out VIM

2017

- Waste Acceptance Criteria developed by Cameco and PHAI
- Supplementary environmental monitoring program developed for VIM
- Protocol for handling safeguarded wastes developed
- Magnesium fluoride and depleted uranium titanium oxide drum transferred from Centre Pier to Building 5 for dumping into lift bags
- Wastes in lift bags transferred back to Centre Pier for interim storage
- Building 27 asbestos abatement
- Waste profiles developed for CNL

2018

- LTWMF opens for the receipt of waste in June
- Shipments of Cameco waste stored on Centre Pier initiated
- CNL removed contaminated soil pile stored on Centre Pier
- Building 70 VIM office established

2019

- Transfer of wastes from Centre Pier to LTWMF completed in January
- Buildings 40, 41 and 43 located on Centre Pier demolished
- Cameco's licensed activities on Centre Pier terminated and CNL assumes control of this property
- Accumulated wastes from main site start transferring to Cameco's 158 Dorset Street East property for characterization, processing, and shipment to the LTWMF
- Civil works initiated to relocate pipe racks, utilities, and upgrade the sanitary sewer system
- The rail spur for anhydrous hydrogen fluoride delivery was upgraded
- Area 1 soil remediation (south of Building 24) completed and new civil infrastructure was initiated
- Building 27 equipment and other internal infrastructure removal was initiated

2020

- VIM progress was limited in 2020 due to the COVID-19 pandemic
- Building 27 equipment removal continued
- Building 27 accumulated waste transferred to 158 Dorset Street for characterization, processing, and shipment to the LTWMF
- Area 1 storm was management systems substantially completed
- A new liquid hydrogen system was installed in Area 1
- Decision made to demolish Building 27 rather than repurpose
- Drummed waste processing continued at 158 Dorset Street to the extent possible

2021

- Additional work stoppages were experienced in 2021 due the COVID-19 pandemic
- Building 27 internals removal continued
- Planning for remediation of the area west of the harbour was initiated
- Commissiong of the new liquid hydrogen station was initiated
- Drummed waste processing continued at 158 Dorset Street to the extent possible

2022

- Building 27 internals removal continued
- Building 27 tower hoarding was initiated in preparation for full demolition
- Commissioning of the new liquid hydrogen station was completed, and the old station was removed
- The VIM long term schedule was adjusted to be coordinated with the LTWMF schedule
- Drummed waste processing continued at 158 Dorset Street

2023

- Building 27 was completely disassembled to the ground floor concrete slab
- Demolition of Buildings 14 and 15 was initiated with internals removals complete by year end
- Building 2 equipment removal progressed
- Redundant equipment was removed from Building 5
- Drummed waste processing continued at 158 Dorset Street

- Redundant pipe rack removal continued

2024

- Building 2 equipment removal continued
- Building 14/15 demolition was completed
- A new drum dumping station was installed in Building 5
- A temporary UF_6 cylinder storage area was established north of the former Building 27
- A proof-of-concept trial was undertaken in an area west of the harbour and north of the warehouse

4.0 VIM Current Plan

Task	2025	2026	2027	2028	2029
Building 72 new build (replace Building 27)					
Warehouse Demolition					
Building 2 equipment removal					
158 Dorset Street shield walls					
Area 5 excavation and stabilization (area west of harbour					
Area 4 infrastructure (Building 72 area)					
158 Dorset Street accumulated waste					

- The VIM project schedule is such that it is coordinated with PHAI project. Cameco anticipates completion of the VIM project in 2029 prior the cap and closure of the PHAI project in 2030.
- Construction of new warehouse (Building 72) will be initiated in 2025 and should be completed in the same year.
- Demolition of the existing warehouse (Buildings 6, 7, 12 and 12A) will be initiated later in 2025 and should be completed mid 2026.
- Building 2 equipment redundant equipment removal will be completed in 2025.
- New shield wall installation at Cameco's 158 Dorset Street property (Buildings 64 and 65) will be completed in 2025.
- Area 5 excavation and stabilization will commence in mid 2026 once the warehouse has been demolished.
- Area 4 (centre of the site) infrastructure improvements will start in 2028 and finish in 2029. This includes some shallow excavations, stormwater system remediation, installation of two oil/grit separators and a flood control wall.
- Accumulated waste processing at 158 Dorset Street is in progress and is anticipated to be completed the end of 2027.

5.0 Conclusion

The VIM project has made significant process since 2017. The project is on track to be completed by 2029 resulting in significant sub-surface remediation in several areas of the site, improved site operations, enhanced safety, and security through site design and improved aesthesis.

27 Waste Nuclear Substance Licence, Canadian Nuclear Laboratories Ltd, Port Hope Area Initiative, Waste Management Project, Licence number WNSL-WI-2310.00/2032

Canadian Nuclear Commission
Commission canadienne Safety de sûreté nucléaire

File / Dossier: 2.05

WASTE NUCLEAR SUBSTANCE LICENCE
CANADIAN NUCLEAR LABORATORIES LTD.
PORT HOPE AREA INITIATIVE
WASTE MANAGEMENT PROJECT

I) LICENCE NUMBER: **WNSL-W1-2310.00/2032**

II) LICENSEE: Pursuant to section 24 of the *Nuclear Safety and Control Act*, this licence is issued to:

Canadian Nuclear Laboratories Ltd.
Laboratoires Nucléaires Canadiens ltée
286 Plant Road
Chalk River, Ontario K0J 1J0

III) LICENCE PERIOD: This licence is valid from **January 1, 2023** to **December 31, 2032**, unless suspended in whole or in part, amended, revoked, or replaced.

IV) LICENSED ACTIVITIES:

This licence authorizes the licensee to conduct the following activities located in the Municipality of Port Hope and Municipality of Clarington, Regional Municipality of Durham, Province of Ontario:

(a) possess, transfer, manage, and store nuclear substances, except Category I, II and III nuclear material as defined in section 1 of the *Nuclear Security Regulations*, that are required for, associated with or arise from historic waste remediation operations as more precisely described in the application.

V) EXPLANATORY NOTES:

(a) Nothing in this licence shall be construed to authorize non-compliance with any other applicable legal obligation or restriction.

(b) Unless otherwise provided for in this licence, words and expressions used in this licence have the same meaning as in the *Nuclear Safety and Control Act* and associated Regulations.

(c) The Port Hope Area Initiative Long-Term Low-Level Radioactive Waste Management Project Licence Conditions Handbook (LCH), LCH-WNSL-W1-2310.00/2032, provides compliance verification criteria including the codes, standards and regulatory documents used to verify compliance with the conditions in the licence. The LCH also provides information regarding applicable versions of documents and non-mandatory recommendations and guidance on how to achieve compliance.

VI) CONDITIONS:

G. GENERAL

G.1 Licensing Basis

The licensee shall conduct the activities described in Part IV of this licence in accordance with the licensing basis, defined as:

(i) the regulatory requirements set out in the applicable laws and regulations;

(ii) the conditions and safety and control measures described in the licence and the documents directly referenced in that licence;

(iii) the safety and control measures described in the licence application and the documents needed to support that licence application;

unless otherwise approved in writing by the Canadian Nuclear Safety Commission (hereinafter "the Commission").

G.2 Notification of Changes

The licensee shall give written notification of changes to the licensed activity or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis

G.3 Financial Guarantee

The licensee shall maintain a financial guarantee for decommissioning that is acceptable to the Commission.

G.4 Public Information and Disclosure Program

The licensee shall implement and maintain a public information and disclosure program.

1. MANAGEMENT SYSTEM

1.1 Management System

The licensee shall implement and maintain a management system.

2. HUMAN PERFORMANCE MANAGEMENT

2.1 Training Program

The licensee shall implement and maintain a training program.

3. OPERATING PERFORMANCE

3.1 Reporting Requirements

The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

4. PHYSICAL DESIGN

4.1 Design Program

The licensee shall implement and maintain a design program.

5. FITNESS FOR SERVICE

5.1 Fitness for Service Program

The licensee shall implement and maintain a fitness for service program.

6. RADIATION PROTECTION

6.1 Radiation Protection Program

The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

7. CONVENTIONAL HEALTH AND SAFETY

7.1 Conventional Health and Safety Program

The licensee shall implement and maintain a conventional health and safety program.

8. ENVIRONMENTAL PROTECTION

8.1 Environmental Protection Program

The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

9. EMERGENCY MANAGEMENT AND FIRE PROTECTION

9.1 Emergency Preparedness Program

The licensee shall implement and maintain an emergency preparedness program.

9.2 Fire Protection Program

The licensee shall implement and maintain a fire protection program.

10. WASTE MANAGEMENT

10.1 Waste Management Program

The licensee shall implement and maintain a waste management program.

10.2 Decommissioning Plan

The licensee shall maintain a decommissioning plan.

11. SECURITY

11.1 Security Program

The licensee shall implement and maintain a security program.

12. SAFEGUARDS AND NON-PROLIFERATION

12.1 Safeguards Program

The licensee shall implement and maintain a safeguards program.

13. PACKAGING AND TRANSPORT

13.1 Packaging and Transport Program

The licensee shall implement and maintain a packaging and transport program.

14. FACILITY SPECIFIC

14.1 Remedial Cleanup Criteria

The licensee shall conduct remedial work in accordance with the project developed cleanup criteria.

SIGNED at OTTAWA, this 19th day of December, 2022.

Velshi, Rumina

Digitally signed by Velshi, Rumina
DN: C=CA, O=GC, OU=CNSC-CCSN, CN="Velshi, Rumina"
Reason: I am approving this document
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Rumina Velshi, President
On behalf of the Canadian Nuclear Safety Commission

28 CNSC, Record of Decision, DEC 23-H107, Applicant: Cameco Corporation, Subject: Application for Acceptance of Cameco’s Port Hope Conversion Facility Revised Financial Guarantee, May 7, 2024

Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Record of Decision

DEC 23-H107

In the Matter of

Applicant: Cameco Corporation

Subject: Application for Acceptance of Cameco's Port Hope Conversion Facility Revised Financial Guarantee

Date of Decision: May 7, 2024

RECORD OF DECISION – DEC 23-H107

Applicant:	Cameco Corporation
Address/Location:	2121 – 11th Street West Saskatoon, Saskatchewan, Canada
Purpose:	Application for acceptance of Cameco's Port Hope Conversion Facility revised financial guarantee
Application received:	September 30, 2022
Hearing:	Public Hearing in Writing – Notice of Hearing in Writing published on October 6, 2023
Date of decision:	May 7, 2024
Panel of Commission:	Mr. Randall Kahgee, Presiding Member

Financial Guarantee: Accepted

Table of Contents

1.0 INTRODUCTION

1. On September 30, 2022, Cameco Corporation (Cameco) submitted an application to the Canadian Nuclear Safety Commission[1] (CNSC) for the acceptance of its proposed financial guarantee for the future decommissioning of Cameco's Port Hope Conversion Facility (PHCF). Cameco's PHCF is located in Port Hope, Ontario, on the traditional territory of the Wendat, Anishinabek Nation, and the territory covered by the Williams Treaties with the Michi Saagiig and Chippewa Nations. At the PHCF, Cameco converts UO_3 (uranium trioxide) powder produced by Cameco's Blind River Refinery into uranium dioxide (UO_2) and uranium hexafluoride (UF_6).

2. Cameco is required to maintain a financial guarantee for the future decommissioning of its Class IB facility, per licence condition 1.3 of its existing licence, FFOL-3631.00/2027. Cameco currently maintains a financial guarantee of approximately $128.6 million to cover the future decommissioning costs for the PHCF. The financial guarantee, in the form of an irrevocable letter of credit, was accepted by the Commission at the time of Cameco's licence renewal in November 2016.[2] Cameco's current licence, FFOL-3631.00/2027, is valid until February 28, 2027.

3. Cameco is also required to review and revise its financial guarantee at least every 5 years, when requested by the Commission, or following a revision to its preliminary decommissioning plan (PDP). As described in CNSC REGDOC-2.11.2, *Decommissioning*,[3] a PDP is used for planning and cost estimation purposes and is to be progressively updated over the lifetime of a facility.

4. In September 2022, Cameco submitted a revised PDP for its PHCF to the CNSC, in accordance with licence condition 12.2 of its licence. The revision to the PDP resulted in an updated financial guarantee cost estimate. Cameco is now seeking the Commission's acceptance of a revised financial guarantee in the amount of $138.2 million, in the form of an irrevocable letter of credit. Cameco is not seeking authorization to undertake any decommissioning activities at this time.

Issue

5. The Commission is considering whether to accept Cameco's proposed financial guarantee for the PHCF in the amount of $138.2 million, in the form of an irrevocable letter of credit.

6. Under subsection 24(5) of the *Nuclear Safety and Control Act*[4] (NSCA):

> *A licence may contain any term or condition that the Commission considers necessary for the purposes of this Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.*

[1] The *Canadian Nuclear Safety Commission* is referred to as the "CNSC" when referring to the organization and its staff

in general, and as the "Commission" when referring to the tribunal component.
[2] Record of Decision, *Application to Renew the Nuclear Fuel Facility Operating Licence for the Port Hope Conversion Facility*, February 27, 2017.
[3] REGDOC-2.11.2, *Decommissioning*, CNSC, January 2021.
[4] S.C. 1997, c. 9.

7. Licence condition 1.3 of FFOL-3631.00/2027 requires that:

The licensee shall maintain a financial guarantee for decommissioning that is acceptable to the Commission.

Licence condition 12.2 of FFOL-3631.00/2027 requires that:

The licensee shall implement and maintain a decommissioning strategy.

8. As an agent of the Crown, the Commission recognizes its role in fulfilling the Crown's constitutional obligations, along with advancing reconciliation with Canada's Indigenous peoples. The Commission's responsibilities include the duty to consult and, where appropriate, accommodate Indigenous interests where the Crown contemplates conduct which may adversely impact potential or established Aboriginal[5] or treaty rights.[6] As such, the Commission must determine what engagement and consultation steps and accommodation measures are called for respecting Indigenous interests.

<u>Panel</u>

9. Pursuant to section 22 of the NSCA, the President established a panel of the Commission consisting of Mr. Randall Kahgee to consider the application. A notice of hearing in writing was published on October 6, 2023.[7] The Commission, in conducting a public hearing based on written materials, considered written submissions from CNSC staff (CMD 23-H107 and CMD 23-H107.A) and Cameco (CMD 23-H107.1, CMD 23-H107.1A and CMD 23-H107.1C). The Commission also considered written submissions from 10 intervenors (see Appendix A).

<u>Request for Confidentiality</u>

10. Following a request by Cameco under rule 12 of the *Canadian Nuclear Safety Commission Rules of Procedure*,[8] the Commission decided[9] that certain information filed by Cameco in respect of this hearing, namely Cameco's PDP, would remain confidential. Cameco summary PDP was filed as CMD 23-H107.1A.

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[5] "Aboriginal" is the term used in this document when referring to the Crown's duty to consult as that is the term used in s. 35 of the *Constitution Act, 1982*. In all other cases, "Indigenous" is the preferred terminology and used accordingly.
[6] *Haida Nation v. British Columbia (Minister of Forests),* 2004 SCC 73; *Taku River Tlingit First Nation v. British Columbia (Project Assessment Director)*, 2004 SCC 74.

[7] *Notice of hearing in writing, Cameco Corporation - Request for the acceptance of the revised preliminary decommissioning plan and financial guarantee for the Port Hope Conversion Facility - Ref. 2023-H-107,* October 6, 2023.
[8] SOR/2000-211.
9 *Commission Ruling on Request to Protect Confidential Information*, CMD 23-H107, December 4, 2023.

2.0 DECISION

11. Based on its consideration of this matter, as described in more detail in the following sections of this Record of Decision, the Commission is satisfied that:

- The amount of Cameco's revised financial guarantee is sufficient for the purpose of the future decommissioning of the PHCF
- The financial instrument for the revised financial guarantee, in the form of an irrevocable letter of credit, is appropriate

Therefore,

> the Commission accepts the revised financial guarantee proposed by Cameco Corporation for its Port Hope Conversion Facility located in Port Hope, Ontario.

12. With this decision, the Commission accepts Cameco's revised financial guarantee amount of $138.2 million in the form of an irrevocable letter of credit. The Commission directs Cameco to provide to CNSC the original financial instruments within 90 calendar days of the issuance of this decision.

3.0 ISSUES AND COMMISSION FINDINGS

13. The Commission assessed the evidence submitted on the record for this hearing to consider the acceptability of Cameco's proposed revised financial guarantee. The Commission considered whether the proposed financial guarantee met the criteria set out in REGDOC-2.11.2, REGDOC-3.3.1, *Financial Guarantees for the Decommissioning of Nuclear Facilities and Termination of Licensed Activities*[10] and CSA N294:19, *Decommissioning of Facilities Containing Nuclear Substances*,[11] and whether Cameco would satisfy the applicable licence conditions for its facility.

3.1 Preliminary Decommissioning Plans and Cost Estimates

14. Cameco submitted information on its revised PDPs and cost estimates. Cameco submitted updated PDPs to the CNSC in September 2022, in accordance with the required 5-year review under licence condition 12.2 of its licences. Cameco submitted that its revised PDPs were in accordance with REGDOC-2.11.2 and the requirements set out in CSA N294:19.

[10] REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*, CNSC, January 2021.
[11] CSA Standard N294-19, *Decommissioning of facilities containing nuclear substances,* CSA Group, 2019.

15. Cameco's operating licence condition 16.1 requires that "*The licensee shall implement and maintain a program to carry out clean-up, decontamination and remediation work.*" Cameco started the Vision in Motion project to clean up and renew the site. The project is a large, long-term investment and Cameco is working closely with the Port Hope Area Initiative to manage the historic low-level waste and coordinate remediation and redevelopment of the conversion facility. This revision resulted in the increase of the proposed financial guarantee to reflect labour rates, progress on the Vision in Motion project, and costs associated with the Centre Pier remediation and harbour retaining wall.

16. As described in CMD 23-H107.1A, Cameco submitted that the end-state objectives of its decommissioning strategy for PHCP were:

- to return the facility site to the conditions that existed prior to the processing and storage of radioactive materials, to the extent practical for future development
- to return the Centre Pier property to the conditions that existed prior to the processing and storage of radioactive materials, to the extent practical for use by the Municipality of Port Hope
- to clean-up the Dorset Street property and buildings for use as a non-licensed industrial site.

In CMD 23-H107.1, Cameco submitted that the current estimated cost for decommissioning the PHCF assumes the construction of a centralized waste management facility for Cameco's operations in Blind River.

17. Cameco explained that its cost estimate included allocations for demolition, soil excavation, fill replacement, landscaping, waste management and disposal, and for project-related costs including regulatory activities, Indigenous consultation, public consultation, engineering, construction management, radiological and other monitoring, as well an escalation provision and contingency funds. Based on the revised PDP, Cameco estimated the cost for decommissioning to be $138.2 million for the PHCF. Cameco noted that the total cost estimate for decommissioning increased about $9.6 million from its current financial guarantees. Cameco is requesting that the Commission accept its proposed revised financial guarantee.

18. In CMD 23-H107, CNSC staff submitted information on its assessment of Cameco's revised PDPs and associated cost estimates for the future decommissioning of the PHCF. CNSC staff reported that Cameco's revised PDP provided an acceptable strategy and credible cost estimate, and was consistent with REGDOC-2.11.2 and CSA N294:19.

19. In section 2.2 of CMD 23-H107, CNSC staff reported that the increase in the cost estimate is attributed to the following changes:

- increase in labour rates

- demolition of the buildings at the Centre Pier
- accumulated waste disposal and changes to infrastructure
- Centre Pier remediation and harbour retaining wall
- indirect costs including contingency, engineering, and construction management

20. Many intervenors commented on the availability of information regarding the PDP. Intervenors, such as the Port Hope Community Health Concerns Committee (CMD 23-H107.12), A. Franche (CMD 23-H107.8) and the Nuclear Transparency Project (CMD 23-H107.9), expressed concerns on the availability of information regarding the PDP and on Cameco's confidentiality request. The Council of Canadians Kitchissippi-Ottawa Valley (CMD 23-H107.6), S.G. Baron (CMD 23-H107.3) and G. Provost (CMD 23-H107.4) expressed concerns that Cameco indicated that it plans to dispose of radioactive waste in Blind River and the lack of Indigenous consent for the disposal of decommissioning wastes in Blind River. Northwatch (CMD 23-H107.7) expressed concerns that the cost estimates for the PHCF did not include the costs for the disposal of the decommissioning wastes, as Cameco has assumed that these costs would be covered under the cost of decommissioning its Blind River Refinery.

21. The Commission notes that the disposal of decommissioning wastes at a waste facility in Blind River is used in Cameco's PDP as a basis for its cost estimate, as it was in 2016. Cameco has not put forward an application for such a facility. Should Cameco decide to apply for authorization to construct a waste facility – in Blind River or elsewhere – that application would be subject to the CNSC's licensing process, including Indigenous and public consultation. The Commission accepted Cameco's financial guarantee for the Blind River Refinery in 2022.[12]

22. The Commission further notes that Cameco has not indicated any intention to decommission the PHCF at this time. Prior to the decommissioning stage, Cameco will be required to develop a detailed decommissioning plan (DDP). As described in REGDOC-2.11.2, if and when a licensee intends to decommission a facility, the licensee is required to apply for a licence to decommission and submit a DDP, which must include a report of any public and Indigenous engagement undertaken in its preparation. The Commission would consider an application for a licence to decommission a facility in a public hearing, with the possibility for interventions.

3.2 Financial Guarantee

23. Cameco currently maintains financial guarantees totalling approximately $128.6 million, in the form of an irrevocable letter of credit. For its updated financial guarantee, Cameco is proposing a financial guarantee in the amount of $138.2 million, in the form of an irrevocable letter of credit.

24. In section 2.3 of CMD 23-H107, CNSC staff provided the Commission with information on its assessment of Cameco's proposed revised financial guarantee amount and instrument. CNSC staff informed the Commission that the proposed financial instrument,

an irrevocable letter of credit, is the same as that currently in place. CNSC staff confirmed that the proposed financial instrument satisfies the criteria of liquidity, certainty of value, adequacy of value, and continuity set out in REGDOC-3.3.1.

[12] Record of Decision DEC 21-H9, *Cameco Corporation's Application to Renew the Class IB Fuel Facility Licence for Cameco Corporation's Blind River Refinery*, February 16, 2022.

3.3 Indigenous Engagement and Consultation

25. The common law duty to consult is grounded in the key principle of the honour of the Crown. The duty is engaged when the Crown contemplates conduct that may adversely affect established or potential Aboriginal and/or treaty rights of which the Crown has real or constructive knowledge.[13] The Commission acknowledges its obligation to fulfill the duty to consult and ensure that it considers impacts to Aboriginal and/or treaty rights, pursuant to section 35 of the *Constitution Act, 1982*[14] in the matter before it. Furthermore, the CNSC, as an agent of the Crown and as Canada's nuclear regulator, recognizes and understands the importance of building relationships and engaging with Canada's Indigenous Nations and communities.

26. In section 3 of CMD 23-H107, CNSC staff submitted that the request for acceptance of the revised financial guarantee is an administrative change and is not expected to cause any new adverse impacts to potential or established Indigenous and/or Treaty rights.

27. In its intervention, CMD 23-H107.11, the Mississauga First Nation (MFN) submitted that:

> *…MFN did not receive any outreach from the CNSC providing us with direct notice of the hearing in writing nor engagement seeking to consult…*[15]

MFN also noted that:

> *MFN has not been consulted by Cameco on its decommissioning plans.*[16]

28. By way of CMD 23-H107-Q, the Commission asked Cameco and CNSC staff for more information on their respective engagement and consultation efforts with Indigenous Nations and communities, particularly MFN, with respect to this matter. Cameco and CNSC staff provided information related to the Commission's questions in CMD 23-H107.1C and CMD 23-H107.A, respectively. Cameco listed the different meetings it held with MFN as well as the subjects that were discussed. CNSC staff submitted that it responded to MFN's concerns and questions on the PHCF PDP during a meeting with MFN held on December 8, 2023, where CNSC staff clarified that the PDP is a preliminary plan at this time and there is no specific project proposal to construct a waste management facility at the Blind River Refinery site.

29. The Commission concludes that the proposed revision to the financial guarantee does not include any new licensed activities that could cause new impacts on the environment or

changes in the ongoing licensed activities at the PHCF, and therefore, will not cause any new adverse impacts to any potential or established Indigenous and/or treaty rights.[17] As such, the Commission's responsibility to uphold the honour of the Crown and its constitutional obligations with regard to engagement and the duty to consult respecting Indigenous interests have been satisfied.

[13] *Haida Nation v. British Columbia (Minister of Forests)*, 2004 SCC 73, at para 35.
[14] Schedule B to the *Canada Act 1982* (UK), 1982, c 11.
[15] CMD 23-H107.11, section 1
[16] CMD 23-H107.11, section 2
[17] *Rio Tinto Alcan v. Carrier Sekani Tribal Council*, 2010 SCC 43, at paras 45 and 49.

30. Notwithstanding the above, the Commission has heard MFN's concerns regarding the potential for a future waste facility in Blind River. The Commission notes that although the acceptance of a financial guarantee may be considered to be administrative in nature from the CNSC's regulatory perspective, MFN's concerns are real and ought to be addressed by the licensee. The Commission expects that Cameco will meaningfully engage on what it has publicly stated about its plans and the concerns raised by MFN. The Commission expects Cameco to follow best practices in this regard in the spirit of reconciliation.

31. The Commission appreciates that CNSC staff and MFN are holding regular meetings. The Commission encourages CNSC staff to continue to build its relationship with MFN and address its concerns in the spirit of reconciliation.

3.4 Commission Findings

32. Following the Commission's analysis of the information submitted on the record for this hearing, the Commission concludes that Cameco's proposed financial guarantee instruments and revised financial guarantee amount are acceptable. The Commission notes that Cameco's proposed financial guarantee instruments are, apart from the amounts, unchanged from its existing financial guarantee. The Commission is satisfied that Cameco's revised PDP provides the basis for a credible cost estimate. The Commission is also satisfied that Cameco continues to meet its licensing requirements related to maintaining a financial guarantee. The Commission comes to these conclusions on the basis that:

- Cameco's revised PDP provides a credible cost estimate for the future decommissioning of Cameco's PHCF and meets the requirements of REGDOC-2.11.2 and CSA N294-19
- Cameco's proposed revised financial guarantee amount is adequate for the future decommissioning of Cameco's PHCF and is consistent with REGDOC-3.3.1
- the proposed financial instrument, in the form of an irrevocable letter of credit, satisfies the criteria of liquidity, certainty of value, adequacy of value, and continuity set out in REGDOC-3.3.1.

33. The Commission expects to be informed should there be an impact on decommissioning cost estimates due to a future revision to the PDP.

34. The Commission acknowledges the importance of transparency and encourages Cameco and CNSC staff to continue to make relevant information available to the public, as appropriate. The Commission notes the concerns raised by intervenors about the level of detail in Cameco's PDP summary and encourages Cameco consider these comments and provide additional details in future updates.

4.0 CONCLUSION

35. The Commission concludes that Cameco's proposed revised financial guarantee will continue to provide for the future decommissioning of Cameco's PHCF. Therefore, the Commission accepts Cameco's proposed revised financial guarantee for the PHCF in the amount of $138.2 million in the form of an irrevocable letter of credit.

May 7, 2024

Mr. Randall Kahgee
Presiding Member
Canadian Nuclear Safety Commission

Date

Appendix A – Intervenors

Evelyn Gigantes	23-H107.2
Sarah Gabrielle Baron	23-H107.3
Gilles Provost	23-H103.4
Susan O’Donnell	23-H107.5
Council of Canadians Kitchissippi-Ottawa Valley	23-H107.6
Northwatch	23-H107.7
Alexandra Franche	23-H107.8
Nuclear Transparency Project	23-H107.9
Mississauga First Nation	23-H107.11
Port Hope Community Health Concerns Committee	23-H107.12

29 CNSC, CMD 02-M12, *New Staff Approach to Recommending Licence Periods,* March 2002

Canadian Nuclear Safety Commission / Commission canadienne de sûreté nucléaire

CMD 02-M12
File/dossier 1-1-19-0
Ref./Réf. : CMD 02-M5

Information from Canadian Nuclear Safety Commission Staff

Renseignements du personnel de la Commission canadienne de sûreté nucléaire

Regarding

À l'égard de

New Staff Approach to Recommending Licence Periods

Nouvelle démarche pour recommander les périodes d'autorisation

A flexible, rational approach to making recommendations to the Commission and Designated Officers on licence periods

Démarche souple et rationnelle pour recommander à la Commission et aux fonctionnaires désignés les périodes d'autorisation

Commission Meeting

Réunion de la Commission

March 1, 2002

Le 1er mars 2002

Canada

Summary

This Information Commission Member Document (CMD) presents a flexible, consistent and rational basis for recommending licence periods to the Commission and Designated Officers.

The new approach takes account of the relative risk posed by the facility, activity or equipment being licensed, and stipulates the criteria to be applied and the reporting requirements to be used for given licence period recommendations.

It provides a basis for recommending licence periods that will reduce unnecessary regulatory burden while maintaining a rigorous level of control.

Résumé

Ce document aux commissaires (CMD) présente une démarche souple, uniforme et rationnelle pour recommander à la Commission et aux fonctionnaires désignés les périodes d'autorisation.

La nouvelle démarche tient compte du risque relatif que présentent l'installation, l'activité ou l'équipement à autoriser. Elle précise les critères applicables et les exigences de rapport à utiliser pour recommander des périodes données.

Cette démarche guide les recommandations à l'égard des périodes d'autorisation. Elle réduit tout fardeau réglementaire inutile et maintient un niveau de contrôle strict.

Signed / Signé le
2002-01-18

M. Taylor
Executive Director
Office of Regulatory Affairs
Le directeur exécutif, Bureau des affaires réglementaires

1) Objective

The objective of this CMD is to inform the Commission of a new staff approach to recommending licence periods to the Commission and to Designated Officers.

2) Background

Over the past few years, CNSC staff has been reviewing its practices for assessing licence applications and for making associated recommendations to the Commission. In doing this review, staff has taken account of the requirements introduced by the Canadian Nuclear Safety and Control Act, the need for continuous improvement in terms of effectiveness and efficiency, public transparency and international practice. This review has led to the introduction of more standardized CMD formats, standard assessment terminology to describe licensee performance, annual and mid-licence term reporting to the Commission on the performance of some major licensees and improvements in the way this information is presented to the Commission at hearings and meetings. Further improvements are proposed, and this document reports one element to the Commission: a more flexible basis for recommending the licence period. Other elements include, modification to the standard assessment terminology (see CMD 02-M5), improvements in formalizing the CNSC compliance program (the new program has been documented and will commence in April 2002), development of a staff guide to the essential elements of a licensing process (nearing completion; to be issued in early 2002) and improvements to the CMDs to further clarify the relative importance of issues and how the staff arrived at its overall assessment (this work is about to start).

3) A Basis for Staff Recommendations on Licence Periods

The attached CNSC staff document provides guidance to staff on making recommendations to the Commission, or to Designated Officers, on licence periods. The objective is to provide a consistent, rational basis which recognises the relative risk posed by the facility, activity or equipment being licensed, the time required for staff to conduct a thorough review, as required by the Canadian Nuclear Safety and Control Act, and the need for transparency. Accordingly, the guide indicates that periodic staff reports to the Commission are required and that there are criteria to be met before staff recommend longer licenses to the Commission or to Designated Officers. An attachment to the guide shows international power reactor licensing practice. Staff does not, at this time, suggest adopting such practice in Canada but does see the intended approach as more rational than the past 'standard 2 year licence' and as a possible step towards future alignment with international norms.

Staff considers that adoption of this approach can lead to improved effectiveness and efficiency of the licensing process while maintaining an appropriate level of public transparency.

Staff Guide on Making Recommendations to the Commission and to Designated Officers on Licence Periods

Purpose

This guide will help ensure that staff recommendations on the terms and conditions that apply to the period of a licence are consistent with risk-informed criteria.

Scope

This guide applies to CNSC staff that make recommendations to the Commission on licence periods and to Designated Officers who make decisions on licence periods. It describes the risk-informed criteria to be applied and the reporting requirements for staff and Designated Officers concerning the performance of licensees, significant issues and other matters of interest.

1 Background

1.1 Relevant legislation

Subsection 24 (1) of the *Nuclear Safety and Control Act* (the Act) gives the Commission the power to establish classes of licences authorizing the licensee to carry on a licensed activity, for the period that is specified in the licence.

Pursuant to Subsection 24(4) of the Act, the Commission and Designated Officers are required, before they issue, amend, or renew a licence, to assure themselves that the applicant is qualified to carry on the proposed activity, and has made adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

1.2 Licensing and compliance-verification activities

The granting of licences and the determination of licence terms is the prerogative of the Commission, or, in some cases, of an officer designated by the Commission. Licensees may request a specific licence length. The role of staff is to make recommendations respecting the granting of licences.

With the promulgation of the *Nuclear Safety and Control Act* in 2000, the Commission has an explicit obligation to satisfy itself that the licensee is qualified to carry on the licensed activity before it issues a licence. A variety of inspections and audits are carried out by staff to monitor a licensee's operations in order to promote, verify and enforce compliance of the licensee with regulatory requirements, including any licence conditions. These compliance-verification activities are risk-informed; that is, inspections, safety assessments and audits are conducted with a frequency and degree of detail determined by the level of risk associated with the licensed activity.

The findings of these activities are integrated into reports submitted to the Commission or to a designated officer appointed by the Commission; staff also report to the Commission on overall industry performance and trends, and on specific issues of interest in Significant Development Reports.

1.3 The two-year licence period

Historically, licences have been issued for a period of two years. This has permitted close scrutiny of the licensee by the Commission and offered frequent opportunities for public intervention. Some variations to the standard two-year term have been granted, ranging from only a few months to indefinite periods. Other activities subject to CNSC licensing have been authorized for various periods depending upon the specific nature and circumstance of the activity, e.g. siting, construction and decommissioning of facilities and transaction-specific or temporary activities.

It is now apparent that the usual two-year licence period is no longer adequate to enable the licensee to complete actions, or staff to facilitate the Commission's consideration of licensing actions with complete and relevant information in order to meet the requirements of section 24 of the Act. This is a function of both the lack of flexibility and the short period of the licences. The two-year licence period is often not long enough to enable staff to complete a full review of the licensee's activities, and the heavy resource requirements of licensing require the redirection of staff away from inspections, compliance-verification activities, and performance audits. In addition, licensing hearings do not always coincide with the planning cycle of the facility being licensed, preventing the Commission from hearing licence applications at significant facility planning points.

Although not a safety issue, licensees have also noted that the two year licensing period is a significant regulatory burden, and has an impact on financing, given that the financial marketplace looks for regulatory stability.

2 Transition

The transition to longer licence periods is part of a broader integrated improvement package that encompasses the compliance program, expanded evaluation of, and reporting on, licensee performance, and an enhanced approach to licensing. As the regulatory regime has matured over the past decades, greater attention has been placed on compliance and enforcement, and more resources have been devoted to these activities. The flexibility to recommend longer licence periods may allow some of the time and resources currently spent by both licensees and staff on administrative licensing activities to be more effectively devoted to assessment and compliance activities. This would, in turn, improve staff's ability to provide assurance of licensee performance in the areas of health and safety, the environment, security, and fulfilment of Canada's international obligations.

Greater flexibility in recommending licence periods would also allow the licence period to be set to reflect the level of risk, licensee performance history and facility planning cycles, and to permit the completion of compliance-verification activities so that comprehensive reports for the Commission's consideration can be compiled. This flexibility will assist the Commission to establish licence periods so that renewals occur at the same time as important events in the licensed operation, resulting in better evaluation of licensee safety performance while preserving the important role of the Commission. As has been the case in the past, a recommendation by staff for a licence period of two years or less will continue to be an option where overall licensee performance is unsatisfactory.

A transition to longer licences with increased emphasis on licensee performance evaluation is consistent with practice in many other countries, particularly for power reactors. As Table 2 shows, international benchmarking shows longer licences with Periodic Safety Reviews (PSRs) as the norm for such facilities. A PSR is a comprehensive assessment of an operational nuclear facility, to determine whether the facility is safe as judged by current safety standards and practices, and whether adequate arrangements are in place to maintain facility safety. It is expected that a PSR would be conducted on a facility every eight to ten years, consistent with international practice, and that licence renewals would follow the same cycle. The CNSC staff intends to introduce PSRs over the next few years.

2.1 Licence periods appropriate to licensed activities

The proposed range of staff recommendations for licence periods for different licence classes and under varying conditions is shown in detail in Table 1. Increased flexibility to recommend longer licence periods enables the CNSC to regulate in a more risk-informed manner, through the adjustment of the licence period to the risk profile of the licensed activity and to the compliance-verification activities that are required for the facility. As noted, however, this flexibility in licence periods does not preclude recommending short licence periods where appropriate. For example, with greater flexibility in licence length recommendations it is possible to

- align the licence period recommendation with the life cycle of the facility or the phase of the operation that is being licensed, such as site preparation, construction or decommissioning of a Class I or Class II facility, or a planned phase of a mining operation, so that Commission licensing hearings coincide with significant planning events of the licensed activity;
- use a longer period recommendation, such a five years, for facilities such as Class I facilities that have a good performance history and a good quality management program, to allow time for more risk-based activities such as compliance verification and performance assessment to be conducted;

- use shorter licence period recommendations of two to five years, depending on the risk of the activity, for new licensed activities and for licensees that have not yet established a proven licensee track record, and for licensees with a poor performance or compliance record, or where the activity or duration of the activity requires it;

- continue to use licence amendments on specific issues or to issue orders to licensees whenever these actions are required;

- use a licence period recommendation of less than two years as a clear indication to the Commission or designated Officer and licensee that serious deficiencies in performance exist and more severe enforcement action is imminent.

As noted above, with the introduction of Periodic Safety Reviews, staff may, in future, recommend that the licence period for large facilities such as nuclear power reactors, large particle accelerators and nuclear substance processing facilities, and uranium mines and mills be extended to eight or ten years.

3 Implementation

It is important to ground regulatory actions in a sound, defensible rationale that demonstrates that regulatory activity is applied according to the risk associated with the licensed activity, and that it is applied consistently by CNSC staff to all licensees. The documentation of recommendations based on a clear set of criteria, along with expanded reporting to the Commission and the public, responds to the demand for increased transparency.

3.1 Criteria for staff recommendations for licence periods

Staff must prepare a recommendation for the Commission on the licence period that is appropriate for the activity to be licensed and the licensee under consideration. The criteria below provide staff with a systematic basis for recommending licence periods that will reduce unnecessary regulatory burden while maintaining a rigorous level of control.

- The recommended duration of the licence should be commensurate with the licensed activity.

- A longer licence period can be recommended when the hazards associated with the licensed activity are well characterized and their impacts well predicted, and they are within the scope considered in the environmental safety case.

- A longer licence period can be recommended when licensees have in place a management system, such as a quality assurance program, to provide assurance that their safety-related activities are effective and maintained.

- A longer licence period can be recommended when effective compliance programs are in place on the part of both the applicant/licensee and the CNSC.

- A longer licence period can be recommended when the licensee has shown a consistent and good history of operating experience and compliance in carrying out the licensed activity. There should be reference to the history of performance in terms of the standard terminology defined in CMD 02-M5.

- The licence period must be consistent with the requirements of the *Cost-Recovery Fees Regulations*. (For those applicants who must pay the full fee for the term of the licence at application, the new licence periods will be applied only after the new *Cost Recovery Fees Regulations* are in place.)

- The licence period should take account of the planning cycle of the facility, and the licensee's plans for any significant change in the licensed activity.

3. 2 Expanded reporting to the Commission and the public

Licensing hearings have been a primary opportunity for staff to present the Commission with reports on licensees, and for the public to review this information and participate in the regulatory process. As recommendations for longer licence periods could mean a reduced frequency of these opportunities, this could be balanced by increased reporting by staff to the Commission and the public.

In the past, staff has submitted regular reports to the Commission on some classes of licences. With the new approach to recommending licence periods, CNSC staff will report to the Commission and the public on the activities of all classes of licences, on a regular basis, at public hearings or at meetings. Reports to the Commission will be made by CNSC staff on the performance of the licensees with respect to the protection of health, safety, security, the environment and meeting international obligations. The scope and depth with which each topic will be covered will reflect the complexity and level of risk of the licensed activities or facilities.

In addition to the regular reports to the Commission, staff will continue to report on significant issues that may arise during the conduct of any regulated activity and on any other matter of interest to the Commission at meetings through an enhanced system of Significant Development or Status Reports.

These reporting requirements are part of the regulatory oversight mechanisms CNSC staff will put in place as part of the implementation of the revised approach. The frequency of these reports will be determined by the class of licence and other factors, as shown in Table 1.

Table 1 Recommended Licence Periods for Licensees Meeting Criteria in Section 3.1, and Frequency of Periodic Reports

Type of Licence or Licensed Activity/Facility	Licence Period	CNSC Staff Reports to the Commission	Licence Issued by *
Operation of Class I Nuclear Facilities — Nuclear Power Reactors	up to five (5) years **	Annual Power Reactor Industry Summary Report	Commission
Operation of Class I Nuclear Facilities — Reactors (other than nuclear power reactors), Large Particle Accelerators and Nuclear Substance Processing Facilities, Waste Facilities and Uranium Mines and Mills (i.e. other Class IA and Class IB Nuclear Facilities)	up to five (5) years**	Interim summary report (approximately mid-period and no less than once every three (3) years)	Commission
Site preparation, construction, and decommissioning of Class I Nuclear Facilities and Uranium Mines and Mills	Duration of the licensing phase (site preparation, construction and decommissioning)	At least one summary report every three (3) years	Commission
Class II Nuclear Facilities	Duration of the licensing phase (construction, operation and decommissioning)	Interim summary report — approximately mid-period and no less than once every three (3) years	Commission or Designated Officer
Licences issued for nuclear substances, radiation devices	From five (5) years to indefinitely	Annual summary report	Designated Officer
Dosimetry services	Indefinitely	At least one summary report every five (5) years	Designated Officer
New licensed activities without a proven licensee track record	Two (2) years normally, but possibly up to five (5) years, depending on class of licence	Commensurate with the class of licence (see above)	Commission or Designated Officer, depending on class of licence

Type of Licence or Licensed Activity/Facility	Licence Period	CNSC Staff Reports to the Commission	Licence Issued by *
Transaction-specific or temporary activities, import and export of nuclear substances and radiation devices, and transport	Up to five (5) years	Commensurate with the class of licence	Designated Officer
Activities carried out at non-operational facilities, such as some radioactive waste storage or disposal facilities, and partly decommissioned reactors in a storage-with-surveillance mode	From five (5) years to indefinitely	At least one report every five (5) years	Commission or Designated Officer
Significant development in a given licensed activity or facility	N/A	Significant Development Reports (SDRs) as necessary	Commission or Designated Officer

* As set out in CMD 00-M16, Establishing Classes of Licences; and CMD 00-M17, Designating Designated Officers.

** When periodic safety reviews are introduced, this period may be extended.

Table 2 International Licence Periods and Periodic Safety Review Requirements for Nuclear Power Reactors

Country	Licence Period	PSR Frequency
Belgium	plant lifetime	every 10 years
Finland	10 - 20 years	every 10 years
France	plant lifetime	every 10 years
Germany	32 years	every 10 years
Japan	plant lifetime	every 10 years
Netherlands	plant lifetime	every 10 years
Spain	10 years	every 10 years
Sweden	plant lifetime	every 10 years
United Kingdom	plant lifetime	every 10 years
United States	40 years, with 20-year renewal option	continuous performance assessment