Cameco

Technical Reports

Public Summary

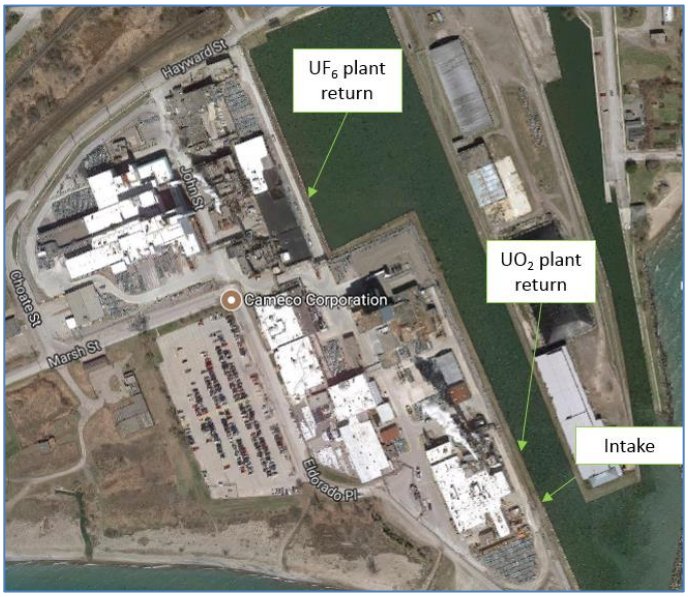
Port Hope Conversion Facility

Self-Assessment of Impingement and Entrainment Losses

Cameco Corporation's (Cameco) Port Hope Conversion Facility (PHCF or facility) is located in Port Hope, Ontario on the northern shore of Lake Ontario. The PHCF consists of an operating site and two storage sites. The PHCF operating site at 1 Eldorado Place is bounded by Hayward Street to the north, the Port Hope harbour (harbour) to the east, Lake Ontario to the south, and Choate Street to the west.

The main facility, shown in Figure 1, operates a once-through non-contact cooling water system under approval from the Ontario Ministry of Environment and Climate Change (MOECC). Most of the once-through cooling water supply requirements are met by the facility cooling water intake, located at the entrance to the Port Hope harbour near the mouth of the Ganaraska River. Remaining cooling water supply requirements are met by municipal potable water. Mechanically pre-treated harbour water is directed to and returned from both the UO_2 and UF_6 plants. Filtered harbour water is also utilized as bypass water to cool plant cooling water effluent and as backwash water in association with the mechanical pre-treatment operations.

Figure 1 | Port Hope Conversion Facility Approximate Cooling Water Intake and Operating Plant Return Locations



As part of a revision to the Environmental Risk Assessment (ERA) in 2016, PHCF undertook a self-assessment of the performance of the current cooling water system operations and the mitigation in place for the reduction of fish impingement and entrainment (I&E) at the cooling water intake. Impingement occurs when aquatic organisms are trapped against an intake screen by the force of the water flowing through the screen. Entrainment occurs when aquatic organisms are small enough to pass through the intake mesh and cannot escape. I&E monitoring data was used in the calculation of equivalent loss models (ELMs) to provide reference points that can be utilized in comparisons for the self-assessment.

Based on the results of the self-assessment with the existing operating regime and fish protection technology in place, it was determined that an authorization for the cooling water intake was not required under the *Fisheries Act*. In September 2017, CNSC staff agreed that a *Fisheries Act* authorization is not required for the PHCF based on, but not limited to, the following:

- information provided in Cameco's environmental risk assessment;
- results of the 2016 self-assessment reporting;
- mitigation measures currently in place to effectively reduce fish impingement; and,
- the unlikely effects to local fish populations in the vicinity of the facility.

Impingement and entrainment losses will continue to be assessed as part of PHCF's five-year environmental risk assessment cycle.

Existing I&E Mitigation in Place

Several operational and mitigation systems are in place to reduce potential impact to fish, including the following:

- Low volume of water withdrawal (< 1 m^3/s)
  - Considered a small water user;
- Low approach velocity
  - Well below the sustained and burst swimming speed capability of fish observed near the screens;
  - Below the 15 cm/s guideline suggested by USEPA 316b as an impingement compliance option;
  - Underwater video from the fall of 2012 did not show any evidence of fish becoming impinged;
- Fine mesh screening;
  - 6.3 mm mesh overlay on screen panels – in place in the harbour; and,
  - 2 mm mesh and 1.5 mm wedge wire travelling screens in the pumphouse.

Fish I&E Sampling Approaches

Impingement and entrainment studies have been conducted to evaluate I&E in current intake design and operations.

Impingement monitoring occurred in 2012 and 2013 (24 sampling days) following industry standard methodology. For each sampling event, a net was attached to the discharge pipe of a travelling screen and collected all debris and fish impinged on the fine mesh screen. After 24 hours, the net was detached and sample contents were collected. All contents were sampled and any fish that were collected were identified, measured, and its condition (live, recently dead, long dead) determined.

Entrainment monitoring occurred in 2014 following industry standard methodology. Each week, two 12-hour day time samples and two 12-hour night time samples were collected from the intake channel with a plankton net to collect fish eggs and larvae. A total of 52 samples were collected over 13 weeks with increased sampling during the spring (expected key entrainment period), which also included 12-hour daytime samples and 12-hour nighttime samples.
For each test, the average flow rate was determined and the flow rates were then used to calculate the estimated entrainment rates for each species of larvae and eggs collected in the samples. All collected eggs were examined with a dissection scope to determine if the eggs were fertilized or unfertilized.

Species at Risk Act (SARA) Species

Looking impingement sample results, no SARA species were collected. Similarly, no SARA species were collected in the entrainment samples.

Analysis of Modelling Results

Estimates of fish loss were based on I&E totals calculated from impingement monitoring conducted in spring-summer of 2013 and entrainment monitoring conducted in spring-summer of 2014. Table 1 summarizes the analysis of production foregone (fish biomass that would have resulted from the survival and growth of the fish impinged or entrained) and equivalent predator yield (biomass that could have been transfer to the next level of the ecosystem).

Table 1 results show a production foregone estimate of a fraction of a kilogram:

- 44.1 grams from entrainment; and,
- 30.7 grams from impingement.

These are conservative estimates as the analysis included the cumulative totals for all species, including the invasive round goby.

In addition, all eggs collected were unfertilized, and were unlikely to have produced fish. Even when including uncertainty analysis in the calculations, the highest estimate of fish biomass that would have resulted from the survival and growth of the fish impinged or entrained was approximately 306 grams (combined I&E).

Table 1| Estimates of Production Foregone and Equivalent Predator Yield

Species	Source	Production forgone (kg)	Equivalent Predator Yield (kg)
Alewife	Entrainment	0.0014	<0.0000
Emerald shiner	Entrainment	0.0097	0.0003
Rainbow smelt	Entrainment	0.0175	0.0005
Round goby	Entrainment	0.0155	0.0004
Total Entrainment		0.0441	0.0012
Alewife	Impingement	0.0216	0.0020
Round goby	Impingement	0.0091	0.0009
Total Impingement		0.0307	0.0029

Summary

The PHCF cooling water intake draws less than 1 m^3/s from Lake Ontario and is considered a small water user.

There are several operational and mitigation systems in place at the PHCF to reduce impingement and entrainment. The PHCF undertook a self-assessment of the performance of the current cooling water system operations and designed mitigation in place for the reduction of fish impingement and entrainment at the PHCF cooling water intake.

Impingement and entrainment monitoring data was used in the calculation of equivalent loss models. Equivalent loss estimates indicated that much less than a kilogram was lost to the ecosystem, using conservative assumptions.

The third party self-assessment report, submitted to the CNSC in August 2016, concluded that a formal request for a Fisheries and Oceans Canada (DFO) authorization is not recommended based on the results of the self-assessment with the existing operating regime and fish protection technology in place. In September 2017, CNSC staff concluded that a *Fisheries Act* authorization is not required for the PHCF.