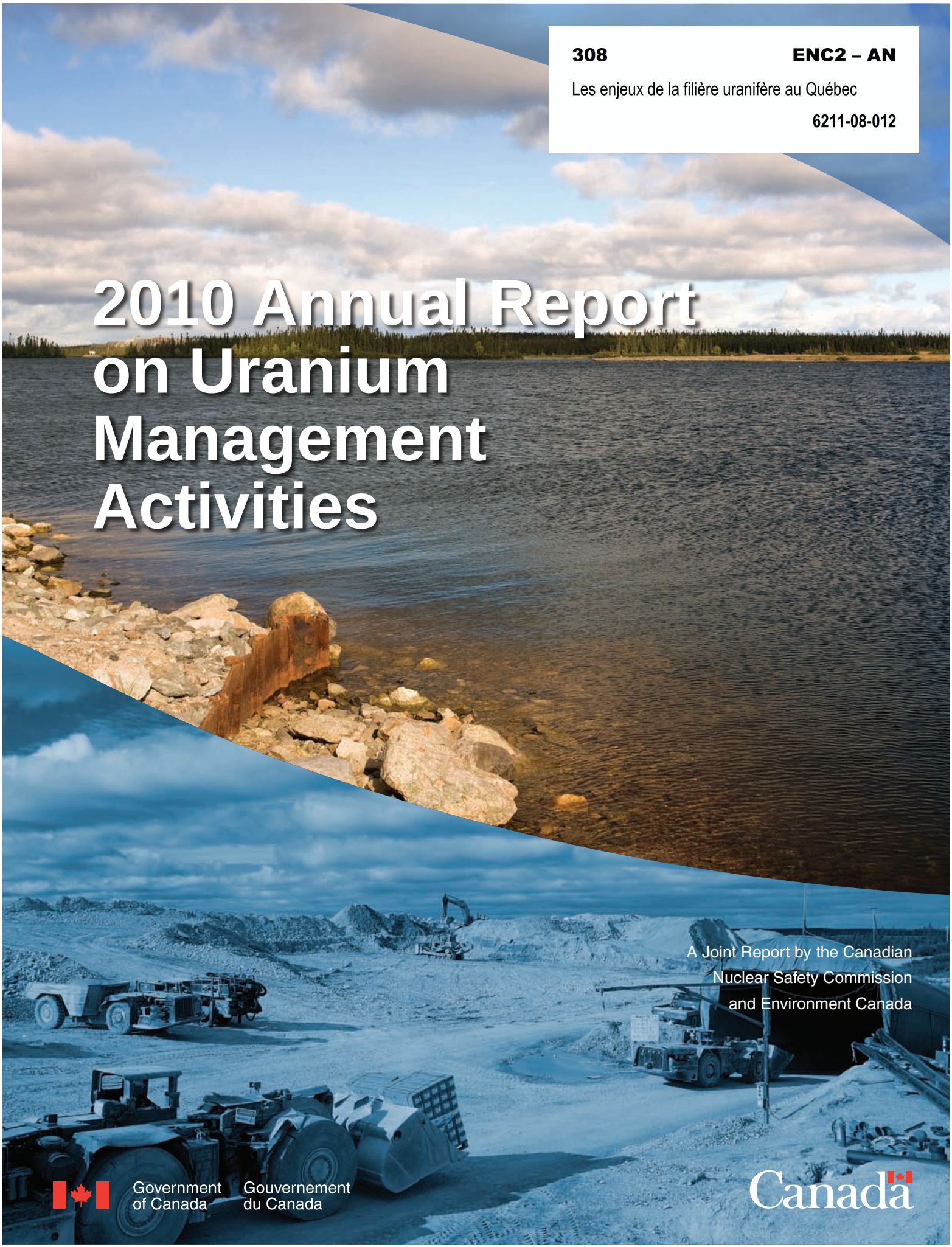
2010 Annual Report on Uranium Management Activities



A Joint Report by the Canadian Nuclear Safety Commission and Environment Canada

Government of Canada Gouvernement du Canada

Canada

2010 Annual Report on Uranium Management Activities

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Cover images
Top: Rabbit Lake
Bottom: Entrance to the Eagle Point Mine at Cameco's Rabbit Lake Operation

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Executive Summary

Environment Canada (EC) and the Canadian Nuclear Safety Commission (CSNC) have a Memorandum of Understanding (MOU) wherein the parties agree to consult and cooperate on the overall regulation of nuclear facilities in Canada. All the terms of the MOU have now been fulfilled; therefore, this is the fourth and final joint report on uranium management activities.

CNSC staff assessments for 2010 indicate that licensed facilities did not release uranium in effluent at levels that resulted in significant ecological risk. As always, licensees are further expected to "take all reasonable precautions to control releases" and to keep all releases (including hazardous substances) as low as reasonably achievable (ALARA).

The CNSC and EC continue to be proactive in preventing pollution and in regulating the releases of nuclear and hazardous substances into the environment.

Uranium mines and mills

The uranium mining sector of the metal mining industry was the best-performing mining sector relative to the *Metal Mining Effluent Regulations* (MMER) effluent limits, with no exceedances of regulatory limits in 2010.

The 2010 review of uranium releases at Canada's operating uranium mines and mills indicates that no facilities exceeded the Saskatchewan licence limit (2.5 mg/L) for uranium effluent discharge concentration. All facilities also achieved the CNSC's optimization screening objective (OSO) of 0.1 mg/L for their annual average concentration of uranium in effluent.

Results from 2010 show that of all facilities, the Rabbit Lake operation continued to discharge the highest load of uranium to the environment. Throughout 2010, the average monthly concentration of uranium in effluent was consistently below the OSO of 0.1 mg/L except in August, September and December. The facility's uranium loading to the environment was also approximately 15% greater than in 2009. Releases are expected to decrease in 2011, with additional fine tuning and modification of the overall treatment process.

Uranium processing and conversion facilities

Monthly mean uranium release concentrations from the Blind River facility were consistently below the OSO during 2010. The Port Hope conversion facility no longer discharges treated process water to the harbour, so there are no routine treated effluent uranium releases to report. The total annual uranium load to the aquatic environment from uranium processing and conversion facilities remained low.

Low-level waste management facilities

Uranium discharge concentrations from all waste management facilities (WMFs) were below the OSO, with the exception of the Welcome and Port Granby WMFs.

During 2010, Welcome and Port Granby WMFs completed all required actions to mitigate effects on the environment and control the releases of nuclear and hazardous substances related to the 12(2) letters issued by the CNSC in 2008. Considering the upcoming full remediation of the Welcome and Port Granby WMFs and their recent improvements, the CNSC believes these facilities can continue to operate in accordance with their licence requirements until remediation occurs under the Port Hope Area Initiative.

In 2009, Cameco was also asked to address the feasibility of extending the Port Granby WMF's discharge pipeline into Lake Ontario. This action — along with additional site modifications and improvements — was completed by Cameco in 2010.

Elliot Lake waste management facilities

All releases for 2010 were below the OSO. These releases are similar to those documented in 2009. Despite consistently low uranium concentrations, releases from Denison tailings management areas were approximately 124 kg.

2010 versus 2009 releases

During 2010, monthly average uranium discharge concentrations from all CNSC-regulated facilities (including mines and mills, processing and conversion facilities, and waste management facilities) were below the screening objective with the exception of the Rabbit Lake mine and mill and the Welcome and Port Granby waste management facilities.

In 2010, the total annual loading released from uranium mines and mills increased 17%. The total annual loading released from waste management facilities decreased by approximately 28%. Loadings from uranium processing and conversion facilities continued to be very low and decreased 29% in 2010.

The 2010 overall uranium mass loading to the environment from all CNSC-licensed facilities was 3.3% lower than in 2009.

Special activities

Progress was made on the Process for Establishing Release Limits for Nuclear Facilities Project. In 2010, the CNSC reviewed the national and international practices used for establishing release limits that were part of the benchmarking performed in 2009. This review showed that while countries establish release limits differently and that they have different practices for dealing with nuclear and hazardous substances, there are three basic approaches: exposure-based, technology-based and a combined exposure/technology-based approach.

Looking forward

Site-specific reviews of facility designs and management practices focusing on uranium solutions and mixtures will continue, in order to ensure that CNSC licensees are effectively minimizing releases of uranium to the environment. Other risk management initiatives will focus on controlled releases of uranium from CNSC-licensed waste management facilities.

To make its recommendations and identify an appropriate methodology for establishing release limits, the CNSC drafted a discussion paper which was released for public consultation in February 2012.

1.0 Introduction

Background

The Canadian Nuclear Safety Commission (CNSC) and Environment Canada (EC) have independent, but related mandates within the nuclear industry for protecting the environment. The two organizations have developed and signed a Memorandum of Understanding (MOU), agreeing to work together on the environmental regulation of nuclear facilities in Canada. This agreement (see Appendix A) was created to minimize regulatory duplication and comply with the Government of Canada's policy requiring departments to coordinate their activities.

The assessment of releases of radionuclides from nuclear facilities was added to the second Priority Substances List (PSL2) of the *Canadian Environmental Protection Act* (CEPA) to determine if such releases pose significant risk to the environment in Canada. The evaluation was produced under the direction of CNSC technical specialists, and the final report, *Releases of Radionuclides from Nuclear Facilities (Impact on Non-human Biota)*, concluded that releases of uranium and uranium compounds contained in effluent from uranium mines and mills are toxic as defined in Section 64 of the CEPA.

As part of the risk management activities required for CEPA toxic substances, an annex was added to the existing MOU between EC and the CNSC in December 2004. This annex identified specific risk management activities for each facility associated with the conclusion of CEPA toxicity. It also required the production of an annual report outlining the progress of these risk management activities.

The first risk management annual report, published jointly by EC and the CNSC in 2007, demonstrated that the specific risk management activities identified within the Annex were achieved within the required timeframe. The report also indicated that in order to promote transparent reporting, that future risk management activities would document uranium releases within the broader nuclear fuel cycle, in addition to facilities identified in the Annex.

This *2010 Annual Report on Uranium Management Activities* reports uranium releases to the environment as specified in the Annex, and reviews management practices related to uranium in effluent within other sectors of the nuclear industry.

2.0 Uranium Releases to the Environment

In May 2000, the CNSC replaced the Atomic Energy Control Board (AECB), following the coming into force of the *Nuclear Safety and Control Act* (NSCA) and its regulations.

The CNSC is mandated under the NSCA to regulate all nuclear facilities and nuclear-related activities in Canada. Under the NSCA, there are currently 11 regulations that set out specific requirements and are further supported by regulatory policies, standards and guidelines.

The CNSC has adopted environmental risk assessment methodologies linked to the site-specific receiving environment, to identify contaminants of potential concern (COPC) and aspects of environmental risk at each facility. Extensive environmental effects monitoring programs have also been implemented at facilities to identify the impacts on the receiving environments and to ensure that licensees have taken all reasonable precautions to control releases. Effluent and environmental monitoring programs are developed on a risk basis and depend upon the complexity of the released effluents, the sensitivity of the receiving environment and the anticipated effects on the environment.

The AECB previously regulated uranium primarily from a radiological perspective; however, uranium is now considered to be a toxic/hazardous substance. The expanded mandate under the NSCA includes the regulation of hazardous substances and environmental protection, and with the conclusions of the PSL2 Assessment, uranium is also regulated under the *Canadian Environmental Protection Act* (CEPA).

In 2006, the CNSC commissioned a review of treatment technologies to assist staff in overseeing uranium risk management activities for the Rabbit Lake operation. This review identified a concentration of uranium in effluent of 0.1 mg/L as a potential treatment design objective that could be achieved with current standard chemical precipitation technology. The CNSC is using this value (0.1 mg/L) as an interim design objective for new facilities. It is also being used as an optimization screening objective (OSO) for existing facilities, in order to identify operations which — while not exceeding regulatory limits — should review their treatment processes to determine if systems can be optimized or upgraded to meet the CNSC's expectations for ALARA.

It is recognized that the OSO value is substantially lower than regulatory limits established by the US Environmental Protection Agency (USEPA) (*Regulation 40 CFR-N Part 440*) and the 1996 Saskatchewan *Mineral Industry Environmental Protection Regulations* (MIEPR). However, this value has been proven to be achievable and demonstrates the CNSC's commitment to incorporating the principles of pollution prevention within its regulatory mandate. It should be emphasized that exceeding this value is neither an indication of unreasonable risk to the environment nor a licence violation.

In addition to effluent concentration, it is important to review a facility's total annual load in kg/year to the receiving environment. Over the operating lifetime of a facility, the annual load provides a measure of the amount of uranium that may accumulate in the downstream

environment, particularly in sediment; for example, a facility with relatively high uranium concentrations but a low volume of effluent can discharge the same total mass of uranium as a high-volume effluent with very low uranium concentrations[1].

In 2010, the CNSC continued to develop formal technical procedures for establishing release limits for hazardous and nuclear substances discharged from nuclear facilities. This project's objective is to review the CNSC's existing practices and present national and international practices both for radionuclides and hazardous substances. This project is outlined further in section 3.2.

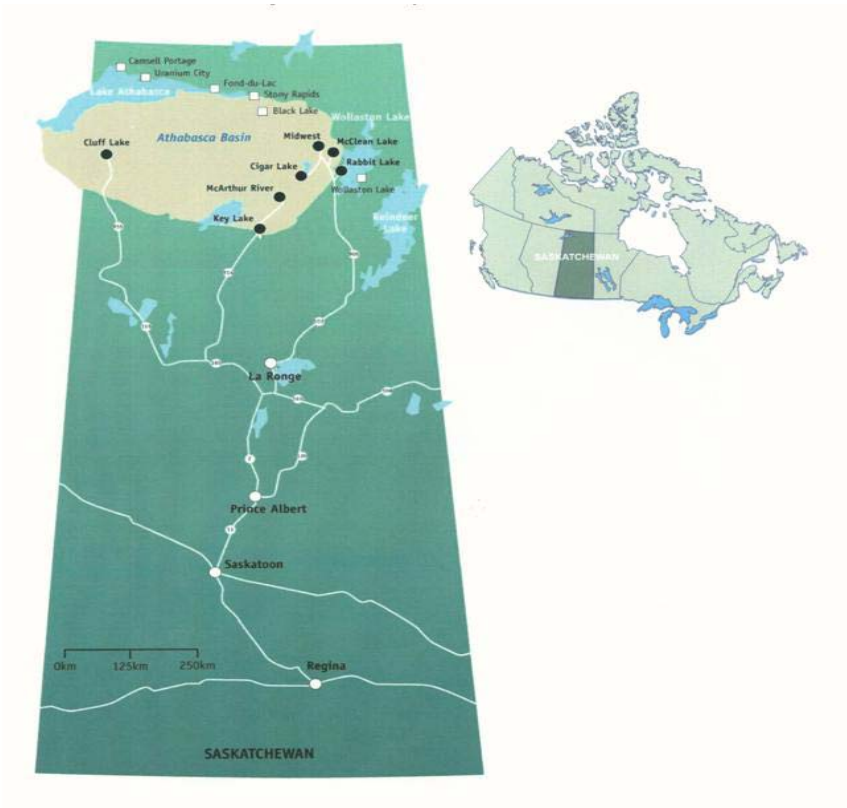
2.1 Uranium mines and mills

The 2003 CEPA toxic determination was related to the releases from specific uranium mines and mills: the Rabbit Lake mine/mill effluent, the Key Lake dewatering water releases and the Cluff Lake mine/mill effluent. This section summarizes uranium releases from these facilities (with the exception of the now decommissioned Cluff Lake operation) and other uranium mines and mills whose releases were not considered to be CEPA toxic. Figure 1 indicates the locations for these operations.

[1] The total load of a contaminant released to the environment is a function of the concentrations of the contaminant and the volume of effluent in which it is being released: concentration x volume = load.

Figure 1 | Locations of Uranium Mine and/or Milling Operations in the Athabasca Basin of Northern Saskatchewan

From *Rabbit Lake Solution Processing Project Environmental Impact Statement* Executive Summary, January 2008



Sources of water potentially requiring control and treatment that are generated at operating uranium mines and mills may include the following: pit dewatering water, mine process water, runoff from waste rock piles and facility aprons, mill process water (i.e., raffinate, scrubbing solutions, barren strip solutions and tailings process water), raise waters or seepage waters from ore, waste rock, tailings management facilities and domestic water. The sources, quantity and quality of water to be handled and treated are site specific and affected by local hydrology as well as the selected mining and milling methods and the characteristics of the ore, waste rock and tailings produced at each site.

Effluent treatment systems at operating uranium mines/mills rely primarily on chemical precipitation and separation to remove contaminants of concern. Earlier systems mainly used large sedimentation ponds to settle precipitated contaminants with continuous release of effluent following the retention ponds. This method has been replaced by batch release discharge in many systems.

The *Metal Mining Effluent Regulations* (MMER) apply to effluent releases from all metal mines, including uranium mines and mills. These limits identify the minimal level of effluent treatment and are incorporated directly into CNSC licences for all uranium mining facilities. The MMER do not include a limit for uranium. As in 2009, the uranium mining sector of the metal mining

industry was the best-performing mining sector relative to the MMER effluent limits, with no exceedances of regulatory limits in 2010.

The use of site-specific ecological risk assessments (ERAs), combined with information obtained from the receiving environment monitoring programs, has caused the CNSC to require additional effluent treatment at various uranium mines/mills for contaminants beyond those encompassed by the MMER. These include uranium, molybdenum and selenium. No other limits have been formally placed into CNSC uranium mining licences, but operational control for these additional effluent COPCs have been incorporated into the facilities' environmental codes of practice (ECOPs).

An ECOP includes tiered response levels to show when a facility is deviating from normal operational releases. These levels provide an early indication of potential loss of control, thereby providing adequate time to implement corrective measures. Two types of response levels are developed for each facility: action levels and administration levels.

2010 results

Table 1 provides the monthly mean and annual average concentrations of uranium in water discharged to the environment during 2010 for active uranium mines and mills in northern Saskatchewan. Mass loadings of uranium are also presented. Uranium is only one of many effluent constituents monitored and reported to the CNSC in each facility's annual report. All discharges to the environment are measured regularly according to site-specific monitoring programs included in licence conditions approved by the CNSC and in the Province of Saskatchewan operating permit.

Table 1 | Discharge Concentrations and Loadings of Uranium from Canadian Mines and Mills, 2010 (NR = No Release)

2010 monthly arithmetic mean	Mine/Mill						
	Key Lake (Mill)	Key Lake (Dewatering)	Rabbit Lake	McArthur River	McClean JEB	McClean Sue	Cigar Lake
January	0.004	0.0008	0.066	0.0171	0.002	NR	0.0002
February	0.003	0.001	0.0508	0.0234	0.002	NR	<0.0001
March	0.004	0.0011	0.0472	0.0337	0.002	NR	<0.0001
April	0.004	0.0015	0.049	0.0239	0.002	NR	<0.0001
May	0.003	0.0016	0.0778	0.0168	0.002	NR	<0.0001
June	0.009	0.0019	0.082	0.0207	0.001	NR	<0.0001
July	0.008	0.0011	0.0885	0.0130	0.012	NR	<0.0001
August	0.006	0.0012	0.1594	0.0109	0.005	NR	<0.0001
September	0.007	0.0017	0.128	0.0115	0.006	NR	<0.0001
October	0.006	0.0015	0.08875	0.0139	0.006	NR	<0.0001
November	0.014	0.0009	0.076	0.0232	0.003	NR	<0.0001
December	0.005	0.0009	0.1113	0.0143	0.004	NR	<0.0001
Annual average (mg/L)	0.006	0.0013	0.0854	0.0185	0.004		<0.0001
Standard deviation (mg/L)	0.003	0.0004	0.0337	0.0067	0.003		
Loading (kg)	7.23	6.31	390	34	5.67		0.04

As shown in Table 1, all operations had discharges below the OSO of 0.1 mg/L. The following sections discuss each of these reported facilities.

2.1.1 Rabbit Lake Mine and Mill

The Rabbit Lake operation is a uranium mining and milling facility in northern Saskatchewan on the west side of Wollaston Lake, approximately 450 km north of La Ronge. It is the oldest active uranium mining and milling operation in Canada.

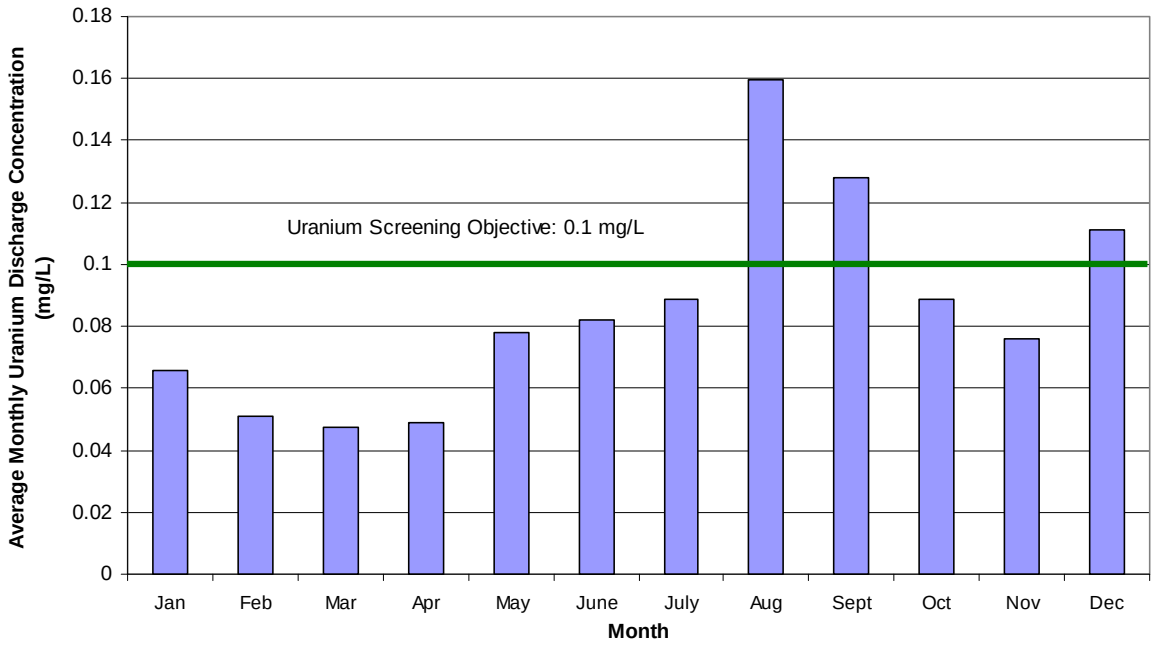
Currently, the mill is operated on a week-on, week-off basis. The water treatment plant operates on a continuous basis, which includes continuous release of treated water from weir #3 to the receiving environment. Unlike batch-release systems, this continuous operation precludes the testing and recycling of pond waters not meeting water quality expectations. Instead, effluent quality relies on monitoring throughout the process to control reagent addition and precipitate removal effectiveness. It also depends on the use of relatively large final settling and buffering ponds.

The CEPA toxic conclusion (for uranium releases from uranium mining and milling) resulted primarily from the Rabbit Lake operation. The *2007 Uranium Risk Management Annual Report*[2] provides detailed documentation of activities completed to the end of 2007 that resulted in a substantial reduction in uranium releases to the environment.

As indicated in Figure 2, during 2010 the monthly average uranium discharge concentration remained below the OSO with exception of August, September and December. During 2010, the Rabbit Lake facility's total loading of uranium to the environment increased by approximately 15%, compared to 2009.

The Rabbit Lake operation continues to release the largest total amount (load) of uranium to the environment relative to other operating mines. This total load is a function of greater effluent concentrations, as well as the high treated effluent volumes that arise from the large number of sources requiring treatment. Uranium reduction therefore remains a key element of this facility's continuous improvement plans.

Figure 2 | 2010 Average Monthly Uranium Discharge Concentrations (Rabbit Lake)



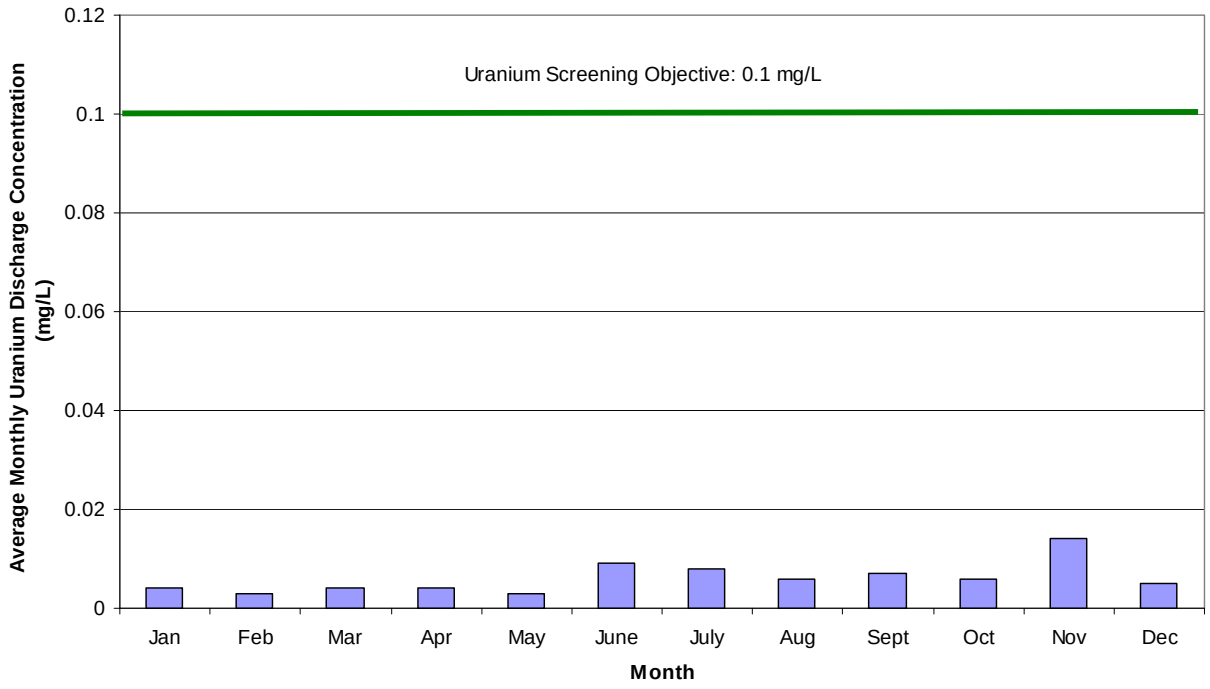
2.1.2 Key Lake Mill

The Key Lake operation is located in north-central Saskatchewan, approximately 70 km east-southeast of Cree Lake (see Figure 1). Mining at Key Lake ceased in 1997, with the milling of Key Lake ore continuing into 1998–99. In 2000, Key Lake commenced milling ore from the McArthur River underground mine.

[2] nuclearsafety.gc.ca/eng/readingroom/reports/uranium/index.cfm

The Key Lake operation has two primary release points to the aquatic environment: the treated mill effluent released to the David Creek drainage, and the treated dewatering water (intercepted groundwater) released to the McDonald Creek drainage. Table 1 and Figure 3 demonstrate that the monthly and annual averages for 2010 have consistently remained well below the OSO of 0.1 mg/L. The 2010 total annual load from the mill (7.2 kg) is approximately 14% greater than the quantity/load released from the site in 2009 (6.3 kg).

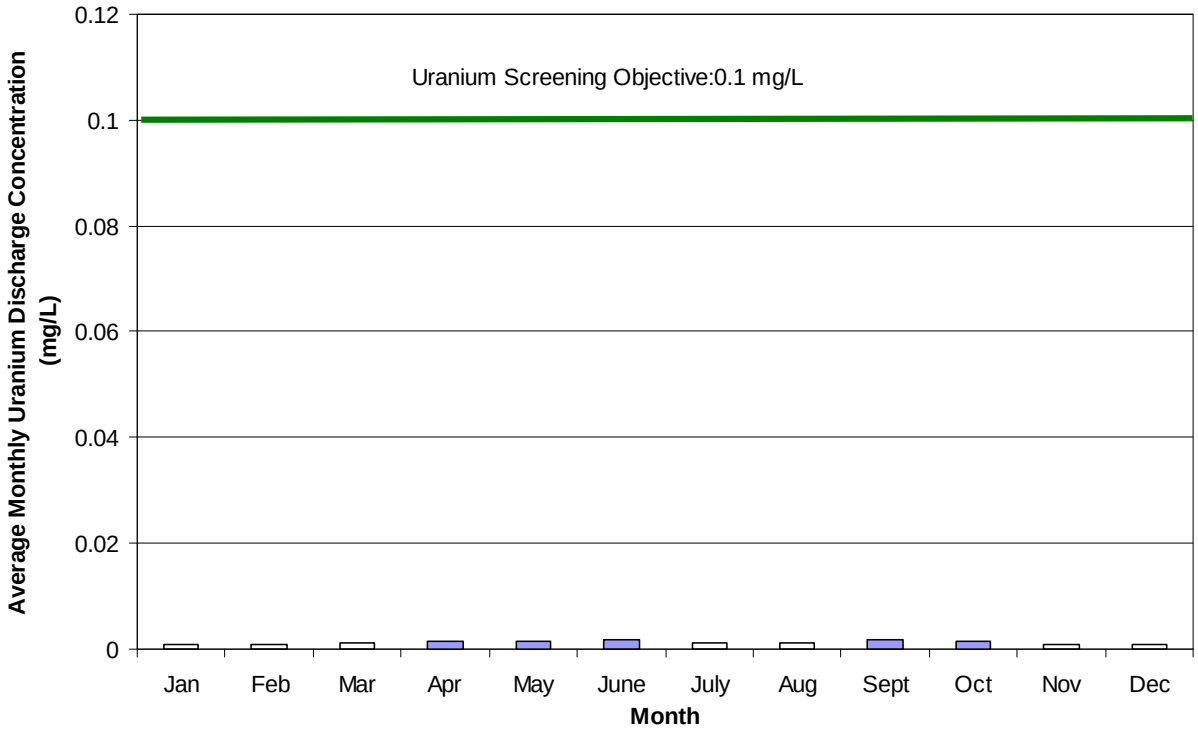
Figure 3 | 2010 Average Monthly Uranium Discharge Concentrations – Mill Effluent (Key Lake)



Releases from the Key Lake operation's dewatering system were specifically mentioned within the PSL2 report (Environment Canada and Health Canada, 2003) CEPA toxic determination. These figures were based on historical releases before the installation of the reverse osmosis treatment system. The *2007 Uranium Risk Management Annual Report* provides details of the history, performance and receiving environment quality associated with these releases.

Data presented in Table 1 and Figure 4 demonstrate the reverse osmosis treatment plant's high level of performance. The 2010 annual average of 0.001 mg/L is more than two orders of magnitude lower than the OSO of 0.1 mg/L. The total 2010 annual load from this treatment system is also relatively low (6.3 kg) but is slightly higher than the 2009 loading (5.6 kg).

Figure 4 | 2010 Average Monthly Uranium Discharge Concentrations – Dewatering (Key Lake)



2.1.3 McClean Lake Mine and Mill

The McClean Lake operation, consisting of a uranium mine and milling facility, is located in the northeast corner of Saskatchewan (see Figure 1). Mining commenced in 1995 and the mill began production in June 1999.

The JEB water treatment plant receives contaminated water feeds mainly from the mill and JEB tailings management facility areas. The plant removes radionuclides, dissolved metals and suspended solids, and then discharges treated effluent to the Sink/Vulture treated effluent management system.

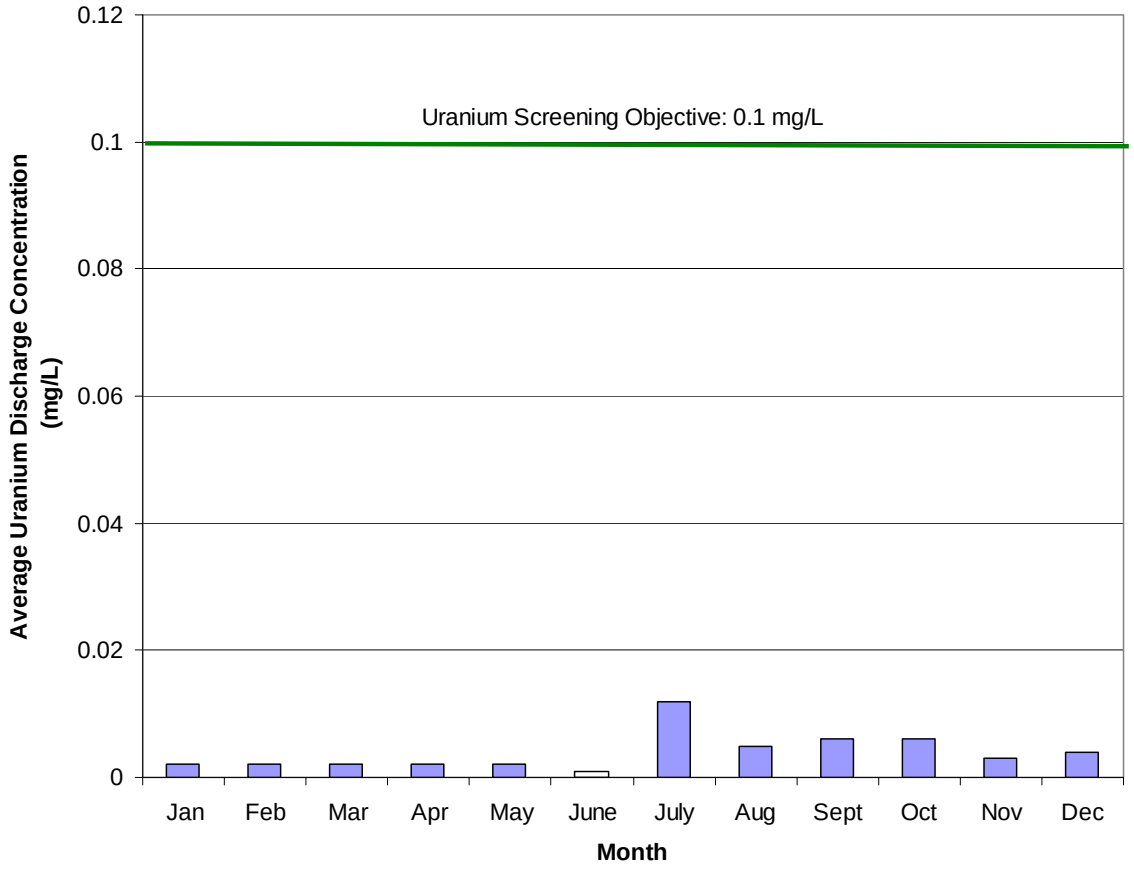
The Sue water treatment plant receives contaminated water feeds from the Sue mine site. It removes radionuclides, dissolved metals and suspended solids, and also discharges treated effluent to the Sink/Vulture treated effluent management system.

Onsite precipitation runoff or spill water from the mine and mill main areas that could be contaminated is intercepted. It is then recycled or treated before being released to the environment.

Table 1 and Figure 5 demonstrate that the 2010 monthly means for treatment plant has consistently achieved concentrations of an order of magnitude or more lower than the OSO. The 2010 releases result in an annual total load of approximately 5.7 kg of uranium discharged to

Sink reservoir, which is approximately 24% lower than 2009 results (7.5 kg). The Sue water treatment plant did not operate during the year of 2010 as there were no mining activities.

Figure 5 | 2010 Average Uranium Discharge Concentrations – JEB Water Treatment Plant (McClean Lake)



2.1.4 McArthur River

Located in north-central Saskatchewan approximately 300 km north of La Ronge (see Figure 1), Cameco Corporation's McArthur River operation mines the world's largest high-grade uranium deposit. It began operations in 1999, extracting ore using the raisebore mining method. The high-grade ore is processed underground and pumped in slurry form to the surface, where it is loaded into specially designed containers and transported by truck to Cameco's Key Lake mill 80 km to the south. At Key Lake, the uranium is extracted, processed and packaged in the form of "yellowcake" and is shipped off site for further refining and conversion.

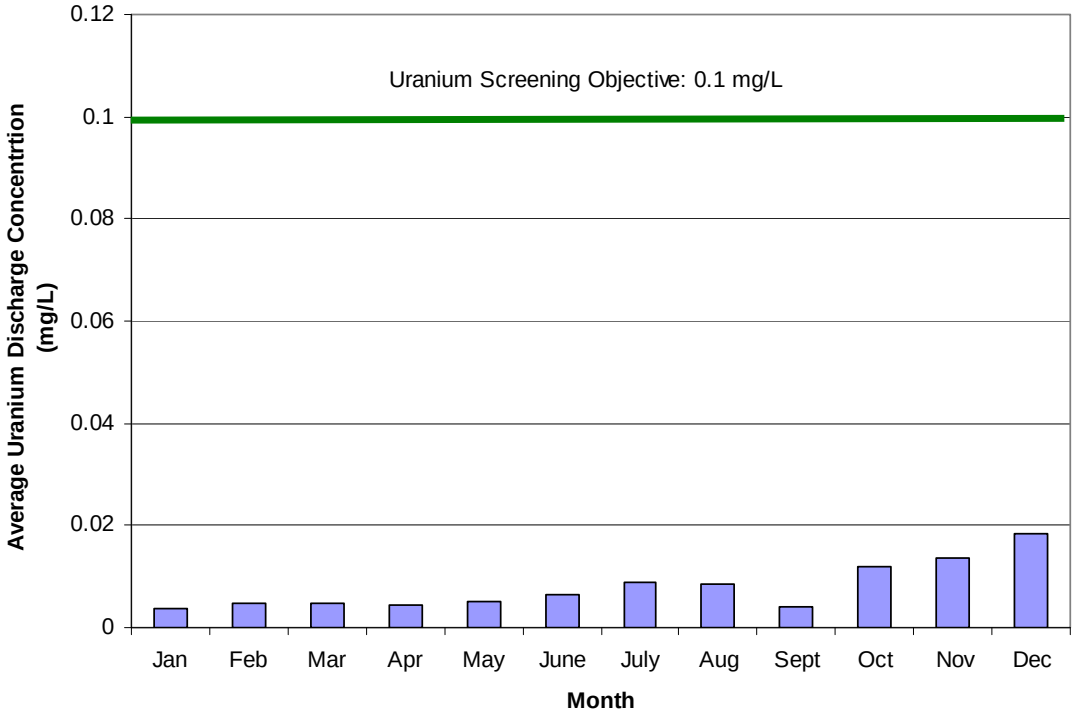
Most ore processing equipment at McArthur River is underground, with the exception of the slurry loadout building, where the high-grade ore slurry is loaded for shipment. The minewater treatment plant, storage ponds and the final effluent discharge point are located on the surface. Treated effluent is discharged from the secondary water treatment plant pumphouse through a

1,250-m pipeline to a muskeg receiving area adjacent to shaft #3. As there is no mill at this site, there is no specific uranium removal process at the facility.

Site-specific risk assessments required by the CNSC have identified uranium as a COPC, and it is specifically targeted for reduction within the McArthur River facility's continuous improvement program. Modifications to water management and optimization of the overall treatment process have resulted in improvements over the last few years.

During 2010, monthly uranium in effluent concentrations were consistently below the OSO (see Figure 6), with a total annual load of 34 kg released from this site (see Figure 8A). The continuing uranium reduction activities at McArthur River are preventative, as releases from this facility were not determined to be CEPA toxic. The annual uranium load (quantity) released in 2010 (34 kg) was approximately 70% greater than the load released from the site in 2009 (20 kg) but continues to be substantially lower than the 69 kg released in 2008.

Figure 6 | 2010 Average Uranium Discharge Concentrations (McArthur River)



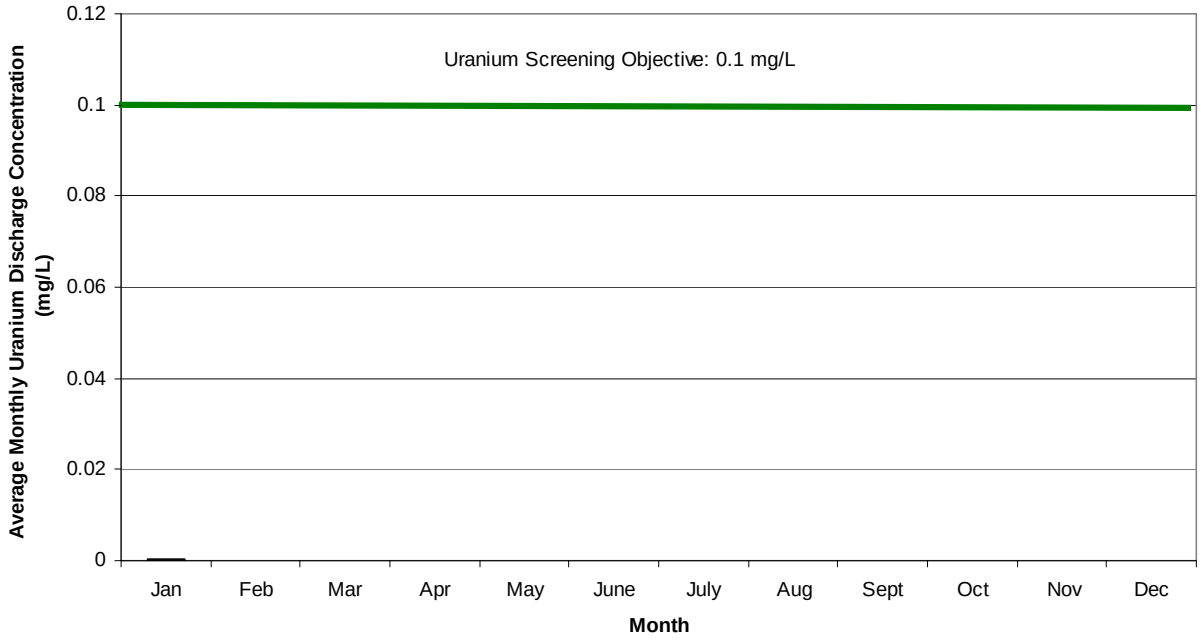
2.1.5 Cigar Lake Mine

In 2010, activities at the Cigar Lake Project focused on underground and surface construction activities. The underground activities include mine dewatering, remediation, re-entry, ventilation, development, construction of pumping facilities and geotechnical drilling. The surface activities included infrastructure construction to support the remediation project plan. During remediation and dewatering activities, mine water pumped from the underground mine was treated to remove contaminants. Effluent is monitored before it is discharged to the receiving environment

(composite samples are collected during the filling of monitoring ponds) and at the final point of control (i.e., during batch discharge). Results for 2010 uranium discharge concentrations are provided in Figure 7.

During 2010, effluent released from the Cigar Lake mine water treatment system consistently achieved the OSO (0.1 mg/L), with an annual load of 0.04 kg released to the environment. The 2010 loading (0.04 kg) is approximately 73% lower than the 2009 loading (0.15 kg).

Figure 7 | 2010 Average Monthly Uranium Discharge Concentrations (Cigar Lake)



2.1.6 Mining Releases Summary

The review of uranium releases at the operating uranium mines and mills indicates that all facilities annual average discharge concentrations are readily achieving the OSO of 0.1 mg/L (see Figure 8A).

Figure 8B provides a summary of the uranium mass loadings for 2010. The highest annual loading of uranium in effluent continues to be the Rabbit Lake operation (390 kg). Figure 8C compares the 2010 annual mass loadings from uranium mines and mills to those of 2009 and 2008. The total annual loadings of 670 kg in 2010 were 3.3% lower than of those from 2009 (693 kg).

Figure 8A | 2010 Uranium Mines – Annual Average Concentrations

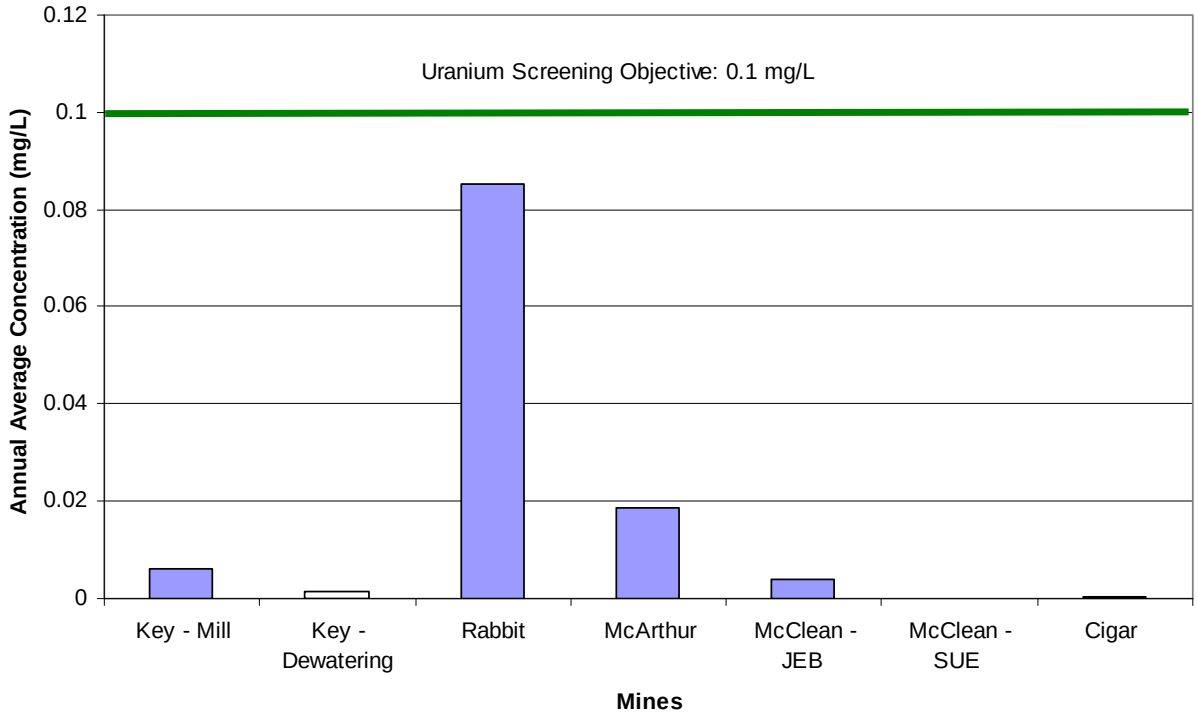


Figure 8B | 2010 Uranium Mines – Mass Loadings

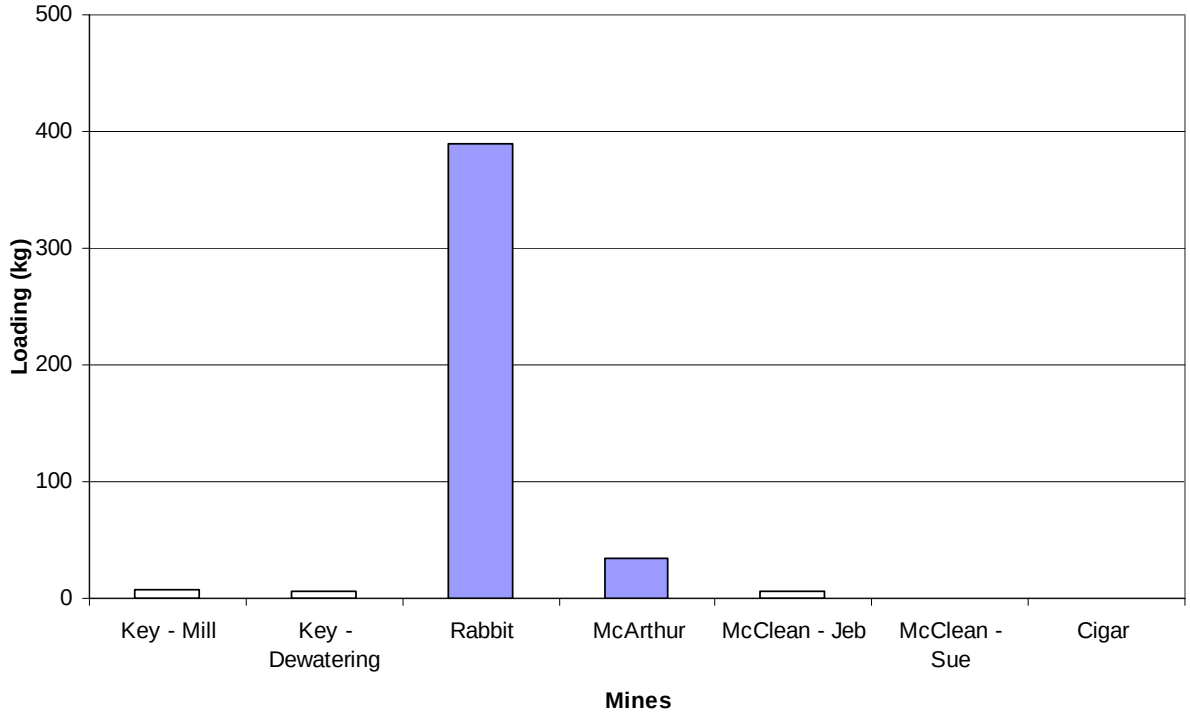
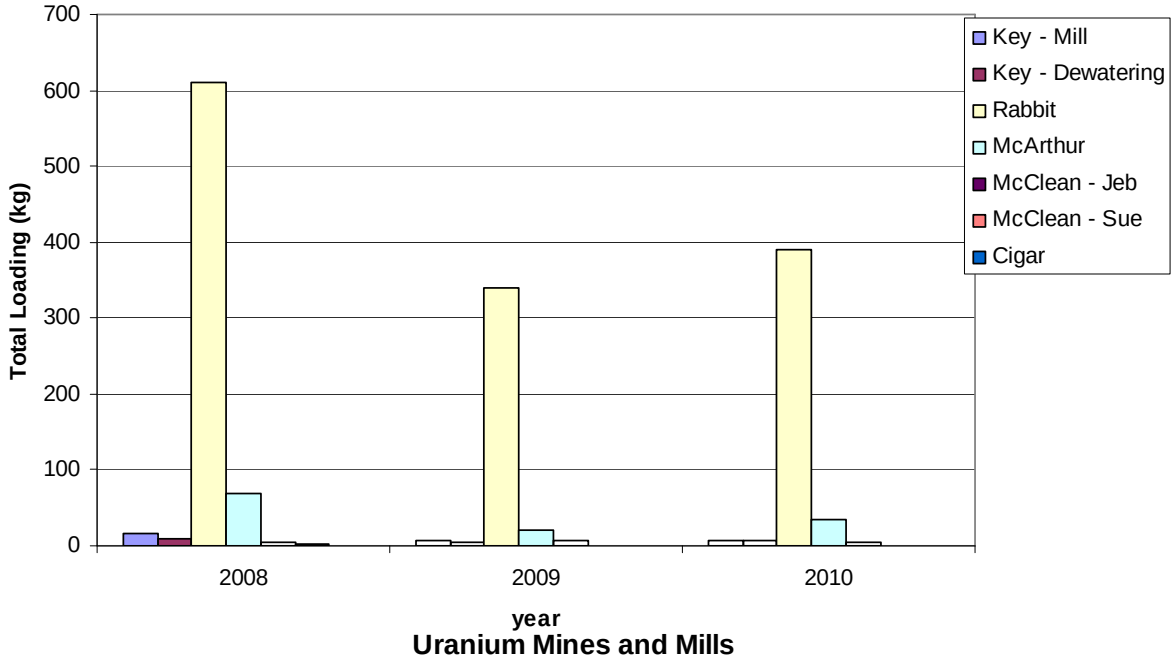


Figure 8C | Annual Mass Loading from Uranium Mining and Milling Facilities



2.2 Uranium Processing and Conversion Facilities

Canada has two uranium processing facilities — the Blind River Refinery and the Port Hope Conversion Facility — as well as three uranium fuel fabrication facilities.

The fuel fabrication facilities are the Cameco fuel manufacturing facility in Port Hope, and the GE Hitachi Toronto and Peterborough facilities, all in Ontario. This report does not consider uranium releases from these facilities, as they are considerably low and outside this document's scope (i.e., contaminated water is discharged to municipal sewers in accordance with municipal by-laws).

2.2.1 Blind River Refinery

Cameco Corporation of Saskatoon, Saskatchewan, owns and operates a Class IB nuclear fuel refining facility near Blind River, Ontario (see Figure 9). This facility refines yellowcake received from various sources to produce uranium trioxide (UO_3), an intermediate product of the fuel cycle. Cameco's Port Hope Conversion Facility is the primary recipient of this product.

The facility is licensed to produce up to 18,000 tonnes of uranium as UO_3 during any calendar year. The facility converts various milled uranium concentrates (i.e., yellowcake) to UO_3 powder through chemical processes. In addition, the facility operates a hazardous waste incinerator that handles contaminated combustible waste from the Blind River refinery and the Port Hope Conversion Facility.

Cameco Blind River Refinery has a single liquid effluent discharge point that releases through a diffuser to Lake Huron. Table 2 provides monthly mean uranium concentrations for releases to water and the total uranium loading for 2010. Monthly means were consistently below the OSO (0.1 mg/L) and the total amount of uranium released in 2010 was low (3.4 kg).

Figure 9| Location of Cameco Blind River Refinery, Blind River, Ontario

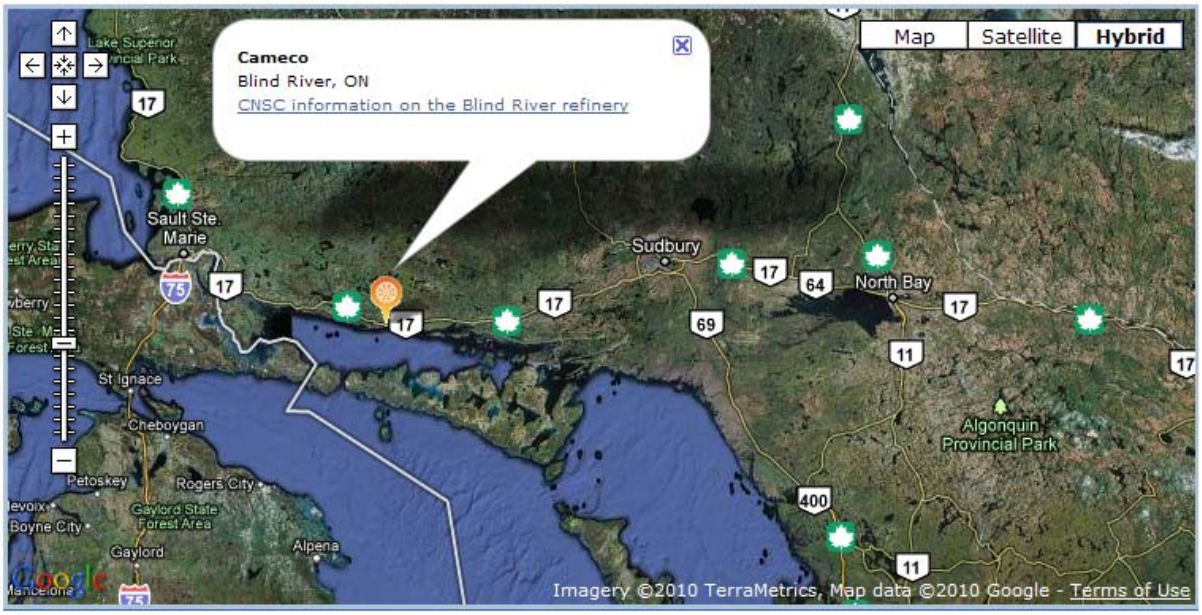


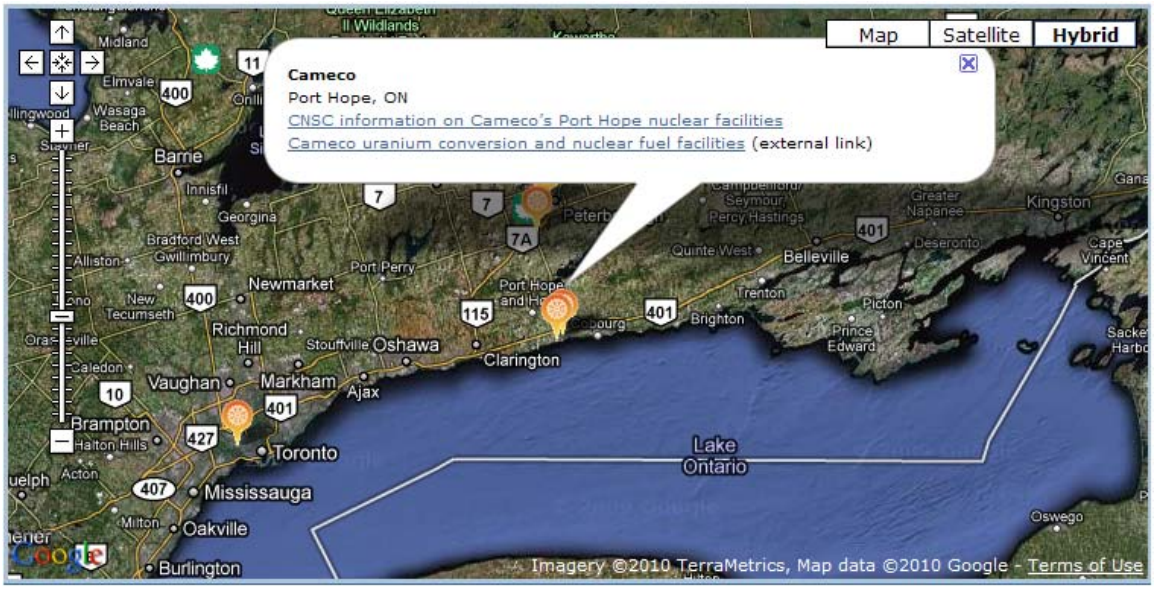
Table 2 | 2010 Uranium Releases to Water (Blind River Refinery)

Month	Mean (mg/L)	Minimum (mg/L)	Maximum (mg/L)
January	0.017	0.013	0.027
February	0.014	0.011	0.016
March	0.012	0.008	0.016
April	0.027	0.012	0.068
May	0.009	0.006	0.012
June	0.009	0.006	0.014
July	0.006	0.005	0.006
August	0.022	0.02	0.023
September	0.015	0.009	0.018
October	0.017	0.013	0.024
November	0.017	0.011	0.032
December	0.012	0.01	0.015
Average	0.0148		
Standard deviation	0.0058		
Total uranium loading (2010): 3.4 kg			

2.2.2 Port Hope Conversion Facility

Cameco Corporation also owns and operates a Class IB nuclear fuel conversion facility in Port Hope, Ontario (see Figure 10). The facility primarily converts uranium trioxide (UO_3) powder produced by Cameco's Blind River Refinery to uranium dioxide (UO_2). The UO_2 is used in the manufacture of CANDU reactor fuel and uranium hexafluoride (UF_6), which, in turn, is exported for further processing into fuel for light water reactors. In addition, there is a specialty metals plant that has been used to convert uranium tetrafluoride into uranium metal shapes for shielding and counterweights for certain types of aircraft. The facility also includes analytical and research laboratories, radioactive waste storage, and recycling and decontamination capabilities.

Figure 10 | Location of Cameco Port Hope Conversion Facility, Port Hope, Ontario

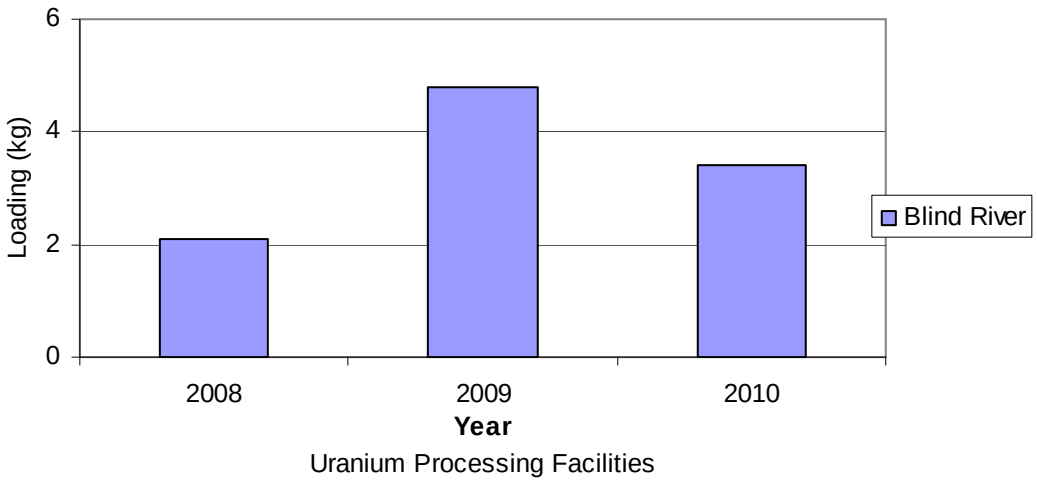


Since the 2007 installation of an evaporative treatment system, all process wastewater streams from the facility are collected, treated, and reprocessed or evaporated. Hence, there are no longer any routine releases of uranium process water to the Port Hope harbour.

2.2.3 Uranium Processing and Conversion Facilities Summary

Monthly mean uranium release concentrations from the Blind River facility were consistently below the OSO during 2010. The Port Hope conversion facility no longer discharges treated process water to the harbour, so there are no routine treated effluent uranium releases to report. Figure 11 compares the 2008 and 2009 annual mass loadings of uranium from the Blind River Refinery to those of 2010. There was approximately 29% of decrease from 4.8 kg to 3.4 kg, and the total annual uranium load to the aquatic environment from the Blind River facility continues to be low.

Figure 11 | Annual Mass Loadings from Uranium Processing and Conversion Facilities (2008 to Present)



2.3 Waste Management Facilities

2.3.1 Elliot Lake Waste Management Facilities

Elliot Lake Historic Sites Facility

For more than 40 years, there were as many as nine operating uranium mines in the area of Elliot Lake, Ontario. The last of these to permanently close were the Quirke and Panel Mines, which both closed in 1990, and the Stanleigh Mine, which closed in 1996.

Following the completion of decommissioning work in 2003, all sites were operated and maintained by Rio Algom Limited under a radioactive waste facility operating licence issued by the CNSC in 2004. The licence was renewed for an indefinite term effective January 1, 2006.

The mining structures on these properties have been demolished and the site has been restored in a manner that protects the environment and public health and safety.

Rio Algom Limited continues to operate and maintain eight tailings management areas and five effluent treatment plants in the watershed.

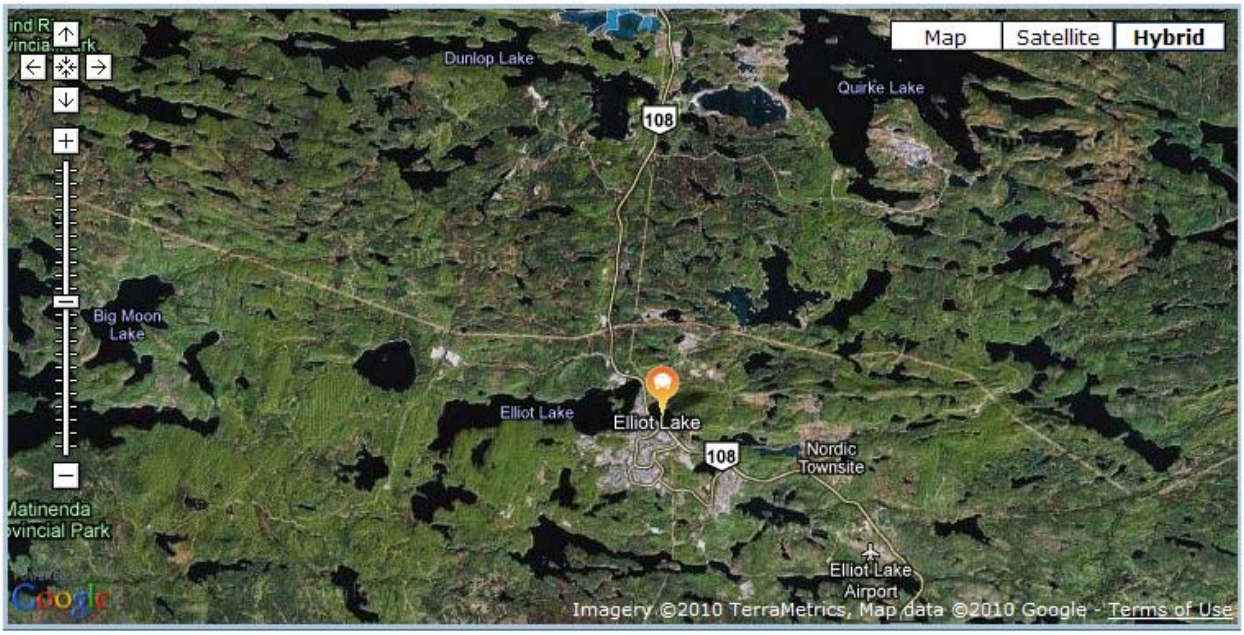
Denison Mining Facility

Denison Mines Inc. possesses CNSC uranium mine decommissioning licences for its two closed uranium mine facilities in Elliot Lake. Both of these sites — the Denison Mine and the Stanrock Mine — have been decommissioned for several years. Mine structures have been removed from both sites, and mine shafts have been capped and decommissioned according to the CNSC requirements.

The CNSC licence covers the facilities and associated physical works, such as dam structures, roads, effluent treatment plants, fencing and tailings management areas that are subject to inspection programs and local and area-wide environmental monitoring programs. The Denison Mine site contains two tailings management areas that are covered by water and contain a total of 63 million tonnes of uranium mine tailings. The Stanrock site is a dry tailings management area with 6 million tonnes of uranium mine tailings. Denison Mines Inc. has 69 million tonnes of the total 168 million tonnes of uranium tailings and associated materials in the Elliot Lake area.

Figure 12 depicts the Serpent River watershed, the City of Elliot Lake and the locations of the tailings management areas (TMAs), which are within a radius of approximately 20 km from Elliot Lake. Drainage from all sites, with the exception of the Pronto site, enters the Serpent River watershed.

Figure 12 | Locations of Waste Management Facilities in Elliot Lake, Ontario



As shown in Table 3, all of the releases for 2010 are below the OSO (0.1 mg/L), with the total annual load generally being in the tens of kilograms or lower. Releases decreased by approximately 41.5% in 2010 (124 kg) compared to those documented in 2009 (212 kg). This table also shows the importance of reviewing total load as well as concentration. Despite consistently low uranium concentrations, releases from Denison tailings management areas (TMA-1, TMA-2 and Rio Algom Limited's Spanish-American TMA) were approximately 43 kg. This is approximately 48% lower than the 2009 mass loading (83 kg) for this area.

Table 3 | 2010 Uranium Releases to the Environment (Elliot Lake Waste Management Facilities)

Waste Management Facility	Annual Average (mg/L)	Standard Deviation (mg/L)	Total Loadings (kg)
Rio Algom			
Pronto	0.0107	0.004	9.8
Nordic, Lacnor and Buckles	0.0032	0.0006	6.0
Panel	0.0126	0.0052	4.0
Quirke	0.0194	0.0036	44.9
Stanleigh	0.0028	0.0008	12.5
Denison Mines			
TMA-1, TMA-2, and Spanish-American TMA: Stollery Lake Outlet (D-2)	0.0965	0.0177	43.2
Seepage from TMA-2: Lower Williams (D-3)	0.0146	0.0057	2.4
Stanrock TMA: Orient Lake Outlet (DS-4)	0.0021	0.0006	1.5

2.3.2 Welcome and Port Granby Waste Management Facilities

The Welcome and Port Granby waste management facilities (WMFs) are regulated by the CNSC through waste nuclear substance licences that came into effect on May 16, 2002. The facilities are located in Ontario, approximately 100 km east of the City of Toronto (see Figure 13).

A private company, Cameco Corporation, was created through the merger of Eldorado Mining and Refining Limited (a federal Crown corporation) and Saskatchewan Mining Development Corporation (a provincial Crown corporation) in 1998. Under the terms of the merger agreement, the Government of Canada (now Natural Resources Canada) retained responsibility for the wastes at the Welcome WMF and the Port Granby WMF. Cameco, however, agreed to manage the facilities on behalf of the federal government until the implementation of a long-term waste management plan. Since the cessation of waste placement, management of these facilities has involved the interception and treatment of contaminated leachate from the waste and the discharge of treated effluent to Lake Ontario.

Under the Port Hope Area Initiative, the Welcome and Port Granby WMFs are to be replaced by two new long-term waste management facilities scheduled for commissioning within the next five to seven years. These facilities will have engineered above-ground mound designs with multilayer covers and base liners and will include wastewater treatment systems that meet modern standards.

Table 4 provides the 2010 monthly mean uranium concentrations and associated total annual load for uranium in the effluent streams for the Welcome and the Port Granby WMFs.

Figure 13 | Locations of Welcome and Port Granby Waste Management Facilities

Table 4 | 2010 Monthly Average Uranium Concentrations Released to the Environment (Welcome and Port Granby Waste Management Facilities)

Month	Welcome WMF (mg/L)	Port Granby WMF (mg/L)
January	0.26	1.6
February	0.15	1.1
March	0.11	0.6
April	0.21	0.63
May	0.35	0.65
June	0.33	0.74
July	0.15	0.91
August	0.17	0.84
September	0.17	0.6
October	0.26	1.24
November	0.19	0.42
December	0.19	1.66
Annual average (mg/L)	0.21	0.92
Standard deviation (mg/L)	0.07	0.40
Load (kg)	20.6	79.5

Releases at the Welcome WMF exceeded the OSO (0.1 mg/L); however, the total annual load was 20.6 kg and was similar to 2009 (20.3 kg).

Differences in the chemical composition of influent caused releases from the Port Granby WMF to be markedly higher than those at the Welcome facility. In 2010, monthly average uranium concentrations were consistently well above the OSO. These elevated concentrations produced a total annual load of 79.5 kg, which is ~3% higher than the 2009 loading (77.2 kg).

In 2008, the CNSC issued the Request for Information pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations: Effluent Discharge Releases at the Welcome and Port Granby Waste Management Facilities*. During 2009, all required actions of the 12(2) letters for the Welcome and Port Granby WMFs were completed. From the information provided, the CNSC required Cameco to take actions to mitigate effects on the environment and to control the releases of nuclear and hazardous substances into the environment. The CNSC's request required two actions:

- to submit an action plan by the end of May 2010 to increase the capacity of the collection ponds and avoid emergency discharges to Clark's ditch during heavy precipitation, which had occurred between January and April
- to submit the results of acute toxicity testing performed during 2009 to the CNSC

With regards to the acute toxicity testing, in 2010 Cameco and AECL submitted their results in the annual reports for Welcome and Port Granby WMFs. The results showed that all samples passed the acute toxicity testing with 0% mortality based on a 48-hour result and 96-hour result.

In 2009, Cameco was also requested to address the feasibility of extending the Port Granby WMF`s discharge pipeline into Lake Ontario. These actions and other site modifications and improvements were completed by Cameco in 2010.

2.3.3 Waste Management Facilities Summary

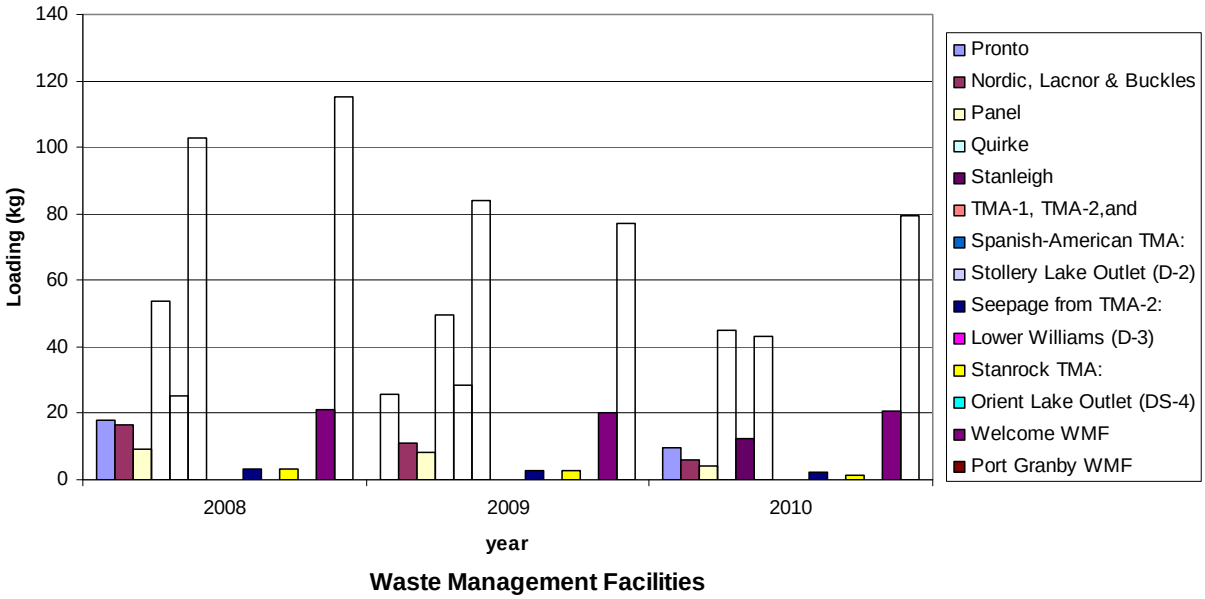
The existing water collection and treatment systems at the Welcome and Port Granby WMFs are currently meeting the licence discharge limits for radium-226, arsenic and pH. Although a discharge limit for uranium is not included in the Welcome and Port Granby WMF licences, Cameco is measuring uranium in treated effluent and reports the results to the CNSC. As shown in Table 4, during 2010, the discharged effluent quality from these facilities exceeded the uranium OSO of 0.1 mg/L. Improvements to the current effluent treatment processes at Welcome and Port Granby WMFs will occur under the Port Hope Area Initiative.

Figure 14 compares the 2009 annual mass loadings of uranium from all waste management facilities to those of 2010. Overall, these releases in 2010 were similar to those in 2009 from Welcome and Port Granby WMF.

During 2010, all required actions to mitigate effects on the environment and to control the releases of nuclear and hazardous substances into the environment related to the 12(2) letters issued by the CNSC in 2008 for the Welcome and Port Granby WMFs were completed.

Considering the upcoming full remediation of the Welcome and Port Granby WMFs and their recent improvements, the CNSC believes these facilities can continue to operate in accordance with their licence requirements until remediation occurs under the Port Hope Area Initiative.

Figure 14 | Annual Mass Loadings from Waste Management Facilities (2008 to Present)



3.0 Management of Uranium Releases: Special activities

3.1 Environment Canada Guidelines: Water Quality Guideline for Uranium

Environment Canada released a draft Canadian water quality guideline for the protection of aquatic life for public review in July 2009 with the final document published in 2011. The guidelines for uranium in fresh water, total recoverable, unfiltered, are 15 μg/L for long-term exposure and 33 μg/L for short-term exposure.

3.2 CNSC effluent project charter: Process for Establishing Release Limits for Nuclear Facilities

The NSCA and its regulations provide the authority and general framework for setting regulatory limits on effluents from nuclear facilities. However, neither the NSCA nor the regulations contain specific numerical effluent limits. In the absence of specified limits, the CNSC has regulated effluent quality through the incorporation of other applicable federal legislation (e.g., the *Metal Mining Effluent Regulations* for uranium mines) directly into licences. This approach does not address a number of radionuclides, nor many other potential hazardous substances within effluent waste streams.

The CNSC has therefore required the development of environmental codes of practice for uranium mines and mills to establish action and administrative levels for COPCs identified through ecological risk assessments or past operating practice. These control levels are based on the normal operating levels of the effluent treatment systems and are used to identify and trigger corrective actions when deviations from normal operating conditions occur.

With the additional responsibilities associated with the NSCA for both environmental protection and hazardous substances, and in response to the CNSC's desire for more clearly specified limits directly within licences, it was determined that a formal review of the CNSC's current practice relative to other international and national means of establishing release limits was required.

To this end, the CNSC staff initiated a project entitled "Process for Establishing Release Limits for Nuclear Facilities". Its overall objective is to develop and document a formal procedure for establishing effluent limits for both nuclear and hazardous substances released from nuclear facilities. These procedures will meet the principles of pollution prevention and regulatory requirements under the NSCA. The project consists of five core activities.

By December 2009, the project's first three core activities were completed. The first core activity documented the international practices used for establishing release limits for radionuclides and compiled releases of radionuclides from international nuclear facilities into a central database. The second core activity documented international and Canadian practices for establishing release limits for hazardous substances and compiled releases of hazardous substances from international nuclear facilities into the database. The assessment of international practices involved Australia, the United States, France, the United Kingdom, other EU member states and South Africa. The third core activity documented current CNSC practices and compiled releases of radionuclides and hazardous substances from CNSC licensed facilities into a central database.

In 2010, the CNSC began work on the fourth core activity and reviewed the national and international practices used for establishing release limits documented in core activities 1 to 3. This review showed that countries establish release limits differently from one another, and that practices varied for nuclear and hazardous substances; however, three generic approaches were identified:

i. Exposure-based approach: Limits are based on scientifically developed standards (or criteria) to ensure the health and safety of people and the environment.
ii. Technology-based approach: Limits are based on the approved design and operating performance of the facility.
iii. Combined exposure/technology-based approach: Limits are established using both a technology-based approach and an exposure-based approach with the stricter limit being applied.

In Canada, the Canadian Council of the Minister's of Environment uses the exposure-based approach to establish release guidelines for hazardous substances.

In order to make its recommendations and identify an appropriate methodology for the establishing release limits, the CNSC issued a discussion paper that for public consultation in February 2012. The discussion paper summarizes the CNSC's current regulatory framework for environmental protection and highlights some improvements to the framework, including the CNSCs proposed recommendations for establishing release limits for nuclear facilities.

4.0 CNSC/Environment Canada 2010 Annual Meeting

The Annex to the MOU states:

"The Department and Commission staff will meet annually or more frequently by mutual consent to assess progress on the implementation of this Annex and on the effectiveness of the control measures to reduce the effluent toxicity of the above mentioned facilities."

CNSC staff (from the Directorate of Environmental and Radiation Protection and Assessment) and Environment Canada staff (from the Environmental Protection Operations Division, Ontario) meet formally every year to address issues related to the Annex to the MOU and to coordinate other activities related to sharing regulatory and technical expertise. These meetings have also served as a venue for coordinating additional cooperative activities that are not specific to the Annex.

Routine coordinated regulatory activities with respect to CNSC licensees continued during 2010. These included participation of CNSC staff in the national *Metal Mining Effluent Regulations* technical advisory panels for each of the uranium mines, as well as coordination with Environment Canada and the Department of Fisheries and Oceans to address issues related to fish impingement and entrainment and thermal effluent at nuclear power plants.

A formal meeting along with a two-day workshop took place in May 2010 to address several common issues both within and outside the MOU. More than 60 CNSC and Environment Canada staff attended the workshop, which included formal presentations and table discussions in smaller groups focused on improving information exchange and collaboration between the Commission and the Department.

5.0 Conclusion

CNSC staff assessments confirm that during 2010, annual average uranium discharge concentrations from all CNSC-regulated facilities (including mines and mills, processing and conversion facilities, and waste management facilities) were below the CNSC screening objective of 0.1 mg/L, with the exception of the Welcome and Port Granby waste management facilities.

In 2010, monthly average uranium discharge concentrations from all CNSC-regulated facilities (including mines and mills, processing and conversion facilities, and waste management facilities) were below the screening objective, with the exception of Rabbit Lake uranium mine and mill and the Welcome and Port Granby waste management facilities.

The Rabbit Lake mill operation continues to discharge the highest load of uranium to the environment. Its load in 2010 was approximately 15% greater than in 2009 (340 kg in 2009, 390 kg in 2010).

In 2010, the total annual loading released from uranium mines and mills increased 17% (from 378 kg in 2009 to 443 kg in 2010). The total annual loading released from waste management facilities decreased by approximately 28%, from 310 kg in 2009 to 224 kg in 2010. Loadings from uranium processing and conversion facilities continue to be very low and decreased 29%, from 4.8 kg in 2009 to 3.4 kg in 2010.

The 2010 overall uranium mass loading to the environment from all CNSC-licensed facilities was 3.3% lower than in 2009 (from 693 kg in 2009 to 670 kg in 2010). The CNSC continues to be proactive in pollution prevention and in regulating releases from nuclear facilities.

In conclusion, the CNSC and Environment Canada continue to meet their regulatory commitments and responsibilities associated with the safe regulation and risk management of uranium releases from nuclear facilities.

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Appendix A: Copy of the Memorandum of Understanding and Associated Annex

Note: Available online at
http://www.nuclearsafety.gc.ca/eng/lawsregs/agreements/mou_ec/

Appendix A: Memorandum of Understanding (MOU) Between the Canadian Nuclear Safety Commission and Environment Canada

WHEREAS the Canadian Nuclear Safety Commission (hereinafter, "the Commission") and Environment Canada (hereinafter, "the Department") have independent but related mandates in regard to the protection of the environment and activities carried out under their respective mandates have the potential to affect the programs and responsibilities of the other;

WHEREAS the Regulatory Policy of the Government of Canada requires that federal departments and agencies take full advantage of opportunities to coordinate their activities with each other;

WHEREAS the Commission regulates, pursuant to the *Nuclear Safety and Control Act* (NSCA), the development, production and use of nuclear energy and the production and use of nuclear substances, prescribed equipment and prescribed information in order to:

i. prevent unreasonable risk to the environment and to the health and safety of persons;
ii. prevent unreasonable risk to national security; and
iii. achieve conformity with measures of control and international obligations to which Canada has agreed;

WHEREAS the Department under the *Department of the Environment Act* has powers, duties and functions relating to the preservation and enhancement of the quality of the natural environment, including water, air and soil quality; renewable resources, including migratory birds and other non-domestic flora and fauna; water; meteorology; the enforcement of rules and regulations arising from the advice of the International Joint Commission relating to boundary waters and questions arising between the United States and Canada in so far as they relate to the preservation and enhancement of environmental quality;

WHEREAS the Department regulates, pursuant to the *Canadian Environmental Protection Act* (CEPA, 1999), has the mandate to:

i. ensure that preventive and remedial measures are taken to protect the environment;
ii. establish nationally consistent levels of environmental quality;
iii. apply knowledge, science and technology to resolve environmental problems;
iv. protect the environment from the release of toxic substances; and
v. assess whether substances in use in Canada are toxic or capable of becoming toxic;

WHEREAS the Department has been assigned responsibility for the administration and enforcement of subsection 36(3) of the *Fisheries Act*, which deals with the deposit of deleterious substances into water frequented by fish;

THEREFORE, the Commission and the Department agree to consult and cooperate in accordance with the following sections of this Memorandum of Understanding in order to minimize regulatory duplication and to use government resources effectively.

I. PRINCIPLES

1. The parties, in carrying out their respective mandates will cooperate and support each other, as appropriate, in meeting their responsibilities in relation to environmental conservation and protection and in other areas of mutual interest.

2. The parties will take all reasonable steps, consistent with their respective mandates, to see that their environmental protection policies and measures are complementary and designed to provide effective environmental protection.

3. The parties will provide each other the opportunity to advise on policies and programs that may affect the mandate of the other, in a manner that allows for timely and substantive advice.

4. The parties will foster strong working relations by establishing mechanisms and links to share information, taking into account legal constraints on the sharing of confidential business information.

II. IMPLEMENTATION

The Department agrees to:

1. Inform and advise the Commission on the Department's current policies, programs, standards and regulations concerning the protection of the environment, and the management of toxic substances of concern to the Commission;

2. Provide the opportunity to the Commission to provide guidance, information and advice prior to developing, amending or terminating the policies, programs, standards or regulations referred to in the above paragraph that may affect the facilities and activities regulated by the Commission;

3. Cooperate with the Commission on regulatory matters of mutual concern involving the nuclear industry, including:
    a. developing and managing programs and processes for the implementation of obligations pursuant to the *Canadian Environmental Protection Act* (CEPA,1999), as they relate to facilities and activities regulated by the Commission;
    b. consulting with the Commission, on request, in the review of applications before the Commission, and where appropriate, providing advice on matters concerning the protection of the environment;
    c. promoting awareness among licensees of the Commission of the Department's mandated requirements;
    d. verifying compliance with the regulatory requirements of either the Commission or the Department;
    e. sharing environmental information; and
    f. informing the Commission of any review or investigation by the Department of a non-compliance incident under its jurisdiction that may have occurred at a facility regulated by the Commission; and where appropriate, consulting and coordinating with the Commission, prior to taking regulatory enforcement actions at facilities, or on activities licensed by the Commission.

4. Consult and cooperate with the Commission in the development of any national or international standard, agreement, convention, or commitment that could affect the regulation of the nuclear industry by the Commission;

5. Cooperate with the Commission in matters of mutual interest related to nuclear emergency preparedness and response;

6. Cooperate with the Commission on the conduct of environmental studies, assessments or research projects of potential interest to the regulation of the nuclear industry, and in the sharing of expert assistance and financial resources for such purpose; and

7. Coordinate public communication and consultation activities with the Commission on matters of mutual interest and responsibility.

The Commission agrees to:

1. Inform and advise the Department on the Commission's current policies, programs, standards and regulations concerning the protection of the environment and the management of toxic substances in relation to nuclear facilities and activities;

2. Provide the opportunity to the Department to provide guidance, information and advice prior to developing, amending or terminating the policies, programs, standards or regulations referred to in the above paragraph that may involve the use, release or management of substances designated as toxic under CEPA, and other contaminants of mutual environmental concern;

3. Cooperate with the Department on joint regulatory matters concerning the nuclear industry, including:
    a. developing and managing programs and processes for the implementation of obligations pursuant to the *Nuclear Safety and Control Act* (NSCA), as they relate to facilities and activities regulated by the Department;
    b. providing the Department with the opportunity, on request and where appropriate, to review applications before the Commission and provide advice on matters concerning the protection of the environment;
    c. promoting awareness of the Department's requirements among licensees of the Commission;
    d. verifying licensee compliance with the regulatory requirements of either the Commission or the Department;
    e. providing the Department with the opportunity, on request and where appropriate, to participate in joint compliance inspections of facilities and activities licensed by the Commission;
    f. sharing environmental information; and
    g. informing the Department of any review or investigation by the Commission of a non-compliance incident under its jurisdiction that may involve substances designated as toxic under CEPA or other contaminants of mutual environmental concern; and where appropriate, consulting and coordinating with the Department, prior to taking regulatory enforcement actions involving the environment.

4. Consult and cooperate with the Department in the development of any national or international standards, agreements or conventions concerning the protection of the environment;

5. Cooperate with the Department in matters of mutual interest related to nuclear emergency preparedness and response;

6. Cooperate with the Department on the conduct of environmental studies, assessments or research projects of potential interest to the regulation of nuclear facilities and activities, and in the sharing of expert assistance and financial resources in the conduct of these studies, assessments or research projects; and

7. Coordinate public communication and consultation activities with the Department on matters of mutual interest and responsibility.

III. TERMS OF THE MOU

1. The primary points of contact under this MOU, and responsible for its administration, are the Vice-President, Operations Branch, CNSC, and the Regional Director General, Ontario Region, Environment Canada who will meet annually during the normal planning process.

2. The parties will make every reasonable effort to resolve at the working level any conflicts that arise from this Memorandum of Understanding. Failing resolution at the working level, conflicts may be referred for resolution to the offices named pursuant to paragraph 1 above, or to the signatories to this Memorandum.

3. Subject to paragraph 4, the parties will provide or honour without charge to the other party the services agreed to and the commitments made in this Memorandum of Understanding.

4. The parties recognize that the delivery of certain services agreed to in this Memorandum of Understanding, or the honouring of certain commitments made in this Memorandum, may be subject to cost recovery regulations or may require, on a case by case basis, financial arrangements between the Commission and the Department to offset, in whole or part, the associated costs. Where such arrangements are necessary, the parties agree to consult and cooperate to develop mutually satisfactory arrangements.

5. The parties agree to consult in advance concerning any significant changes in the level or nature of service that either party may request, or intends to request, of the other party pursuant to this Memorandum of Understanding.

6. The parties agree to collaborate on identifying opportunities for training and staff exchanges in areas of mutual interest.

7. This Memorandum of Understanding becomes effective on the date of the last signature, and shall remain in effect until modified or withdrawn. The Memorandum may be revised by the mutual consent of the Department and the Commission. Either party may withdraw from the agreement by providing at least six (6) months notice in writing to the other party, specifying its intention to withdraw and the effective date of withdrawal.

Signed in duplicate in the English and French languages.

Signed on: 23/09/03 Signed on: 10/7/03

For the Canadian Nuclear Safety Commission: For Environment Canada:

President Deputy Minister

ANNEX 1

To the Memorandum Of Understanding (MOU) Between Environment Canada And The Canadian Nuclear Safety Commission - Risk Management Process For Radionuclides As Assessed Under The *Canadian Environmental Protection Act*, 1999

Assessment of Radionuclides under the *Canadian Environmental Protection Act,* 1999

Pursuant to the provisions of the *Canadian Environmental Protection Act, 1999* (CEPA, 1999), Environment Canada (the Department) completed an assessment of releases of radionuclides from nuclear facilities, consisting of sectoral assessments for impacts on non-human biota.

The assessment concludes that uranium and uranium compounds contained in effluents from uranium mines and mills meet the environmental toxicity criteria set out in paragraph 64(*a*) of CEPA, 1999. The assessment recommends that the investigation of options to reduce exposure to uranium and uranium compounds contained in effluents from such facilities be considered a high priority.

Considerations / Principles for Cooperation

Pursuant to paragraph 3(*a*) under Section II (Implementation) of the MOU between the Department and the Canadian Nuclear Safety Commission (the Commission) and under the terms of this Annex, the Department and the Commission agree to develop and implement a program to reduce or control the exposure of non-human biota to uranium and uranium compounds contained in effluents from such facilities.

Under the *Nuclear Safety and Control Act* (NSCA), the Commission has the mandate to ensure that the operation of nuclear facilities, such as uranium mines and mills, does not pose unreasonable risks to the environment. The NSCA came into force on May 31, 2000. Environmental protection is integral to the new regulatory mandate, and the NSCA provides a broad range of regulatory powers respecting environmental protection.

It has been determined that it is possible to prevent or control the amount of uranium and uranium compounds released to the environment in effluents from uranium mines and mills under the NSCA. The Department and the Commission will work cooperatively to ensure preventive or control measures are developed and implemented in a manner that is consistent with and comparable to CEPA 1999.

It is on this basis, and to avoid regulatory duplication, that it has been recommended that the Minister of the Environment and the Minister of Health take no further action at this time, pursuant to subsection 77(6) of CEPA 1999. The Commission will develop preventive or control measures under the NSCA with support from the Department.

Nothing in this Annex modifies or restricts the mandate, responsibilities or authorities of the Minister of the Environment, of the Minister of Health or of the Canadian Nuclear Safety Commission.

Development of Preventive or Control Measures

The Commission will appoint a risk manager and initiate the process to develop preventive or control measures for releases of uranium and uranium compounds from specified uranium mines and mills where the effluent has been identified as likely to be causing harm to aquatic organisms, within three months of the date of the release of the final CEPA assessment report. These mines and mills include Rabbit Lake, Key Lake and Cluff Lake.

Commission staff will consult with stakeholders on the proposed preventive or control measures in a public process.

Commission staff will consult with the Department during the options review and approval process.

While developing the preventive or control measures under the NSCA, the Commission can utilize, depending on the circumstances, licence conditions, orders, or requests for analyses and modification of designs, equipment or procedures, to ensure that effluent releases are not likely to cause significant environmental harm.

Preventive or control measures will include an Environmental Emergency Plan to prevent or mitigate the environmental effects of accidental releases of uranium and uranium compounds in effluent within the site of the licensed activity and into the environment.

In the case of the Rabbit Lake Mine/Mill, a study of technical options to improve the quality of effluent of the mine/mill will be completed within 26 months of November 1 2003, which corresponds to the coming into force of the Rabbit Lake licence renewal. The design, installation and commissioning of the control measures will be completed within the following 16 months.

In the case of the Key Lake Mine/Mill, environmental performance objectives will be developed and implemented within 12 months of the date of release of the CEPA assessment report. Commission staff will verify that effluent management improvements and the treatment facilities that have been installed are effective and that the effluent is no longer causing significant toxicity.

Environmental performance objectives identified in the preventive or control measures will be based on implementation of all reasonable precautions to control the release of uranium and uranium compounds in effluent within the site of the licensed activity and into the environment as a result of a Commission-licensed activity.

In the case of the Cluff Lake Mine/Mill, the mine/mill has ceased operations and was granted a Decommissioning Licence for a five-year term, valid until July 31, 2010. The Cluff Lake Mine/Mill is, therefore, not subject to immediate risk management measures.

The Commission will continue to ensure that uranium and uranium compounds contained in effluent from all nuclear facilities are not causing significant environmental harm.

The Department will identify a point of contact to coordinate assistance to the Commission.

The Department will assist the Commission through the provision of training and guidance documents, and/or the conduct of specific studies.

The Department and Commission staff will meet annually or more frequently by mutual consent to assess progress on the implementation of this Annex and on the effectiveness of the control measures to reduce the effluent toxicity of the above-mentioned facilities.

Releases of radionuclides from nuclear facilities will be regularly monitored by the Commission to evaluate whether risk management initiatives are needed for ionizing radiation. The Department and Commission staff will meet annually or more frequently by mutual consent to review and assess any new information related to the environmental risk from ionizing radiation and take action if necessary.

The Department and the Commission agree to prepare and make public a joint annual report outlining progress on the implementation of this Annex within six months after the end of the calendar year for which it is prepared. Signed in duplicate in the English and French languages.

Signed on: Dec 13, 2004

For the Canadian Nuclear Safety Commission:

President

Signed on: DEC 0 2 2004

For Environment Canada:

Deputy Minister

1. Government of Canada Regulatory Policy, 1999

Appendix B: Glossary

ALARA (as low as reasonably achievable)	Every reasonable effort to maintain exposures as far below the regulated dose limits as is practicable, taking into account the state of technology, economics of improvements in relation to the state of technology, economics of improvements in relation to benefits to the public health and safety and other societal/socioeconomic considerations, and in relation to the use of nuclear energy and licensed material in the public interest.
Code of Practice: Effluent	An administrative framework applied to identify when effluent quality is deteriorating, indicating the potential loss of treatment control. Effluent contaminant concentrations are identified and, if exceeded, require the operator to perform specific actions (as documented in the Code of Practice) to decrease contaminant concentrations. The Code of Practice identifies specific treatment plant actions as well as reporting requirements to the CNSC.
µg/L (micrograms per litre)	A concentration measurement that describes the quantity of a substance within a liquid media. 1 µg/L is the same as one part per billion (1 ppb), meaning there would be 1 g of uranium distributed in 1 million litres of water.
biota	All living organisms, including humans.
CEPA toxic	Substance determined to be toxic as defined under the *Canadian Environmental Protection Act* (CEPA 1999). "A substance is toxic if it is entering or may enter the environment in a quantity or concentration or under conditions that (*a*) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; (*b*) constitute or may constitute a danger to the environment on which life depends; or (*c*) constitute or may constitute a danger in Canada to human life or health."

Class I nuclear facility

These facilities include the following:

- nuclear fission or fusion reactors
- vehicles equipped with reactors
- particle accelerators
- uranium, thorium or plutonium processing and product manufacturing plants
- disposal facilities for nuclear substances generated at another nuclear facility

commissioning

The process during which systems and components of facilities and activities, having been constructed, are made operational and verified to be in accordance with design specifications and to have met the required performance criteria. Commissioning may include both non-radioactive and radioactive testing.

decommissioning

Administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility. This does not apply to a repository or to certain nuclear facilities used for mining and milling of radioactive materials, for which closure is used.

deleterious substance

As defined in the *Federal Fisheries Act:*
"(*a*) any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or
(*b*) any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, and without limiting the generality of the foregoing includes
(*c*) any substance or class of substances prescribed pursuant to paragraph (2)(a),
(*d*) any water that contains any substance or class of substances in a quantity or concentration that is equal to or in excess of a quantity or concentration

	prescribed in respect of that substance or class of substances pursuant to paragraph (2)(b), and (*e*) any water that has been subjected to a treatment, process or change prescribed pursuant to paragraph (2)(*c*).”
dewatering water	Groundwater intercepted by pumps to prevent it from flowing into open pits or into the underground workings of a mine.
effluent	The waste stream (in particulate, gaseous or liquid form) from a facility released into the environment.
ion exchange process	A usually reversible exchange of one ion with another, either on a solid surface or within a lattice. A commonly used method for treatment of liquid waste.
loadings	A quantity of a substance (e.g., water, sediment, nutrients, pollutants) introduced into a receiving media. Loading may be from humans (e.g., pollutant loading) or natural (e.g., natural background loading) sources, and is typically described as the mass (of introduced substance) per unit volume air or water (the receiving media). Liquid effluent loadings are calculated by multiplying the concentration of a contaminant in the effluent by the volume of effluent released. For example, releasing 20,000 L of effluent containing 1µg/L of uranium results in the release of 0.02 g of uranium to the environment; hence, the loading to the environmental system in this case is 0.02 g.
memorandum of understanding (MOU)	A document describing a bilateral or multilateral agreement between parties. It expresses a convergence of will between the parties, indicating an intended common line of action.
modelling parameters	Numerical values used to characterize properties of contaminants (e.g., octanol-water partitioning coefficient) and environmental media (e.g., organic matter fraction of soil) that are used in models to predict the environmental fate and transport of contaminants for the environmental risk assessment.

optimization screening objective (OSO)	The CNSC is using a value of 0.1 mg/L for the concentration of uranium in treated effluent as an interim design objective for new facilities and as an optimization screening objective for existing facilities. This value is used to identify those facilities which, while not exceeding any regulatory limits, should review their treatment process to determine whether the present system can be optimized or upgraded to meet the CNSC's expectations for ALARA.
precipitation pond	A precipitation pond retains treated water, allowing increased time for chemical reactions to occur between treatment agents and contaminants. This results in the 'precipitation' or settling of solids and associated contaminants from the water column.
Priority Substances Lists (PSL1 and PSL2)	The Priority Substances Lists (PSL1 and PSL2) were established by the ministers of the Environment and of Health. They identify substances to be assessed on a priority basis to determine whether they are toxic (as defined under Section 64 of the CEPA) and pose a risk to the health of Canadians or to the environment.
radionuclide	A nucleus of an atom that possesses properties of spontaneous disintegration (i.e., radioactivity). Nuclei are distinguished by their mass and atomic number.
reverse osmosis	Movement of a solvent out of a solution under pressure through a semipermeable membrane into pure solvent or a less concentrated solution at lower pressure. This process can be used to increase the radionuclide concentration in a solution.