

BEAVERLODGE DECOMMISSIONED PROPERTIES

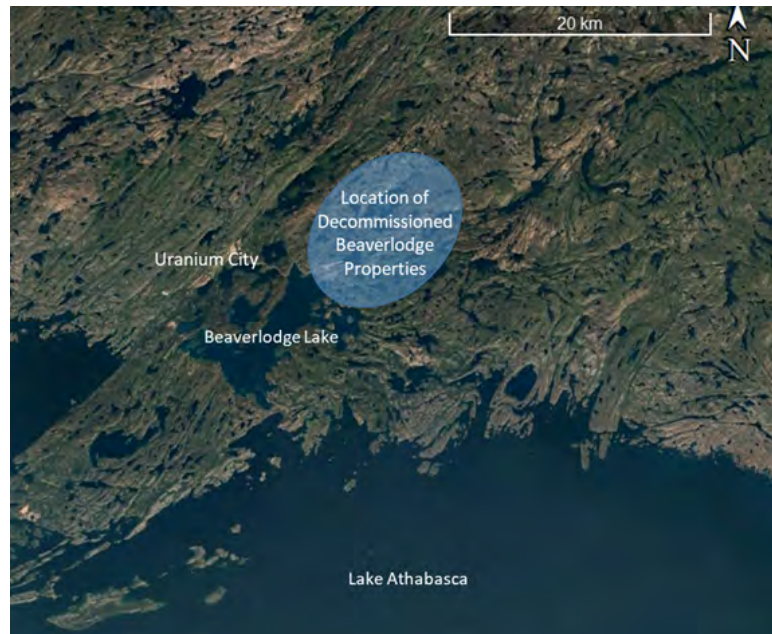
Environmental Risk Assessment Overview

The decommissioned Beaverlodge properties, are located north of Lake Athabasca, in the northwest corner of Saskatchewan (approximately 840 km north of Saskatoon).

OVERVIEW

Eldorado Mining and Refining Limited operated the Beaverlodge uranium mine/mill complex from 1952 until 1982. The decommissioning of the associated properties occurred between 1982 and 1985 (the Beaverlodge properties), following a regulatory approved plan. Post-decommissioning monitoring was initiated in 1985. Cameco Corporation (Cameco) took over the responsibility of the Beaverlodge properties in 1988 on behalf of the Government of Canada as the site licensee. The financial liabilities associated with the site belong to the Government of Canada and are managed through Canada Eldor Inc.

An environmental risk assessment (ERA) was completed to help assess the potential risks to people and the environment posed by the historic mining and milling activities that occurred on the properties. The most recent ERA was completed in 2020; this assessment was built on knowledge gained from previous studies and reports and incorporated information gathered through almost 40 years of environmental monitoring, stakeholder input, and survey of local community members. The ERA evaluated the influence of the decommissioned Beaverlodge properties on the immediate and downstream receiving environment, and assessed whether recovery of the environment is occurring as expected.



The results of the 2020 ERA are consistent with the findings from the 2008 to 2012 Status of Environment (SOE) and the 2018 ERA. The immediate and downstream environments will continue to gradually recover over time.

Based on reported use of the land, there are not expected to be risks to humans residing near or consuming food from areas surrounding the decommissioned Beaverlodge properties. Therefore, living a traditional lifestyle and consuming country foods from the area, while respecting the water and fish advisories, can safely continue.

ENVIRONMENTAL RISK ASSESSMENT - ERA



An ERA is a systematic process used to identify and assess potential risks. There are two parts to an ERA: 1) an assessment of people who use the area through a human health risk assessment (HHRA); and 2) an assessment of living things in the environment (such as plants, insects, animals) through an ecological risk assessment (EcoRA). In 2020 Cameco completed an environmental risk assessment (ERA) for the decommissioned Beaverlodge properties to align with the standardized requirements found in CSA N288.6-12 Environmental risk assessments at Class I nuclear facilities and uranium mines and mills (CSA 2012).

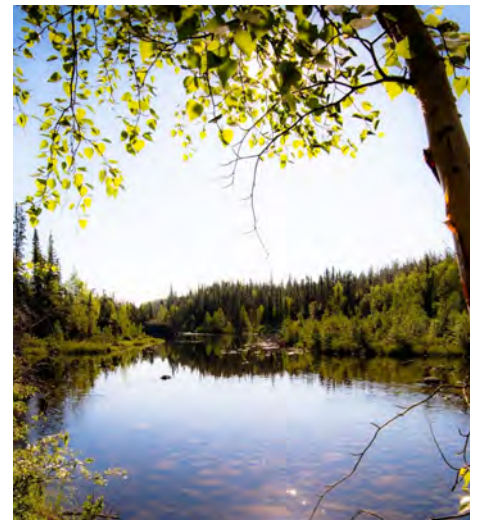
In addition to the Canadian Standards Association (CSA), ERA are developed consistent with guidance from various federal authorities, such as Health Canada (HC), Environment and Climate Change Canada (ECCC), the Canadian Council of Ministers of the Environment (CCME) and the Canadian Nuclear Safety Commission (CNSC).



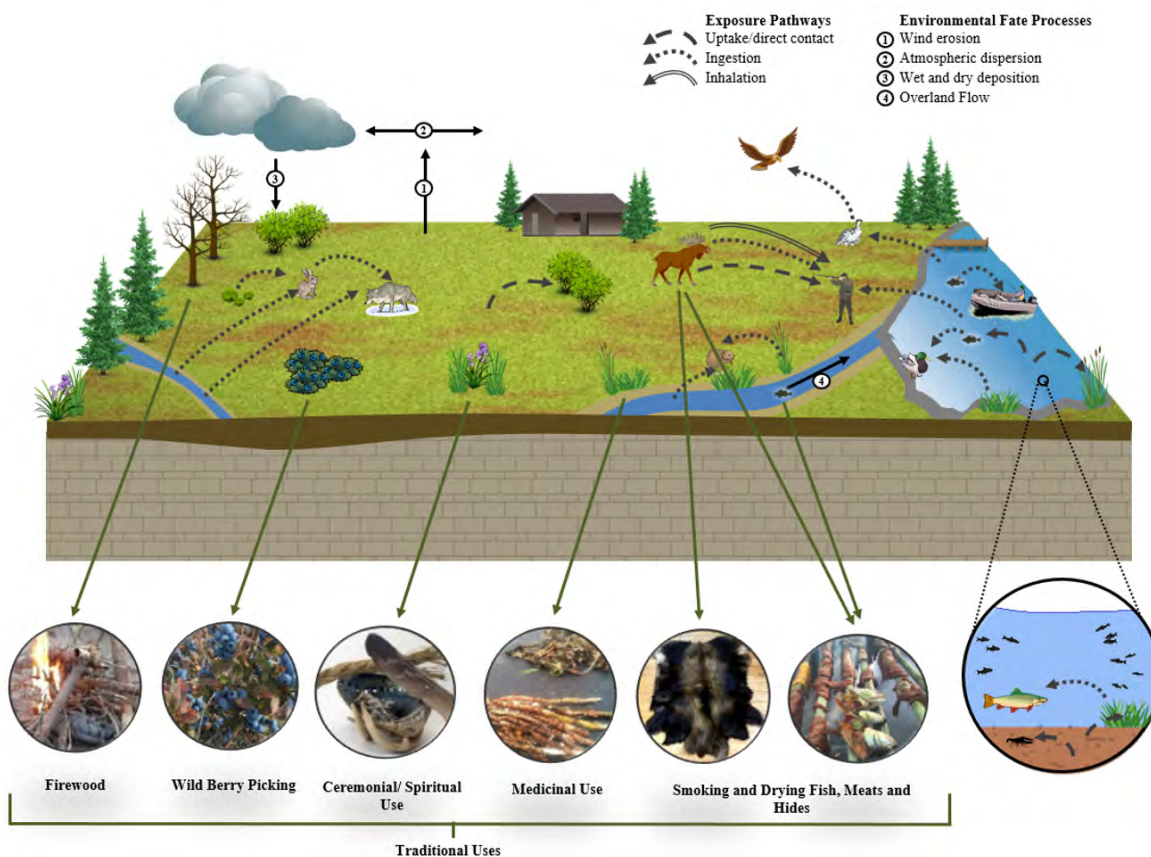
SITE DESCRIPTION

Beaverlodge Lake receives surface water influenced primarily by historical mining and milling activities on the decommissioned Beaverlodge properties, which are located upstream within the Ace Creek and Fulton Creek watersheds; however, it also is influenced from other non-Eldorado abandoned uranium mine sites and tailings areas within the Beaverlodge Lake watershed. An aerial view of the main decommissioned Beaverlodge mine and mill site is shown above.

The assessment study areas include waterbodies within both the Ace Creek and Fulton Creek watersheds, the eastern and central areas of Beaverlodge Lake, and downstream waterbodies, including Martin Lake and Crackingstone River. Virtual site tours of the decommissioned Beaverlodge properties are available in English and Dene at www.beaverlodgesites.com.



The foundation of the ERA is the Conceptual Site Model (CSM). The CSM summarizes releases to the environment and how contaminants are expected to move in the environment. It identifies who uses the land, including both people and biota (e.g., wildlife, plants). This information, together with information on the potential influence of Constituents of Potential Concern (COPCs), are used in the risk assessment. The CSM for the decommissioned Beaverlodge properties (below) was developed from understanding of the historic operations, environmental monitoring data, as well as scientific and traditional knowledge of the site.



The COPCs were determined to be selenium, uranium, and radium-226. Since uranium and radium-226 are radionuclides, total radioactivity was also included. Total dissolved solids (TDS) was included to aid contaminant dispersion model calibration.

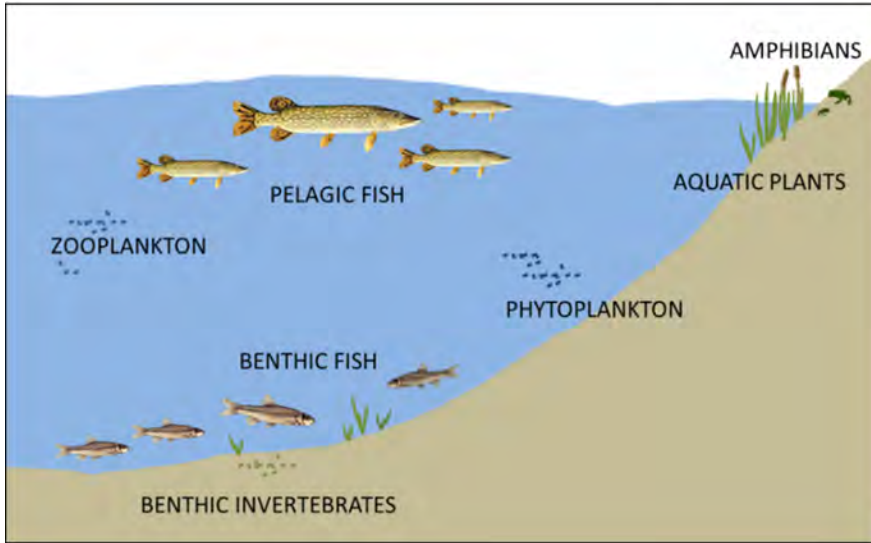
The ERA is based on an understanding of the loadings from the site and how the COPCs move in the natural environment. The ERA used measured data on concentrations and flow in the environment, as well as estimates from environmental modelling. The 2020 assessment provided the opportunity to update the environmental modelling, which is informed by almost 40 years of monitoring results.

Environmental Modelling

The movement of COPCs in the environment was modelled in 2020 using a computer program called ADEPT (Assessment of the Dispersion and Effects of Parameter Transport), which is a contaminant dispersion and transport model for waterbodies that includes pathways and risk assessment calculations.

The model can assess a variety of COPCs and considers numerous lakes/rivers/wetlands/bays and can handle complex watershed systems. The Beaverlodge model was developed to integrate loadings from features such as runoff/infiltration from waste rock piles, historical flow from plugged boreholes, etc., as well as including the current load within the waterbodies (e.g., sediments) and to incorporate the predicted benefit of implemented remedial activities.

The assessment includes the prediction of water and sediment quality in the Ace Creek Watershed, Fulton Creek Watershed, Beaverlodge Lake, and downstream through Crackingstone River. As expected, as natural recovery of the modelled systems occur, water and sediment concentrations are predicted to gradually improve over a longer period of time.



Selection of Receptors

A number of ecological receptors were selected to represent the diversity in the environment in the area, while focusing on the aquatic environment. In the water, this includes all parts of the community (insects, plants, algae, and fish). Animals that use the water (e.g., waterfowl, muskrat, mink) are also included.

Ecological receptors were selected based on surveys in the area, as well as other considerations including stakeholder interviews and input from local communities. It is also important to determine the presence or absence of species at risk, which require a more stringent level of protection and can influence the choice of receptor. Potential species at risk for a specific site are identified by cross-referencing registries which list all species at risk with the site location; this list is then narrowed down based on knowledge of the site obtained from previous biological surveys. Selected species at risk for the Beaverlodge 2020 ERA include the little brown bat and common nighthawk, both of which are potentially present in the area and are listed as endangered and threatened, respectively. These species are both generally abundant in Saskatchewan.

The selected wildlife include mallard, merganser, scaup, mink, muskrat, common nighthawk and little brown bat.



The human receptors were selected to capture a range of people who may use the area. The evaluated human receptors are consistent with previous assessments, and include a family spending three months of the year at the Bible Camp on Ace Lake and people camping for two weeks each year at other locations in the area. Input from regulators and local users was important for defining the appropriate scenarios. The evaluated exposure scenarios are considered conservative in nature, as local land users reported minimal use of the decommissioned Beaverlodge properties.

For each receptor, exposure estimates are compared to various benchmarks.



Receptor Pathways

Consistent with N288.6-12, the receptor pathways for the ecological and human health assessments are shown in the tables below.

Ecological Exposure Pathways

Receptor Group	Exposure Pathways		
	Surface Water	Sediment	Food
Aquatic birds	✓	✓	✓
Terrestrial birds	✓	NR	✓
Semi-Aquatic mammals	✓	✓	✓
Terrestrial mammals	✓	NR	✓
Amphibians ¹	✓	✓	NR*
Fish	✓	✓	NR*
Aquatic plants	✓	✓	NR*
Aquatic invertebrates	✓	✓	NR*

Notes: NR – not relevant; ✓ - assessed; *Evaluated by comparing water or sediment concentrations to benchmarks that address all pathways, including food; 1 - Assessed using fish as surrogate.

Human Health Exposure Pathways

Potential Pathway of Exposure	Members of the Public
Incidental ingestion and direct contact with soil	Min
Inhalation of air and contact Drinking water	Min
Other uses of potable water (e.g., bathing)	Yes
Harvest local foods (e.g., berries)	Min
Hunting / Trapping	Other
Fishing	Other
Garden produce ingestion	Yes
Irrigation of vegetation (potable / groundwater / surface water)	Min
Livestock	Min
External dose from soil (groundshine)	No
Recreational use of surface water (e.g., swimming)	Yes
	Min

Notes: Yes – Potential Pathway for 2020 ERA; No – Not a potential pathway of exposure; Min – Minimal exposure, not significant and not quantified; Other – addressed by other exposure (e.g. harvest of local foods and hunting/trapping evaluated in the Uranium City Country Foods Study, as discussed below).

OTHER STUDIES

Country Foods

The Uranium City Country Foods Study examined the human health implications of consuming locally-sourced country foods. It was a two-year study that surveyed the residents of Uranium City to collect detailed information on country foods consumption patterns. A total of 115 people from Uranium City and the surrounding area were interviewed, representing ~91% of seasonal and permanent residents. The survey asked where each individual sources their regional country foods from and how much of each item are typically consumed. Samples of local country food were sent for laboratory analysis. Information collected during the survey and subsequent sampling plan was used in a risk evaluation. The results indicated that, in general, the exposures to residents as a result of the consumption of country food are similar to those of members of the general Canadian population and do not represent a cause for concern

Eastern Athabasca Regional Monitoring Program (EARMP)

EARMP is a regional monitoring program initiated in 2011 to monitor potential cumulative effects downstream of uranium mining and milling operations. It focuses on seven communities in the Athabasca region (four First Nation and three municipalities), including Uranium City and Camsell Portage. The program includes technical and community-based monitoring components that involve ongoing sampling of water, sediment, fish, and other locally harvested foods, and evaluation of the benthic invertebrate community for long-term trends. Further information on the EARMP program can be found at www.EARMP.ca A 2018 Human Health Risk Assessment looking at the collected information concluded that the risks associated with consuming country foods and drinking water were negligible for all locations, including Uranium City.

Community Based Environmental Monitoring Program (CBEMP)

There is a history of broader environmental monitoring throughout the area. Starting in 2000, the Athabasca Working Group (AWG) Environmental Monitoring Program was in place across all of the Athabasca Basin. In 2018, the AWG program became the Community Based Environmental Monitoring Program (CBEMP). As part of this program, each community in the Athabasca Basin will have a specific, focused study that reflects what they eat, how much they eat and generally where the food comes from. CBEMP results for 2018 and 2019 indicate that country foods identified by members of the Black Lake First Nation, the Hamlet of Stony Rapids, and the community of Fond du Lac remain safe for consumption. The 2021/22 CBEMP program will occur in Uranium City and Camsell Portage, and, as with the previous CBEMP studies, results from this study will be shared with community leaders and members in a report and at a community meeting.





Risk Assessment Methodology

The risk assessment uses information on "What" (selected COPCs), "Who" (identified receptors), and "How" (exposure pathways) to assess the risk.

The CSA standard N288.6-12 provides a systematic approach and calculations that are used to estimate the exposure of the human or ecological receptor to each of the COPCs. The calculations are conducted using a cautious approach in order to overestimate the potential for an impact. An example of a conservative assumption made in the Beaverlodge 2020 ERA is that it was assumed that all the food consumed by a given receptor was obtained in and around a single selected waterbody (e.g., a nighthawk was assumed to eat insects exclusively from the Fookes Reservoir area), while it is expected that they would realistically range over a larger area. These calculations are used in a weight-of-evidence approach, along with direct information, such as what biota are present and whether any effects are evident, to form a conclusion.

RISK ASSESSMENT FINDINGS

The 2020 ERA meets the requirements of CSA N288.6-12 and has been accepted by the CNSC and Saskatchewan Ministry of the Environment.

The results of the 2020 ERA are consistent with the findings from the 2008 to 2012 SOE and 2018 ERA. The immediate and downstream environments will continue to gradually recover over time.

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