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## **Oral presentation**

### **Written submission from the Athabasca Chipewyan First Nation**

In the Matter of the

#### **Orano Canada Inc., Cluff Lake Project**

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Request to Revoke the Current Licence and  
Release the Cluff Lake Project to the  
Institutional Control Program

#### **Commission Public Hearing**

**March 1, 2023**

## **Exposé oral**

### **Mémoire de la Première Nation des Chipewyan d'Athabasca**

À l'égard de

#### **Orano Canada Inc., Projet de Cluff Lake**

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Demande visant à révoquer le permis pour le  
projet de Cluff Lake et à transférer la propriété  
au Programme de contrôle institutionnel

#### **Audience publique de la Commission**

**1<sup>er</sup> mars 2023**



January 19, 2023

**Via E-mail:** [interventions@cnsccsn.gc.ca](mailto:interventions@cnsccsn.gc.ca)

Senior Tribunal Officer  
Commission Registry  
Canadian Nuclear Safety Commission  
280 Slater St, PO Box 1046 Stn B  
Ottawa, ON, K1P5S9  
Tel.: 613-996-9063  
Fax: 613-995-5086

Dear Canadian Nuclear Safety Commission:

**Re: Request to Intervene in the Canadian Nuclear Safety Commission ("CNSC" or the "Commission")  
Public Hearing on Orano Cluff Lake Licence Revocation.**

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We thank you for providing the Athabasca Chipewyan First Nation's ("ACFN") Dene Lands and Resource Management ("DLRM") department with an extension of time to January 19th, 2023, from the original deadline of January 12, 2023, to provide comment on Grano's application to revoke its Cluff Lake uranium mine and mill operating licence ("Grano's Application").

**Request to Intervene**

We write to the Commission, pursuant to rule 19 of the *Canadian Nuclear Safety Commission Rules of Procedure*, to request to intervene in the Public Hearing regarding Grano's Application.

In accordance with the Commission's rules, please accept the following information with respect to our request to intervene:

- a. Athabasca Chipewyan First Nation, Box 366, Fort Chipewyan, AB, Canada, TOP 1B0; T:780.697.3730; F: 780.697.3500;
- b. Callie Davies-Flett, 220 Taiganova Crescent, Fort McMurray, AB, T9K 0T4; T: [REDACTED] F: 780.697.3500;
- c. The Cluff Lake Mine site is in ACFN's traditional territory, and our Nation has a direct interest in ensuring this mine site is monitored and maintained in accordance with the highest safety standards. Importantly, we will provide firsthand expertise about land-use and ecosystems in the project area; and
- d. ACFN wishes to intervene by both written submission and oral presentation. Please find enclosed copies of the relevant information and submissions from ACFN.

## **Matter at Issue**

Orano's Application requests that the Commission release the property from licensing under the NSCA with the intention of transferring it to provincial oversight under Saskatchewan's Institutional Control Program ("ICP"). The provincial regulations that establish the ICP require the province to be exempt from CNSC licensing in relation to any properties entering the program. The Commission will also consider whether to exempt the Province of Saskatchewan from requiring a licence for the released property, pursuant to section 7 of the *Nuclear Safety and Control Act* ("NSCA").

The Commission is required to decide, pursuant to section 25 of the NSCA and in accordance with subsection 8(2)(h) of the *General Nuclear Safety and Control Regulations*, if a failure to revoke the licence could pose an unreasonable risk to the environment, the health and safety of persons or national security.

However, this is not the only requirement of the CNSC in its decision making. The CNSC must also ensure that its licence decisions under the NSCA uphold the honour of the Crown and ensure our Treaty Rights are protected pursuant to section 35 of the *Constitution Act, 1982*.

## **ACFN's Position**

The cumulative impacts of industrial activities in our territory have already diminished our ability to exercise our constitutionally protected Treaty Rights and maintain our way of life. We urge the Commission to take a precautionary approach that ensures the risk of harm is minimized for all members of our First Nation. The majority of ACFN's concerns will be set out in our technical memorandums and presentation materials. However, we thought it pertinent to highlight some key points.

ACFN is disappointed by Orano's failure to address components of our DLRM's technical requests and concerns in this process. Further, Orano has shown a lack of transparency and willingness to collaborate regarding the specifics of their approach to the use of monitoring data for risk management. Given that our members will continue to remain on the land long after Orano is gone, and given the nature of their application, we ask that CNSC give careful consideration to Orano's lack of transparency and collaboration with ACFN.

As currently proposed, the Long-Term Monitoring and Maintenance Plan (the "LTMMMP") is unlikely to protect ecosystem and human health from exposure to contaminants of concern in the far future. We urge Orano and the Commission to implement the requested changes to the LTMMMP provided by ACFN on April 22, 2022.

Our members have reported to Orano and CNSC staff that they already have concerns about contamination and many land users avoid the area. Orano and CNSC staff consistently point to the site's compliance with the minimum accepted standards. However, such standards are not site-specific, nor were they designed to consider constitutionally protected Treaty Rights and a traditional lifestyle involving the consumption of country foods. For example, ACFN members continue to rely on the freshwater from the Island and Cluff Creek Watersheds. Thus, minimum standards are inappropriate and inadequate to protect the health of Indigenous peoples, our traditional way of life, and our future generations.

Accepting Orano's Application as it currently stands and revoking Orano's licence will pose an unreasonable risk to the environment and human health and safety. Orano extracted enormous wealth from our territory and CNSC must ensure they honour their obligations before responsibility for the site is passed to the province. For all the above reasons, CNSC should ensure their decision making is consistent with the honour of the Crown and require Orano take further steps to protect our members, whose health and safety depends on the health and safety of the environment.

## ACFN's Public Hearing Presentation

In support of our position, the oral presentation portion of ACFN's intervention in the Public Hearing will be as follows:

1. Our Regulatory Advisor, Callie Davies-Flett will present on ACFN's overarching site concerns since the mine was decommissioned;
2. ACFN member(s); Edward Flett and Rose Desjarlais will provide oral testimony regarding land use; and
3. Two of ACFN's technical experts will present on surface water quality in the project area according to ACFN's own *Water Quality Criteria for Indigenous Use*.

Please find enclosed our technical memorandums and presentation materials in support of our Intervention. These will be the only submissions provided by and representing the nation. We will submit further presentation materials to the Commission by February 22, 2023.

Thank you for taking the time to consider our intervention. Please let us know if we can provide any further information or materials in support of this request.

Sincerely,



Lisa Tsessaze

Executive Director, ACFN DRLM

cc. Charlene Williams  
Callie Davies-Flett



# Technical Review of Orano Canada Inc.'s Cluff Lake Project Long-Term Monitoring and Maintenance Plan, Orano Canada Inc Response

January 3, 2023

**To:** Callie Flett-Davies  
Dene Lands and Resource Management  
Athabasca Chipewyan First Nation  
Fort McMurray, AB

**From:** Mandy Olsgard, M.Sc., P. Biol.  
Integrated Toxicology Solutions Ltd.  
Edmonton, AB

## Introduction

At the request of Athabasca Chipewyan First Nation Dene Lands and Resource Management (ACFN DLRM) Integrated Toxicology Solutions Ltd. (ITS) is pleased to provide the following technical review of responses provided by Orano Canada Inc. to the health risk related components of ACFN DLRMs technical review of the long-term monitoring and maintenance plan for the Cluff Lake Project (October 2022).

This has involved review of the following documents:

- Thompson, M., Olsgard, M., and Araujo, E. Technical review of the Cluff Lake Project Long-term Monitoring and Maintenance Plan Version 2 Revision 3. Submitted by ACFN DLRM to Orano Canada Inc dated Mach 2022.
- Orano Canada Inc., Technical Review of Orano Canada Inc.'s Cluff Lake Project Long-term Monitoring and Maintenance Plan, containing a summary of ACFN DLRM comments and Orano Canada Inc. responses, dated October 5, 2022.
- Orano Canada Inc., Cluff Lake Project Long-Term Monitoring and Maintenance Plan, Version 2 Revision 3, dated November 2020, hereafter referred to as the LTMMP.

In relying on content presented herein, please consider the following:

- Content reflects the reviewer's technical expertise and provides comments and discussion related to health risk assessment and toxicology. Geotechnical and

limnological aspects from the original memo (Thompson, M. et., al. 2022) have been removed.

- The reviewer did not have access to or undertake a review the Environmental Performance technical information documents (TIDs), prepared by Orano Canada Inc. (Orano) for submission to provincial and federal regulators in 2019. According to information provided in the LTMMP, these documents included results of predictive modeling and risk assessments that are referred to as the basis of the LTMMP. For this reason, this review will consider the appropriateness of the LTMMP and Orano's responses as provided, without scrutinizing these contributing information sources and documents.

### **Technical Review Comments on Responses Provided by Orano to Health Risk Technical Review Comments on the LTMMP**

#### **General Request from Water Quality and Biota Monitoring Plan (Thompson, M. et., al 2022; pg 7 of 19):**

Notwithstanding the above, based on the information provided in the LTMMP, there are concerns that can be addressed through the following requested modifications:

- Apply ambient water quality objectives (human, wildlife watering, protection of aquatic life, fish tissue residue) to all areas that are accessible by wildlife and humans and are considered or hydraulically connected to fish bearing water bodies
- Consider applying human health criteria for ambient water quality
- Expand the monitoring to include sediment and fish tissue residues in the core program (currently proposed every 3-5 years)
- Identify areas with elevated risk potential under current conditions (as identified in ED TIF) and propose land use restrictions and remedial actions to decrease risks to traditional land users from consumption of natural surface water, fish, plants and wildlife over both short and long term periods.

Note: the temporal scale for modeling should be closely evaluated to determine the defined short- and long-term periods and it is recommended the temporal scale be within current users' lifetimes or 1-2 generations.

#### **Response (Orano, 2022; pg 7 of 20):**

With a solid understanding of climate, topography, geology, hydrogeology, source terms, and the removal of uncertainties identified in the decommissioning environmental assessment, the mass flux from sources to various receptors can be confidently predicted. The mass flux outputs from the GW TID model have been carried forward into the EP TID, to inform the ecological risk assessment and predict long-term

surface water quality in downstream receptors. Cover performance monitoring and modelling verify that engineered covers are limiting infiltration through tailings and waste rock and will continue to do so in the future. Bounding cases considering increased infiltration have been prepared and carried forward into the EP TID, in order to address climate change scenarios and cover damage scenarios. The model was set up to predict COPC transport through groundwater flowpaths for 10,000 years in the TMA, with the exception of radionuclides that were modelled for 50,000 years. In the mining area, COPC transport was similarly modelled for 10,000 years. These timeframes were selected in order to capture the predicted maximum loadings to surface receptors.

**Review Comment (ITS):**

The response does not address each component of the request from ACFN DLRM to address concerns that the proposed monitoring locations, sampling frequency, media, and COPCs as presented in the LTMMP. As no revisions or modifications to the LTMMP were proposed by Orano, the information presented in the LTMMP is likely insufficient to measure, assess and manage health risks in aquatic biota, wildlife and humans from exposure to COPCs in human and ecological receptors as described in the objectives. It is recommended that the LTMMP be updated to reflect request from Thompson, M. et. al., (2022).

**Issue 7 (Thompson, M. et., al 2022; pg 12/13 of 19): It is unclear if the proposed sampling program design (locations, frequency, COPCs, media) is representative of current and future risks to human and environmental health.**

**References:** Section 1.4, p. 1-12 through 1-16 and Appendix A

**Rationale:** As stated in the LTMMP *"Risk assessments provide the basis for the scope and complexity of monitoring programs, identifying contaminants of potential concern (COPC), and project-environment interactions of concern and interest. (CSA N288.4-19 Clause 4.1, CSA 2019)"*.

Results of the risk assessment are available in a supplemental document which was not provided with LTMMP review materials (EP TID 2019). Therefore, it could not be verified whether the proposed sampling program design (locations, frequency, COPCs, media) are representative of current and future risks to human and environmental health. However, review of various sections within the LTMMP indicate that the proposed sampling design may not provide sufficient data to meet the identified objectives<sup>1</sup>

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<sup>1</sup> From Orano LTMMP pg 1-4 "CSA 4.1 General objectives "a) to assist in collecting the data required i) to assess the level of risk to human health and safety, and the potential biological effects in the environment of the contaminants and physical stressors of



which could ultimately limit the identification and implementation of risk mitigation and management activities such as removing sources of ongoing contamination through remedial activities or restricting land use.

There are several statements in the LTMMP (Section 1.4, p. 1-12 through 1-16 and Appendix A) which indicate current and future concentrations of COPCs in surface water, groundwater and sediments and risks to exposed receptors that ACFN relies on as traditional foods (fish, wildlife, plants) and medicines (plants) may not be sufficiently reflected in the proposed LTMMP.

**Request:** Please provide ACFN access and sufficient resources (time and funding) to review the EP TID (Orano 2019) to determine if the risk assessment adequately considered ACFN traditional land use activities to estimate potential exposure to COPCs via consumption of traditional foods and medicines and if the current and predicted risks are reflected in the proposed LTMMP sampling design, including verification that the proposed land use restrictions to ensure ACFN member protection.

**Response (Orano, 2022; pg 4 of 20):**

With the status of the Cluff Lake property accepted as achieving decommissioning objectives, based on the regulatory acceptance of evidence provided in various technical information documents, long-standing reviews and audits of site, and the scope of the LTMMP, the decommissioned status of the project is not subject to review. As such the request to review various historical documents including technical information documents and closure records is beyond the scope of the review requested, the Environmental Performance TID will be sent to you via shareware, for reference.

**Response (Orano, 2022; pg 15 of 20):**

The purpose of the LTMMP is to confirm that the decommissioning objectives are being sustainably achieved and ultimately the ongoing absence of unreasonable risk. The frequency is commensurate with potential risks, focused on validating the predicted environmental performance. The EP TID has been provided for your reference.

**Review Comment (ITS):**

The provided response relies on the assumption that the TID (2019) conservatively and accurately assessed risks to ecological and human health and can be relied on to

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concern arising from the facility; and ii) to provide data to verify the predictions made by the ERA, refine the models used in the ERA, or reduce the uncertainty in the predictions made by the ERA; b) to demonstrate compliance with any applicable limits on the concentration and/or intensity of contaminants and physical stressors in the environment or their effect on the environment; and c) to check, independently of effluent monitoring, on the effectiveness of containment and effluent control, and provide public assurance of the effectiveness of containment and effluent control.”

inform monitoring and risk management at the Cluff Lake site under current conditions and in the far future as proposed in the LTMMP.

As noted, the TID has not been reviewed to support technical review of the LTMMP or this memo and the statements provided here are limited and require verification once review of the TID can be undertaken. It is also unclear if ACFN was engaged in review of the TID and regulatory activities beyond engagement in traditional land use discussions as indicated in the response provided to Issue 10.

Given these limitations and uncertainties, it appears the response provided by Orano does not address the concern as to whether the proposed sampling design reflects results of the risk assessments undertaken in the TID as presented in the LTMMP (as noted in the provided rationale) and the concern that the LTMMP may not provide sufficient data to meet the identified objectives which could ultimately limit the identification and implementation of risk mitigation and management activities such as removing sources of ongoing contamination through remedial activities or restricting land use to prevent adverse environmental and human health effects today and in the future.

The above request from Thompson, M. et. al., (2022) is outstanding and it is recommended the rationale be considered and request addressed prior to approval of the proposed LTMMP.

**Issue 8 (Thompson, M. et., al 2022; Pg 13/14 of 17): The key COPCs and the surface water quality objectives do not reflect COPCs identified in the risk assessment summary presented in Appendix A.**

**References:** Section 1.4.1, p. 1-16, and Appendix A, p. A-2 to A- 5

**Rationale:** The identified key COPCs (Table 1-5, p. 1-15) and proposed monitoring and surface water quality objectives in decommissioned areas (Table 1-6, p. 1-18) exclude several COPCs identified in the risk assessment summary (Table A-1 and A-2).

COPCs identified as potential risks to human and ecological receptors that are not proposed to be monitored on the decommissioned site include chloride, arsenic, copper, iron, and molybdenum.

**Request:** Expand the proposed surface water quality monitoring to include the following COPCs which have been associated with predicted risks in the EP TID; chloride, arsenic, copper, iron, and molybdenum.

Sediment monitoring for COPCs should also be added to the core program at the same frequency as surface water (see issue 8). Please also consider the frequency of surface water monitoring as discussed in issue 4.

**Response (Orano, 2022; pg 15 of 20):**

Although there is a focus on key COPCs, the LTMMP includes analysis of a full suite of parameters for each monitoring location.

**Review Comment (ITS):**

Thank you for the response. However, it remains unclear how Orano proposes to rely on the key COPCs and full suite of monitoring parameters to assess and manage predicted risks from the ecological and human health risk assessments (LTMMP Appendix A.2) with the monitoring program described in the LTMMP.

The above request from Thompson, M. et. al., (2022) is outstanding and it is recommended the rationale be considered and request addressed prior to approval of the proposed LTMMP.

**Issue 9 (Thompson, M. et., al 2022; pg 14 of 17): It is unclear why sediment, benthic invertebrate and vegetation are outside the scope of the LTMMP.**

**Reference:** Section 1.5.2, p. 1-21, and Appendix A, p. A-2 to A-5

**Rationale:** Recognizing a single sampling event is proposed 20 years from entry into the IC program, the proposed sampling for sediment and biota does not reflect the identified COPCs, fate and transport pathways and predicted risks in higher trophic level wildlife and humans presented in Appendix A.

Since the multi-media model used to predict exposures of wildlife and human receptors was not available it is unclear if partitioning to sediment and biomagnification with the aquatic food web was a risk driver for the identified risks (HQ > 1). However, the fate and transport of contaminants from sediment is a well-documented exposure pathway in aquatic ecosystems with elevated surface water quality conditions (Health Canada, 2021; CCME 2020).

**Request:** Please provide access to and necessary support for ACFN to review the EP TID to confirm if concentrations of COPCs in sediments and biota were drivers of identified risks to human and environmental health to confirm if the proposed monitoring in surface water and one time sediment and biota sampling is sufficient.

If Orano is aware of risks associated with partitioning of COPCs to sediment and biomagnification and bioaccumulation within the food web, then a core program similar to surface water should be developed and the LTMMP revised. Revisions should consider additional monitoring on both the decommissioned site areas and in downstream surface water bodies and fens which are accessible to ACFN traditional land users.

**Response (Orano, 2022; pg 16 of 20):**

Sediment, benthic invertebrate and vegetation are being sampled within the LTMMMP on a frequency deemed adequate for the state of risk and recovery of site. The purpose of the LTMMMP is to confirm that the decommissioning objectives are being sustainably achieved and ultimately the ongoing absence of unreasonable risk. The frequency of the sediment, benthic invertebrate and vegetation is commensurate with potential risks, focused on validating the predicted environmental performance and will allow for more sediment deposition to occur than between previous monitoring programs. The larger accumulation of sediment will result in more stable concentrations of COPCs.

**Review Comment (ITS):**

Thank you for the response. However, it remains unclear how Orano proposes to rely on predictions from the human and ecological risk assessments, which identified elevated COPCs in sediment as a key exposure pathway elevating the health risk to aquatic and semi-aquatic biota.

The concern that the proposed sampling design within the LTMMMP may not provide the necessary data to assess and manage potential adverse environmental health effects from elevated COPCs and result in land use restrictions to protect ACFN members from engaging in traditional land use activities are outstanding.

The above request from Thompson, M. et. al., (2022) is outstanding and it is recommended the rationale be considered and request addressed prior to approval of the proposed LTMMMP.

**Issue 10 (Thompson, M. et., al 2022; pg 14/15 of 17): Potential risks to human health (i.e., ACFN traditional land users) from current conditions and far into the future:**

**Reference:** Tables 1-3 through 1-7, and Appendix A, p. A-5

**Rationale:** A summary of the human health risk assessment was not provided and the following statement indicates that short term risks are unlikely but it is unclear if long term risks from more frequent (i.e. greater than 6 months) over a community members lifetime were identified.

*"The results of the human health assessment indicated that casual visitors (adult, child and toddler) to the site who hunt, fish and trap over a lifetime at the Cluff Lake Project, as well as consume the food over a six month period, will not experience adverse effects from exposure to radionuclides or non-radionuclides"* (Appendix A, p. A-5)

As described in the predictive water quality modeling (Figures 1-3 to 1-7) there are elevated concentrations of COPCs for hundreds to thousands of years. However, insufficient information was provided to understand the frequency and magnitude of potential risks from exposure to these measured and predicted concentrations of COPCs in surface water are driving elevated risks from exposure to COPCs in surface

water, sediment, groundwater and traditional foods and medicines (fish, wildlife and plant species).

**Request:** Please provide a more thorough description of all potential risks to human health including the COPCs and exposure pathways (i.e. ingestion of untreated surface water, consumption of traditional foods) which contributed to the risk.

Also, please provide the parameters used to define the exposure period and duration, including clarifying the term “casual visitor” and whether a 6 month consumption period was assumed for a single year or over a lifetime.

This issue may also be resolved through addressing the request under issue 7.

**Response (Orano, 2022; pg 17-19 of 20):**

The pathways of exposure considered in the assessment, as discussed in Section 3, where there may be a contribution from the Cluff Lake Project include:

- dietary intake: o harvest local foods – e.g. gathering berries from the site, including the decommissioned TMA o hunting and trapping – e.g. moose, hare, beaver, mallard o fishing
- medicinal intake: e.g. Labrador tea
- water intake: drinking water while in the area
- air and soil intake: external dose from soil

Orano acknowledges and appreciates land use information shared from the representatives from the Environmental Quality Committee (EQC) and west side EQC representatives in particular, the Athabasca Chipewyan First Nation (ACFN), the Clearwater River Dene Nation (CRDN), registered trappers in the N22 Fur Block, outfitters, interested interveners in regulatory proceedings, and west side community members.

On February 21 and 22, 2005, Orano held a workshop on the decommissioning of the Cluff Lake Project with members of the west side EQC and the ACFN to gain insights into the historic, current, and expected future traditional use of the land. The participants included a trapper from the ACFN, and members of his family, who have seasonally accessed the Cluff Lake area and maintained a trap line in the local study area prior to mine construction and throughout operations. Members of the extended family have maintained cabins on both Cluff Lake and Sandy Lake.

During the workshop, attendees were asked to envision having a cabin on Cluff Lake available for year-round use when advising of land use activities, locations, and time frames. Expected and potential land use was identified as, but not limited to fishing, hunting, berry picking, firewood collection, trapping, wild rice production, herbs and medicine harvesting, gardening, tourism, hiking, swimming, and camping. Attendees then described the amount of time they would spend conducting these activities

throughout the year and identified the probable locations for the various activities. The participants agreed that under a scenario with year-round cabin availability at Cluff Lake, approximately 91 days would be spent in the Cluff Lake area, with 25% of the time spent in the immediate Cluff Lake area (~23 days) and 75% of the time would be spent at other lakes including Sandy, Carswell, and Two-Mile lakes.

This advice is supported by known local land use as presented on Figure 9-1. The family of owners of the traditional resource use cabin on Cluff Lake also own a near-by cabin on Sandy Lake and spend time in northern Alberta and the Northwest Territories. ACFN has identified land use throughout the area. The Cluff Lake area is part of the south-north corridor identified by the CRDN consistent with Orano's understanding of the area as part of a travel route. CRDN has identified areas of cultural significance. Orano is aware of hunters throughout the region that travel Highway 955 north towards, to, and past the Cluff Lake site. The two closest outfitters are located on Sandy and Carswell lakes.

The following are major outcomes of the discussion:

- Traditional land use, while sometimes utilizing land and resources in a small and preferred area, generally involves travelling over a wide area. The decommissioned Cluff Lake footprint is generally considered small relative to areas used for traditional purposes.
- Traditional land users would be unlikely to set up a cabin at Cluff Lake given that there are better fishing lakes in the region. The location could and would more likely be used as a base with most activities conducted away from this area. Fishing on Cluff Lake would be expected but limited as the lake is not preferred.
- The mining areas were viewed as unattractive areas for most activities, with the exception of gathering blueberries. With the exception of berry picking, activities were unlikely to be conducted in the small, localized areas affected by mining.
- The vicinity of pit lakes was viewed as unlikely areas for setting up camp. The pits are isolated from the aquatic system and, although remediated for aesthetics and safe surface water quality, traditional users are unlikely to drink water from, or fish on, pit lakes because they are obviously humanmade lakes in a region of abundant and known good fishing.
- It is unlikely that a cabin in the area, away from home communities, would be occupied year-round. This feedback is consistent with current cabin use by the family owning a traditional resource user cabin on the shore of Cluff Lake who use the cabin periodically.

The land use advice received during discussions and workshops has been utilized by Orano to develop the Long-term Monitoring Plan and was used to inform land use

scenarios to assess potential risk in the Human Health Risk Assessments (HHRA) conducted by Orano.

- The base case human health risk assessment considered several receptors, an adult, a child, and a toddler, visiting the Cluff Lake Project (both the Island Creek and Cluff Creek watershed exposure areas) on a casual basis. These receptors were assumed to spend 6% (23 days) each year doing activities such as fishing, hunting, and camping in the immediate Cluff Lake Project area. The human exposure assessment was considered for calendar year 2018 to calendar year 7000, with additional examination of exposures in calendar year 4000 and year 2400 for non-radionuclides.
- There is the potential that someone could reside at the site longer than a traditional land user using a seasonal cabin, either as approved through the Ministry of Environment or unauthorized. To assess this potential scenario, the human receptors (adult, child, toddler) were considered residing at the site on a full time basis.

it is assessed that a toddler, child, and adult could safely live at the Cluff Lake site fulltime even when COPCs reach peak concentrations (~2400). There are no predicted effects to an adult, child, or toddler from exposure to non-radionuclides including arsenic, cadmium, cobalt, copper, molybdenum, nickel, selenium, and uranium throughout the post-decommissioning period. Similarly, there are no predicted effects to an adult, child, or toddler from radionuclides or arsenic as a carcinogenic COPC throughout the post-decommissioning period.

#### **Review Comment (ITS):**

Thank you for the response and for clarifying that ACFN members were engaged early in the risk assessment process and provided information on traditional land use activities in 2005, several years before submission of the TID to the regulators. It appears that Orano has considered land use characteristics in undertaking the exposure assessment component of the HHRA but it does not appear that information shared by ACFN members regarding avoidance and altered traditional use from mining activities was adequately reflected in the response (i.e., members want to use the area more and drink water but do not and will not because of fear of contamination).

**Recommendation: Based on the response, it is recommended that ACFN and Orano discuss potential management actions to minimize altered and restricted land use in the Cluff Lake area and potential accommodation for loss of use in this area.**

The response is limited and does not address the first request to clarify all potential risks to human health including the COPCs and exposure pathways (i.e. ingestion of untreated surface water, consumption of traditional foods) which contributed to the risk. The potential risks to human health from exposure to COPCs under current and

future conditions remain unclear and the request from Thompson, M. et. al., (2022) is outstanding and it is recommended that the request addressed prior to approval of the proposed LTMMP.

Please note, review of the TID may address this concern and request however, adequate time and resources would be required to complete the review to support ACFN in engagement with Orano and regulatory proceedings.

**Issue 11 (Thompson, M. et., al 2022; pg 15/16 of 17): Objectives and guidelines applied to surface water monitoring data may underestimate potential risks**

**Reference:** Section 1.7, p. 1-22 and 1-23, And Appendix A, p. A-6

**Rationale:** The Decommissioning Surface Water Quality Objectives described in Tables A-1 and A-2 are higher than provincial and federal thresholds and may underestimate potential risks and limit the LTMMP and do not appear to consider monitoring or assessing risks to wildlife.

As the site is decommissioned application of Decommissioning Surface Water Quality Objectives which are 2-10 higher than provincial and federal thresholds would allow for elevated risks on mine site areas which are currently sources of COPCs to both Island Lake and Cluff Creek watersheds which will result in continued elevations of COPCs in ambient waterbodies where ACFN members hunt, fish and trap as shown in the LTMMP and Cultural Significant Areas map.

The selenium SWO for the TMA (Table 1-6) may be too high (10 ug/L) to manage risks to terrestrial birds exposed through diet items with elevated selenium from biomagnification in the aquatic and semi-aquatic food web as identified in Snake and Island Lakes (excerpt below). This is likely the same for molybdenum and uranium (excerpts from Appendix A identifying risk not included)

*"Potential risks from selenium in Snake Lake for several receptors (particularly mink, yellowlegs and nighthawk should they choose to use this water body exclusively) are in the future as the groundwater loading from the TMA reaches this waterbody. For Island Lake, Island Lake Fen, and Island Creek at the Dolomites, selenium is a potential issue currently due to the release of treated effluent during operations. The levels decline over time; however selenium does remain a potential concern for some VECs in the future due to the ongoing loading from the TMA to Snake Lake (pg A-4)".*

Further, groundwater, sediment, and tissue residue (wildlife, plants) quality guidelines do not appear to have been used to develop the LTMMP monitoring program.

**Request: If the decommissioned site areas are open to wildlife and the public, please identify more stringent surface water quality guidelines, aligning with ambient surface water areas, to assess both long and short term performance, and update the LTMMP accordingly.**



**Response (Orano, 2022; pg 19-20 of 20):**

Orano has demonstrated that the Cluff Lake site is achieving the required surface water or decommissioning water quality objectives defined during the decommissioning environmental assessment, for the site to remain protective of the environment and human health. Additionally, modelling predicts the site will remain safe and stable for the far future. ERA and HHRA conclude that the site is safe for traditional land uses, including hunting, fishing, drinking water and collection of berries. Therefore, more stringent surface water quality guidelines are not required. On-going long-term monitoring is in place to monitor and identify changing trends. Should performance decline, the Province of Saskatchewan may impose restrictions or actions to address. Orano provides the funding to accommodate long-term monitoring, maintenance and unforeseen events.

**Review Comment (ITS):**

The provided response does not provide sufficient information to address the request and the concern that monitoring under the LTMMP using the approved DSWQOs could result in unsafe conditions for ecological and human receptors and contribute to adverse health effects is outstanding.

To better understand the degree of risk management and protection of ecological and human receptors from adverse effects which could be achieved through implementation of the decommissioning objectives described in the LTMMP, a comparison of DSWQOs to published standards was undertaken.

This comparison indicates that the approved DSWQOs are approximately 10-200% higher than published standards for arsenic, cadmium, cobalt, copper, iron, molybdenum, selenium, and uranium. Of the COPCs proposed to be monitored at various locations in the LTMMP, the DSWQOs for nickel and radium 226 appear to be the only parameters with objectives (ug/L) that are like published standards for the protection of health.

Based on this comparison, it appears that implementation of the LTMMP as proposed is unlikely to protect the health of ecological and human receptors from exposure to the predicted concentrations of COPCs in local lakes in the far future (as presented in Tables A-1; A-2 of the LTMMP).

The potential risks to wildlife and human health from exposure to COPCs under current and future conditions remain unclear and the request from Thompson, M. et. al., (2022) is outstanding and it is recommended that the request addressed prior to approval of the proposed LTMMP.

**Issue 12 (Thompson, M. et., al 2022; pg 16 of 17): Surface water and tissue residue guidelines for the protection of human health were not consistently applied to assess potential risks and additional water quality guidelines were not considered.**

**Reference:** Appendix A, p. A-6 and A-7

**Rationale:** In some instances, the selected DSWQOs identified in Tables A-1 and A-2 are greater than available WQOs for the protection of human health from consumption of drinking water and organisms published by Health Canada (2020), the World Health Organization (WHO) (2017), and United States Environmental Protection Agency (2022). The objectives selected for arsenic are an example of where the identified DSWQO (50 ug/L) and WQOs (5 ug/L) are greater than the US EPA Ambient Water Quality Criteria for the Protection of Human Health (0.018 ug/L) which was developed to account for the carcinogenic effects of arsenic when humans are exposed orally.

**Request: Please consider applying additional published water quality guidelines as WQOs in the LTMMP (Health Canada, WHO, US EPA) for the protection of human health and update Tables A-1 and A-2 accordingly.**

**Addressing this request may require confirmation of selected Toxicity Reference Values (TRVs) used to assess potential risks as described in the EP TID risk assessment.**

**Response (Orano, 2022; pg 20 of 20):** See response to #11.

**Review Comment (ITS):**

The response to Issue #11 does not address the concern or request identified in issue #12 related to minimal or lack of monitoring related to COPCS in sediment and biological tissues which could contribute to adverse health effects in aquatic biota, wildlife and humans (as predicted by Orano and summarized in A.2 of the LTMMP).

The potential risks to human health from exposure to COPCs under current and future conditions remain unclear and the request from Thompson, M. et. al., (2022) is outstanding and it is recommended that the request addressed prior to approval of the proposed LTMMP.

Please note, review of the TID may address this concern and request however, adequate time and resources would be required to complete the review to support ACFN in engagement with Orano and regulatory proceedings.

**Issue 13 (Thompson, M. et., al 2022; pg 16 of 17):: The recommended land uses do not appear to reflect identified and potential risks to ACFN community members which may consume fish, wildlife, and plants from the Island Lake watershed.**

**Reference:** Section 2.A, p. 2-1

**Rationale:** The risk assessment summary provided in the LTMMP indicates there are potential risks to wildlife from exposure to metals both on decommissioned areas and in downstream aquatic habitats (see rationale provided in Issue 7).

Potential risks from both current and future conditions to human health from ingesting surface water and traditional foods and medicinal wildlife, plant and fish species is not clear but does appear to be likely.

**Request: Please provide a summary of each identified risk to an ecological species and/or human including the area, COPC(s) and exposure pathway and provide rationale for why a land use restriction was not proposed. If during this exercise, conditions which require restrictions to manage risk to humans or the environment are identified, please update the LTMMP accordingly and engage ACFN in discussions so that the Nation can identify appropriate management strategies for members.**

**Response (Orano, 2022; pg 21 of 20):** See response to Comment #10 – in accordance with the Human Health Risk Assessment conducted, restrictions on traditional land use activities at the decommissioned Cluff Lake site are not required.

**Review Comment (ITS):**

The response to Issue #10 does not address the concern or request identified in issue #13 which is related to whether land use restrictions are required during early phases of monitoring to verify risk assessment (as predicted by Orano and summarized in A.2 of the LTMMP).

The potential risks to ACFN members from exposure to COPCs in surface water, sediments, shallow groundwater (i.e., muskeg), and traditional foods and medicines and any necessary restrictions on land use to protect member health under current and future conditions remain unclear.

The request from Thompson, M. et. al., (2022) is outstanding and it is recommended that the request addressed prior to approval of the proposed LTMMP.

Please note, review of the TID may address this concern and request however, adequate time and resources would be required to complete the review to support ACFN in engagement with Orano and regulatory proceedings.

## Closure

In summary, review of the responses provided by Orano do not address requests provided by ACFN DLRM (Thompson, M., et. al. 2022) to understand and mitigate concerns and issues related to long term health risks to ACFN members from exposure to elevated COPCs under current conditions and into the far future at the decommissioned Cluff Lake mine area in perpetuity (i.e., temporal model scale extends 50,000 years in the future with predicted peak concentrations of COPCs in surrounding lakes between 450 and 2500 years from now).

As previously stated, the LTMMP is lacking in detail regarding the monitoring indicators, metrics, and objectives, and that it is limited in such a way as to be most likely inadequate for the ongoing assessment of the Cluff Lake site performance and potential risks to ecological and human receptors. This is especially true in terms of evaluating and reporting on the safety and suitability of the site and surrounding areas for traditional land use by ACFN members. With that in mind, the previously suggested improvements to the LTMMP are still recommended for consideration by provincial and federal authorities and Orano.

Thank you for the opportunity to provide this technical review. We trust that it will provide ACFN DLRM with the information it requires to continue to meaningfully and effectively contribute to the LTMMP and the ongoing closure and management of the Cluff Lake site.

Sincerely,

A handwritten signature in black ink, appearing to be 'Mandy Olsgard', with a stylized flourish at the end.

Mandy Olsgard, M.Sc., P. Biol.  
Integrated Toxicology Solutions Ltd.  
Edmonton, AB

## References

Health Canada (2020). Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Available at:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html#t2>

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WHO (World Health Organization). 2017. Guidelines for drinking-water quality: fourth edition incorporating the first addendum. Available at: <https://www.who.int/publications/i/item/9789241549950>



# **Comment on Orano Canada Inc.'s Response to Technical Review of Cluff Lake Project Long-Term Monitoring and Maintenance Plan**

**December 20, 2022**

**To:** Charlene Williams & Callie Davies-Flett  
Dene Lands and Resource Management  
Athabasca Chipewyan First Nation  
Fort McMurray, AB

**From:** Megan Thompson, Ph.D., R.P. Bio., P. Biol.  
Thompson Aquatic Consulting  
Calgary, AB

## **Introduction**

At the request of Athabasca Chipewyan First Nation (ACFN) Dene Lands and Resource Management (DLRM), Thompson Aquatic Consulting contributed to a technical review of a long-term monitoring and maintenance plan (LTMMP) for the Cluff Lake Project, a decommissioned uranium mine and mill site in northern Saskatchewan. This involved review of the following documents:

- Orano Canada Inc., Cluff Lake Project Long-Term Monitoring and Maintenance Plan, Version 2 Revision 3, dated November 2020, hereafter referred to as the LTMMP.
- A map attached to the LTMMP entitled "Cluff Lake Project LTMMP and Areas of Cultural Significance", which includes ACFN traditional land use (TLU) information. According to that map, the ACFN TLU information was provided in a document dated 2003.

It is important to note that this reviewer did not review the Environmental Performance technical information documents (TIDs), prepared by Orano Canada Inc. (Orano) for submission to provincial and federal regulators in 2019 during the drafting of the original LTMMP review. Our earlier review of the LTMMP considered the appropriateness of the LTMMP as currently proposed, without scrutinizing this contributing information source. The TID documents have since been provided to ACFN for review, but the short timeline necessitated a cursory review.

## **Water Quality and Biota Monitoring Plan - General Request**

In our earlier review, Orano was asked to do the following:

- **Apply ambient water quality objectives (human, wildlife watering, protection of aquatic life, fish tissue residue) to all areas that are accessible by wildlife and humans and are considered or hydraulically connected to fish bearing water bodies**
- **Expand the monitoring to include sediment and fish tissue residues in the core program (currently proposed every 3-5 years)**

**Note: the temporal scale for modeling should be closely evaluated to determine the defined short- and long-term periods and it is recommended the temporal scale be within current users' lifetimes or 1-2 generations.**

Orano's response was a simple discussion of its approach to predicting future water quality in the water bodies to be monitored as part of the LTMMP (Orano Canada Inc. 2022a). Orano has reiterated its focus on predicting groundwater mass flux outputs to surface waters. Orano also explains that the groundwater transport models were used to predict COPC transport for 10,000 years, except for radionuclide parameters, which were modeled for 50,000 years.

The response did not comment on the request to apply ambient water quality objectives (human, wildlife watering, protection of aquatic life, fish tissue residue) to all areas that are accessible by wildlife and humans and are considered hydraulically connected to fish-bearing water bodies. Similarly, there was no response to the request to include sediment and fish tissue residues in the core program of the LTMMP.

The response is inadequate.

### **Water Quality and Biota Monitoring Plan - Specific Requests**

**We asked that Orano modify the LTMMP to increase water quality sampling frequency in each monitoring year, encompassing conditions across the range of flow conditions (e.g., collection of monthly or flow-weighted samples that can be collected using an autosampler) in order to compare against concentration-based surface water quality objectives (SWQOs). This sampling frequency should also apply to follow-up sampling where an exceedance is detected.**

**We asked that Orano modify the LTMMP to increase water quality sampling frequency in each monitoring year to encompass conditions across the range of flow conditions (e.g., collection of monthly or flow-weighted samples that can be collected using an autosampler). This sampling frequency should also apply to follow-up sampling where an exceedance is detected.**



Orano has responded by asserting that COPCs remain below the DSWQO (it isn't clear whether Orano is referring to predicted future conditions or measured conditions from sometime in the past). Orano also asserts that modeling of future groundwater flux has shown that the proposed frequency of monitoring for surface water is appropriate. If Orano has modeled or extrapolated future annual average surface water concentrations, then a single point surface water sample cannot be used to verify or validate the predictions, or as a trigger for action where deviance from the annual average is the criteria. The focus of the request is not to allow for the assessment of seasonal variation, but to properly account for seasonal variation in developing a technically defensible surface water quality trigger or "envelope" for determining when further management action, including mitigation, must occur. This is a fundamental and basic principle of surface water quality monitoring programs, which has not been addressed in the LTMMP.

Orano pointed out that regulators have accepted the sampling frequency as proposed, and that the Province of Saskatchewan can increase sampling frequency if sample results demonstrate the need to do so. Although it is possible that the LTMMP sampling as currently proposed would never demonstrate an unexpected or unacceptably high COPC concentration in surface waters even where it occurs, Orano further suggests that the Province of Saskatchewan can increase sampling frequency in response to such an occurrence in the future. However, it is this reviewer's understanding that part of the development of the LTMMP is to ensure that adequate funding is provided to the Province to complete the planned monitoring. Therefore, it would seem very important to include, at this moment in time, a technically defensible and meaningful sampling frequency in the cost of such a program.

Finally, Orano has commented that the wilderness and cold environment of the area means that leaving autosamplers at the location for extended periods is not feasible. This may be true, and the autosamplers were just one example of a solution that could reduce the burden of higher-frequency sampling, especially during the open water season. However, there are many other methods of collecting water, sediment and biota samples as required that are feasible for the area, especially where ACFN or other community members are willing and able to assist.

The response is inadequate.

**We asked that Orano modify the LTMMP to remove statements referring to water quality equilibrium and to self-correcting chemoclines in pit lakes. Instead, we asked that Orano propose approaches and contingencies to both detect and address changes in the site conditions over the coming decades and centuries, as that would better acknowledge the realities of long-term environmental monitoring.**

Orano's response included an assertion that the Cluff Lake site meets decommissioning objectives under passive care into the future. Further, Orano reiterated that contaminant transport will be along known, slow-moving groundwater flowpaths underground towards receiving surface water, and that the monitoring frequency of those surface waters will be effective to monitor site conditions. The response has not addressed the specific request. The failure of a chemocline in either of the meromictic pit lakes has the potential to lead to catastrophically negative impacts on humans and wildlife in the area. For this reason, it is both worthwhile and necessary to monitor the performance of chemoclines specifically and the pit lakes in general.

The response is inadequate.

**We asked that Orano specify the sample fraction of the analytes listed for monitoring in Table 1-8 of the LTMMP, and ensure that they are the same as was stipulated in the water quality objectives and the predicted future annual averages that will serve as performance thresholds. We also asked that Orano add the collection of relevant toxicity modifying factors (TMFs) in water and sediment to the LTMMP.**

Orano's response simply stated that the sampling analysis is reflective of the decommissioning environmental assessment and comprehensive study report conducted for the Cluff Lake Project.

This request was a simple clarification, with the goal of assuring the rigour and completeness of proposed LTMMP program. It is disappointing that Orano could not provide the requested clarification.

The response is inadequate.

## **Closure**

In summary, my review of the water and sediment quality monitoring-related responses provided by Orano to our earlier review of the LTMMP has found the responses to be inadequate.

Thank you for the opportunity to provide this technical response review. I trust that it will provide ACFN DLRM with the information it requires to continue to meaningfully and effectively contribute to the LTMMP and the ongoing closure and management of the Cluff Lake site.

Sincerely,

A handwritten signature in black ink, appearing to read 'M Thompson'.

Megan Thompson, Ph.D., P. Biol., R.P. Bio.  
Limnologist, Principal  
Thompson Aquatic Consulting

## **References**

CNSC (Canadian Nuclear Safety Commission) Staff. 2022. Commission Member Document for Public Hearing: Orano Canada Inc. Cluff Lake Project Request to Revoke the Current Licence and Release the Cluff Lake Project to the Institutional Control Program.

Orano Canada Inc. 2022. Letter and response to Athabasca Chipewyan First Nation Re: Technical Review of Orano Canada Inc.'s Cluff Lake Project Long-term Monitoring and Maintenance Plan.



## **Comment on Orano Canada Inc.'s Response to Technical Review of Cluff Lake Project Long-Term Monitoring and Maintenance Plan**

**January 11, 2023**

To: Charlene Williams & Callie Davies-Flett  
Dene Lands and Resource Management  
Athabasca Chipewyan First Nation  
Fort McMurray, AB

From: Eber Araujo, P.Geo, MBA  
Georoots Env Svcs and Consulting

### **Overview**

Georoots was reached by Athabasca Chipewyan First Nation (ACFN) Dene Lands and Resource Management (DLRM), to participate in a technical review of a long-term monitoring and maintenance plan (LTMMP) for the Cluff Lake Project, a decommissioned uranium mine and mill site in northern Saskatchewan.

The following documents were used as basis for the technical review:

- Orano Canada Inc., Cluff Lake Project Long-Term Monitoring and Maintenance Plan, Version 2 Revision 3, dated November 2020, (LTMMP)
- A map attached to the LTMMP entitled "Cluff Lake Project LTMMP and Areas of Cultural Significance", including ACFN traditional land use (TLU) information. ACFN 2003

In the technical review prepared in March 2022, Georoots raised several questions in addition to other reviewers, to which the owner Orano Canada Inc (Orano) responded to ACFN through the document Technical Review of Orano Canada Inc.'s Cluff Lake Project Long-term Monitoring and Maintenance Plan, October 5, 2022 (ORANO, Oct 2022).

### **Background**

It is important to note that this reviewer did not review the Environmental Performance technical information documents (TIDs), prepared by Orano Canada Inc. (Orano) for submission to provincial and federal regulators in 2019. According to information provided in the LTMMP, these documents included results of predictive modeling and risk assessments that are referred to as the basis of the LTMMP. The earlier review of the LTMMP considered the appropriateness of the LTMMP as currently proposed, without scrutinizing this contributing information source.

## Responses

### Section 2 - Geotechnical Monitoring Plan

**It is necessary for the LTMMP to include more detailed information on the quality and content of geotechnical monitoring and inspections. The level of detail shared in the proposed plan is very generic. Each structure must have site specific information and that level of detail was not disclosed in the plan. Access to that information is critical to understand that mechanisms that create before an assessment could be concluded about the adequate locations, completeness and frequency of this program.**

Orano's response states that they believe the LTMMP adequately addresses the scope for a professional engineer inspection. Subsequently Orano states that has added a few more details about the geotechnical professional scope, while inspecting and reporting on the low risk features at the Cluff Lake site. It also stated that it typically includes visual inspection of site infrastructure and a review of past documents, including as-built reports, technical information documents, decommissioning plan documents, and past follow-up items. The reviewer is encouraged that these activities are part of the annual inspections, since these are the basic level of inspection. The reviewer however, could not identify if this addition is already or will be part of a new version of the LTMMP.

- ⚠ The response is partially adequate, since the reviewer could not confirm if these plans have already been revised and are guidelines for the next inspection scope.  
The reviewer would request clarity if these plans have already been revised and are guidelines for the next inspection scope.

### Section 3 - Geotech Concerns

**The LTMMP has not detailed any type of geotechnical performance evaluation that would define triggers or acceptable levels for anomalies on Accidents and Malfunctions that would engage adaptive management actions, such as repairs, additional monitoring, or even timelines for response to such anomalies that would require intervention. This is concerning and does not support a successful long-term sustainable Monitoring and Maintenance Program. It would be reasonable that ORANO considers including the comments and recommendations described in this section to future updates to the LTMMP.**

#### Issue 1 Tailings/Landfills

**Request: The reviewer would like to confirm that the following items are minimum aspects included in the site inspection, and requests this information for review:**

##### **1. Geotechnical:**

- a. any records of geotechnical control for the TMA protection cover construction.**

**b. monitoring records of settlement areas and maintenance after closure efforts for the TMA cover and industrial landfill, as well as any other records for the domestic landfill, and mill landfill.**

The 2018 Biennial Geotechnical Review (SRK2018) summarizes that final grading of some areas where compaction could not support the glacial till layer would be revisited at a later time (post 2006). Despite the lack of information about geotechnical control of the glacial till placement and when the re-grading occurred, both reports from SRK2018 and 2020 Biennial Geotechnical Inspections (SRK2020) demonstrate acceptable behavior with absence of visual detection of settlement.

- ✓ The records from SRK2018 and SRK2020 are adequate to answer part a) of this request.

Orano, through SRK's report identifies ponding at southern toe and spillway of the main dam. At the Domestic landfill area a persistent erosional feature has been identified since 2016. These should be a focus for the coming inspections and more adequate repairs conducted to avoid more complex consequences.

- ✓ The response from SRK2020 is adequate to answer part b) of this request.

## **2. Vegetation**

**a. Monitoring records of coverage performance on the TMA and other landfills (bare soil, presence of large vegetation – trees)**

The line of questioning about monitoring of vegetation was related to the geotechnical stability of the tailings and water management structures performance. Such biological activity may cause impacts to the efficiency of the water management features (drainages) and protection cover (fill) over the main tailings, exposing tailings material. The report states that inspection is purely qualitative based on visual observation and perceived health, density, and size. A quantitative assessment of the vegetation coverage and health has been completed (Hab-Tech 2015) and is outside the mandate of that geotechnical inspection report.

- ✓ The records from SRK2018 and SRK2020 are adequate to answer part a) of this request.

## **3. Biological**

**a. Monitoring records of presence of burrowing animals and potential new species**

The line of questioning about monitoring of burrowing animals was related to the geotechnical stability of the tailings and water management structures performance. Such biological activity may cause impacts to the efficiency of the protection cover (fill) over the main tailings, exposing tailings material. Additionally, the interaction of aforementioned factors may encourage new species to the TMA area, and bring additional disruption to the protection cover.

The responses from SRK2018 and SRK2020 provide clarity on what was inspected, level of impacts to important structures from beaver activities and recommendations to repair/restore functionality.



✓ The response is adequate to answer part b) of this request.

#### **4. Water Quality**

**a. monitoring records of ponded water in settlement cover areas within the Open pit area.**

**b. monitoring records of seepage water in the Open pit area covers (Claude Pit, CWRP, DJN WRP, D-Pit WRP).**

Orano reports that has sampled ponded water between 2010-2016 at the TMA cover. Additionally, asserts that no adverse effects are identified other than nickel concentrations to be an issue for individual toads.

The groundwater/surface interaction is an important item that requires attention during inspections taking place during active and passive care stages of decommissioning.

⚠ The reviewer would like to refer this topic to the toxicologist reviewer for comments related to **Water quality and biota Monitoring Plan.**

#### **5. Air Quality**

**a. Any records of Radon 266 gas monitoring in the TMA cover and mill landfill.**

The records from TRACK-ETCH recent and historical monitoring provide clarity on levels of radon in the local areas.

✓ The response is adequate to answer part a) of this request.

#### **2: Underground Mine**

**Request: The geotechnical inspections along the raise (shafts) and ramp areas must include long term monitoring which should include assessments of cracks, water ponding, etc. It is also critical however, that groundwater is monitored during these geotechnical inspections to identify any potential COPCs reaching ground surface such as constituents that favor acid mine drainage (AMD). These groundwater sources in contact with surface water and structures such as stockpiles may promote local leaching of COPCs that may become ignored as a point source.**

**The reviewer would also like to request the following information for review:**

##### **1. Geotechnical:**

**a. any records of geotechnical controls for the Underground mine area (raises and ramps) construction.**

Despite the lack of information about geotechnical control or construction records shared in the SRK2018 or SRK 2020 the available Underground workings description reports key steps to decommission the facility. Some important areas were excluded from the inspections such as the OP Fill

Raise, the OP Exhaust Raise, the DP Portal and the DJ Portal, with no further explanation for the reasons of exclusion.

⚠ The response is partially adequate to answer part a) of this request.

The reviewer requests clarity on why the OP Fill Raise, the OP Exhaust Raise, the DP Portal, and the DJ Portal were **not inspected in SRK2020** report, since these were recommended for inspection following SRK2018.

**b. monitoring records of settlement areas and maintenance after closure efforts for the Underground mine area (raises and ramps).**

⚠ The response is partially adequate to answer part b) of this request.

The reviewer requests clarity on why the OP Fill Raise, the OP Exhaust Raise, the DP Portal, and the DJ Portal were **not inspected in SRK2020** report, since these were recommended for inspection following SRK2018.

**2. Water Quality**

**a. monitoring records of ponded water in settlement areas in the Underground mine area (raises and ramps).**

**b. monitoring records of seepage water in the Underground mine area (raises and ramps).**

**c. monitoring records of coverage performance (bare soil, presence of large vegetation – trees) on the Underground mine area (raises and ramps).**

**If the above-listed information and records have not been obtained or created, please expand the current monitoring to collect these data and provide the requested inspection information to inform the LTMMP.**

Orano affirms that the decommissioning status and stability has been reviewed by regulators and 3rd party consultants and will continue to be a part of the LTMMP, however groundwater monitoring has been removed from the decommissioning Cluff Lake environmental monitoring plan, as well as the LTMMP. Despite Orano's response (ORANO, Oct 2022) it is stated in SRK2020 that while the geotechnical inspection was taking place, there were water samples being collected at the DJ Exhaust location. The response is contradictory to the field observation.

⚠ The response is inadequate to answer part a), b) and c) of this request.

The reviewer requests clarity on why water samples were collected at the DJ Exhaust location, and requests clarity if these are being monitored for COPCs or have been raised as a concern. Additionally the reviewer would like to ask if this sampling campaign was extended over the remaining underground raises/ramps/portals.

### Issue 3: Open Pit

**Request: Groundwater (seepages) should be monitored during geotechnical inspections to identify any potential COPCs reaching ground surface, such as constituents that favor acid mine drainage (AMD). Groundwater sources coming from open pits and interacting with stockpiles may promote local leaching of COPCs that may become ignored as a point source. Of important interest is the potential for leaching into Claude Lake (from Claude Pit) and Boulder Creek and Cluff Lake (from D Pit).**

**The reviewer would like to confirm that the following are available and requests this information for review:**

#### **1. Geotechnical:**

- a. any records of geotechnical control for the Open pit areas protection cover construction**
- b. monitoring records of settlement areas and maintenance after closure efforts for the open pit area (Claude Pit, CWRP, DJX pit lake, DJN WRP, D pit lake, D-Pit WRP).**

- ✓ The records from SRK2018 and SRK2020 are adequate to answer part a) and b) of this request

#### **2. Vegetation**

- a. Monitoring records of coverage performance on the Open pit areas (bare soil, presence of large vegetation – trees)**

The records from SRK2018 and SRK2020 provide clarity on visual assessment of vegetation density, maturity and relative classification performed and identification of inadequacies and impacts in erosion control.

- ⚠ The response is partially adequate to answer this request.  
The reviewer requests clarity on areas of no vegetation, and geochemical reactions that were noted along the northern crest of the waste rock pile at locations identified in 2016 and 2018 (SRK2020). The reviewer would like to refer this topic to the toxicologist reviewer for comments related to **Water quality and biota Monitoring Plan**.

#### **3. Biological**

##### **Monitoring records of presence of burrowing animals and potential new species**

The records from SRK2018 and SRK2020 provide clarity on what was inspected, level of impacts to important structures from beaver activities and recommendations to repair/restore functionality.

- ✓ The response is adequate to answer this request.

#### **4. Water Quality**

**a. monitoring records of ponded water in settlement cover areas within the Open pit area.**

**b. monitoring records of seepage water in the Open pit area covers (Claude Pit, CWRP, DJN WRP, D-Pit WRP).**

Orano affirms that studies conducted have been reviewed by regulators and accepted. Also that groundwater monitoring has been removed from the decommissioning Cluff Lake environmental monitoring plan, as well as the LTMMP. Additionally informs that lakes at risk remain in the LTMMP, but does not detail which ones.

Records from SRK2018 and SRK2020 indicate that historical seepage was identified in CWRP. Additionally, some areas of no vegetation, and geochemical reactions were noted along the northern crest of the waste rock pile at locations identified in 2016 and 2018 site inspections. At Claude Pit Cover, both North and South horizontal drains are performing poorly and generating surface ponding and flow into the lake.

- ⚠ The response is partially inadequate to answer this request.  
The reviewer requests clarity on why historical seepage that was identified in CWRP, are not being monitored for COPCs or has been raised as a concern. The reviewer also questions why the water coming from horizontal drains flowing into the lake at Claude Pit Cover are also not being monitored for COPCs or has been raised as a concern.

**5. The reviewer would like to request clarification about the hydrotechnical calculations defining available freeboard for the pit lakes DJX and D.**

**If the above-listed information and records have not been obtained or created, please expand the current monitoring to collect these data and provide the requested inspection information to inform the LTMMP.**

- ✓ The response related to the hydrotechnical calculations defining available freeboards for pit lakes DJX and D is adequate.

## **Closure**

The responses provided by Orano to our earlier review of the LTMMP contain inadequate responses related to water quality monitoring and related concerns with COPCs and the impacts related to water quality and biota monitoring. Also contains partially adequate answers to items related to geotechnical inspections not completed.

The reviewer thanks ACFN DLRM for the opportunity to review these documents.





## Memo

To: **Callie Davies-Flett on behalf of ACFN** MSES File no: **2241**

From: Shannon Gavin (shannon.gavin@mses.ca ) cc: Sheri Gutsell Sheri.gutsell@mses.ca

Tel: (403) 710-5556

Date: **Dec 20, 2022**

**Subject: Review of Orano Canada Inc.'s: Request to Revoke Current Licence and Release the Cluff Lake Project to the Institutional Control Program**

Athabasca Chipewyan First Nation (ACFN) DLRM (Dene Lands & Resource Management) requested that Management and Solutions in Environmental Science (MSES) review Orano Canada Inc.'s (Orano) submission to the Canadian Nuclear Safety Commission (CNSC). Orano's submission is a request that the CNSC revoke the Cluff Lake Uranium Mine Decommissioning licence and exempt the Government of Saskatchewan from requiring a CNSC licence to manage the remaining parcels, allowing for their transfer into the Saskatchewan Institutional Control Program (ICP). The ICP represents a process for the long-term monitoring and maintenance of a decommissioned mine and/or mill site located on provincial Crown land in Saskatchewan. Institutional control refers to the control of residual risks at a site after it has been decommissioned; it can include active measures, such as water treatment, monitoring, and maintenance, and passive measures, such as land use restrictions and markers.

The Cluff Lake Project, located in the Athabasca Basin of northern Saskatchewan, is a uranium mine and mill site that was decommissioned in 2006. It has since been in post-decommissioning monitoring and maintenance. The Cluff Lake Project consisted of two underground mines, four open pit mines, an above ground tailings management facility, a mill, and other support facilities. These facilities were located within the boundaries of two watersheds, Cluff Creek Watershed, and Island Creek Watershed.

As per the Cluff Lake End State Report (2022), Orano states that the "decommissioning was designed to achieve an end-state where the:

- *environment was safe for use by human and non-human biota;*
- *reclaimed landscape is chemically and physically stable;*
- *self-sustaining landscape allows utilization for traditional purposes; and*
- *potential constraints on future land use are minimized" (pg. 2-1).*

Orano and regulators believe that Orano has met all decommissioning objectives based on the following indicators:

- "achievement of Decommissioning Surface Water Quality Objectives (DSWQO) and other accepted decommissioning objectives at surface water and flooded pit locations;

- *levels of gamma, radon, and long-lived radioactive dust, which pose no unacceptable risk to traditional land use, and which are consistent with the application of the As-Low-As-Reasonably-Achievable social and economic factors considered (ALARA) principle;*
- *a stable, self-sustaining landscape;*
- *reduction of infiltration rates around the TMA and the Claude waste rock pile to levels that adequately restrict contaminant movement in groundwater and are suitably protective of downstream surface water receptors; and*
- *return of the site to an aesthetically acceptable state, similar in appearance and land capability as that which existed prior to mining activities, and that poses no unreasonable risk to humans or the environment” (End of State Report, pg 2-1).*

However, ACFN DLRM shared with MSES concerns with these conclusions and requested a review of the Hearing Application to better understand whether the Project area lands are restored in a way that would support their cultural and traditional livelihoods and practices prior to any approval for the transfer of lands to the ICP.

The parcels of land that require long-term administrative controls and are being requested for transfer to the ICP totals 336.39 hectares of land that represent the following:

- D Mining Area
- Claude Mining Area\*
- DJ Mining Area\*
- OP-DP Mining Area
- Mill Complex Area
- Tailings Management Area\*
- Landfills
- Snake Lake and the portion of Claude Lake that is within the surface lease boundaries.

\*- contains subsets of land that include disposed nuclear substances

In support of a transfer of the Cluff Lake Mine property to the ICP, Orano developed a Long-Term Monitoring and Maintenance Plan (LTMMP), which would be administered by the Province of Saskatchewan. Orano states that they have developed a robust LTMMP that will ensure the protection of people and the environment in the long-term, and that the remaining residual risks can be adequately and confidently addressed under the Province of Saskatchewan’s ICP. ACFN previously reviewed the LTMMP and provided Orano’s responses to MSES for consideration with the current review of the Application.

Our technical review focused on the following disciplines: vegetation and reclamation, and wildlife and wildlife habitat. Overall, very little direct information was provided for these disciplines in the Application material provided for review. The focus of the environmental information in the Application was on the risks and impacts from the release of radioactive and hazardous substances from the Project, which was supported by an Ecological Risk Assessment (ERA). **We strongly recommend that the ACFN have experts in human health and wildlife risk assessments review the material in the Application to assess the adequacy of their conclusions/predictions.** Below we provide questions and recommendations relevant to impacts on vegetation and wildlife and Orano’s conclusions that they have achieved a “*stable, and self-sustaining landscape.*”

MSES reviewed two submissions filed by Orano and CNSC staff for the public hearing on the application to release the site from licensing under the *Nuclear Safety and Control Act (NSCA)*. These include the following, with the addition of Orano's responses to the ACFN technical review of the LTMMP:

- Hearing submission CMDH-8 Submission from CNSC;
- Hearing submission CMDH8-1 Orano Canada Written submission to revoke licence and transfer to ICP; and
- Cluff Lake ACFN LTMMP comments and responses.

### **Vegetation and Reclamation Comments**

**Issue:** Decommissioning objectives related to traditional resource use are not met

**Reference:** CMD23-H8, Section 1.2, Figure 2, pg. 8 and End State Report for Provincial Institutional Control, Section 2.1, pg. 2-1, Section 2.1.5, pg. 2-8, Section 2.4.11, Figures 2.1 to 2.6, pg. 2-22.

**Comment:** Decommissioning involves the removal or stabilization of constructed structures and the reclamation of disturbed areas. Decommissioning of the Cluff Lake project area was designed to achieve an end-state where, *“the self-sustaining landscape allows utilization for traditional purposes, the potential constraints on future land use are minimized.”* (pg. 2-1). Orano and provincial and federal regulators believe that these decommissioning end-state objectives have been met.

However, aerial images of some of the reclamation areas, particularly the reclaimed tailings management area (Figure 2, pg. 7, Figure 2.5, pg. 2-27), shows that in 2017 and 2019 the reclaimed area appeared to be an open field dominated by species of low-lying vegetation, likely grasses and forbs, with some shrubs and young trees, as well as roads and other areas appearing to be devoid of vegetation. In other reclaimed areas, trees and shrubs may have grown up (Figures 2.1-2.4, 2.6); however, it is unclear what species have re-established in the understory because no data was provided. Prior to disturbance these areas would have been home to diverse plant communities, dominated not only by trees and shrubs, but a species-rich understory including forbs, mosses, lichens, bryophytes, grasses, and epiphytes. Given the revegetation program of planting a few trees and shrubs, or seeding with grasses and forbs, it is unlikely that the understory of these reclaimed areas has more than a few understory plant species. As such, to believe that these reclaimed areas will allow utilization for traditional purposes, and that the potential constraints on future land use are minimized, seems questionable. From the images provided (Figure 2 and Figures 2.1 to 2.6), and the likely species-poor understory of these reclaimed areas, it seems certain that traditional uses with respect to vegetation, which include the gathering of traditional plants, roots, and berries for consumption, or spiritual or medicinal purposes, will be difficult.

To evaluate the success of the decommissioning program for the Cluff Lake project, site-specific objectives were established, which, when achieved, indicate the site has been successfully decommissioned. One of the criteria that is an indicator of decommissioning success is, *“a return of the site to an aesthetically acceptable state, similar in appearance and land capability as existed prior to mining activities”* (pg. 2-2). It is not clear to whom the state must be aesthetically acceptable. To suggest that the reclaimed sites, particularly the reclaimed tailings area shown in Figure 2 and 2.5, is *“similar in appearance and land capability as existed prior to mining activities”* is clearly inaccurate, which one can see if compared to the adjacent the intact boreal forest areas around the site. Orano believes that planting and few trees and shrubs in some areas, and seeding other areas with grasses and forbs, will *“accelerate the process of natural succession and result in a forest environment similar to that which existed prior to mining.”* (pg. 2-8). However, no evidence for this is provided, and in fact, there is ample evidence that reclaimed sites in the boreal forest are very different



from that which existed prior to mining (see more discussion below, Pinno and Hawkes 2015, Dhar et al. 2017).

Trees and shrubs seem to have been planted but given what is likely to be grasses dominating the ground cover, it is unlikely that many other species will be able to re-establish and grow because of the inhibitory effect of grasses on many other plant species. As a result, it is unlikely that as these plants grow, that this area will develop into a forest with the diversity of species found there prior to disturbance. Consequently, it seems likely that future land uses, including traditional land uses, will be limited.

**Question/Recommendation:**

- a. **Please explain on what basis Orano and CNSC believe that traditional uses with respect to vegetation, including gathering of traditional use plant species for consumption, or spiritual or medicinal purposes, will be possible within the decommissioned and reclaimed areas shown in Figures 2.1-2.6.**
- b. **Please explain to whom the reclaimed sites must be aesthetically acceptable to.**
- c. **Given that it appears that some of the performance objectives for the decommissioned Cluff Lake Project have not been met, please explain how it is possible to justify revoking the CNSC licence and transferring the regulatory responsibility to the Government of Saskatchewan.**

**Issue:** Orano must provide evidence of the natural re-establishment of native plant species in their reclamation sites

**Reference:** End State Report for Provincial Institutional Control, Section 2.1.3, pg. 2-6

**Comment:** Orano's revegetation program consists of "*seeding soil covers with grasses and forbs.. and planting trees in other disturbed areas.*" (pg. 2-6). There were six species of woody species planted, including four trees and two shrubs, all of which were propagated with local seed and cuttings. Trees planted were balsam poplar, white birch, trembling aspen, and jack pine, and shrubs planted were green alder and willow. From 2005 to 2007, Orano planted over 600,000 seedlings within 129 ha. And their monitoring results showed that, "*good survival and density of trees has been observed. Some small, low risk disturbed areas were not seeded but rather regraded to allow indigenous vegetation to establish naturally.*"

Orano believes that once a few trees or shrubs are planted, other plant types that inhabit natural plant communities (forbs, mosses, lichen, grasses, bryophytes, epiphytes) will eventually re-establish on their own (i.e., succession). However, this outdated idea is not supported by scientific evidence (e.g., Charron and Greene 2002, Peters et al., 2002, Purdy et al., 2002, GDC 2006, Gutsell and Johnson 2006, Pinno and Hawkes 2015, Dhar et al. 2017). Evidence from the scientific literature shows that some native plant species re-establish over time (GDC 2006); however, patterns of species richness and composition, non-native species richness, soil nutrients, and other measured components of reclaimed stands do not resemble natural forested stands (e.g., GDC 2006, Pinno and Hawkes 2015, Dhar et al. 2017). For example, when compared to natural boreal forest stands, reclaimed sites' native plant species richness is significantly lower and non-native species richness is significantly higher (Pinno and Hawkes 2015).

Therefore, Orano should not expect that the plant communities that develop on their reclamation sites will differ much from the relatively species-poor reclaimed communities currently present on their sites. Whereas Orano may have achieved its objective of a stable, self-sustaining reclaimed landscape, it adds further evidence that Orano has not met its decommissioning objectives, particularly "*a return of the site to an aesthetically acceptable state, similar in appearance and land capability as existed prior to mining activities,*"

“the self-sustaining landscape allows utilization for traditional purposes,” and “the potential constraints on future land use are minimized.”

**Question/Recommendation:**

- a) **Given the lack of evidence in the scientific literature for the natural succession of a large number of plant species in reclaimed sites, Orano should provide data to show the natural re-establishment of native vegetation in reclamation sites to justify their contention that decommissioning objectives have been met.**

**Issue:** Orano should provide key references to show success of decommissioning objectives

**Reference:** End State Report for Provincial Institutional Control, Section 2.1.3, pg. 2-6

**Comment:** Orano hydro-seeded the tailings management area (TMA) and Claude Waster Rock Pile (CWRP) with a mixture of “shallow-rooted grasses and forbs.” (pg. 2-7). And they state, “These types of vegetative covers tend to resist and slow the rate of natural invasion onto the site and ensure the integrity of the covers for an extended duration.” However, they also believe that native vegetation will eventually re-establish, and claim that the native plant community “has shifted over time with both the TMA and CWRP on a natural revegetation trajectory (Hab-tech, 2014; CanNorth 2020).” It is not clear what they think is a natural revegetation trajectory, and what evidence they have to substantiate the predicted trajectory.

There is little direct evidence for trajectories, but there is ample evidence that few plant species are capable of re-establishing in grasses, and those that do often are not the native plant species one sees after natural disturbances processes in the boreal forest (e.g., Chipman and Johnson 2002, GDC 2006, Pinno and Hawkes 2015). In any case, it would have been helpful to have the key references that Orano used that they said provided evidence or documented achievement of objectives including, “Status of Vegetation Recovery in the Cluff Lake Project Reclaimed Areas 2008-2014 (HAB-TECH Environmental, 2014)” and “Vegetation Recovery at the Cluff Lake Mine Site 2008 to 2020. December 2020.” (pg. 2-6). Without these references, conclusion with respect to vegetation shifting over time cannot be verified.

**Question/Recommendation:**

- a) **Please provide key references that Orano used that they said provided evidence or documented achievement of objectives.**

**Issue:** Assessing fen wetland vegetation using remote sensing not possible

**Reference:** CNSC Comprehensive Study Report, Section 2.1.3, pg. 2-5

**Comment:** The CNSC comprehensive study report examined the Island Lake Fen follow-up program. The Island Lake fen is “immediately downstream of Island Lake, and has accumulated a substantial contaminant load over the operational period.” (pg. 10-8). Orano states that, “The water monitoring component will be augmented by remote sensing of the wetland vegetation community to assess current status and provide a baseline for future comparison.” (pg. 10-8). It is not clear how wetland vegetation can be assessed through remote sensing, when the species present cannot be identified. How can they assess current status and a baseline if they cannot identify which species are present?

**Question/Recommendation:**

- a. **Please explain how Orano will be able to assess wetland vegetation using remote sensing, when the species present cannot be identified.**
- b. **How will they assess current status and a baseline of the wetland if they cannot identify which plant species are present?**

**Issue:** Orano needs to provide evidence of well-established vegetation progressing towards a natural state

**Reference:** Cluff Lake ACFN\_LTMMP Comments and Responses, Section 2.1.3, pg. 2-5

**Comment:** In response to a reviewer's request for vegetation monitoring information for review, Orano responded that vegetation surveys were carried out by consultants and provided to regulators for review, the most recent of which was conducted in 2020. Based on these surveys, they concluded that, "*a relatively well-established vegetation cover that is progressing towards a more natural state, and that natural plant succession is occurring in previously disturbed areas.*" (pg. 8). Orano did not appear to provide the data such that Orano's conclusions could not be verified. Consequently, many questions remain.

**Question/Recommendation:**

- a. **Please explain what is meant by *relatively well-established vegetation cover*. What is it relative to and how was this measured?**
- b. **How does Orano know that vegetation is *progressing towards a more natural state*? How was this measured?**
- c. **Please explain what is a more *natural state*, and how this was quantified. Were measures of the percent cover of each plant species in pre-disturbance plant communities compared to the same measures found in reclaimed areas to establish what is a natural state?**
- d. **What direct evidence can Orano provide of the patterns of natural plant succession they believe to be occurring in previously disturbed areas?**

**Literature Cited**

Charron, I. and Greene, D.F. 2002. Post-wildfire seedbed and tree establishment in the southern mixedwood boreal forest. *Canadian Journal of Forest Research* 32:1607-1615.

Chipman, S.J., and Johnson, E.A., Understorey vascular plant species diversity in the mixedwood boreal forest of western Canada. *Ecological Applications* 12(2): 588-601.

Gutsell, S.L. and Johnson, E.A. 2006. Accurately aging trees and examining their height growth rates: implications for interpreting forest dynamics. *Canadian Journal of Forest Research* 26: 166-174.

Peters, V.S., Dale, M.R.T., and Macdonald, S.E. 2002. Aging discrepancies of white spruce affect the interpretation of static age structure in boreal mixedwoods. *Canadian Journal of Forest Research* 32: 1496–1501.

Purdy, B.G., Macdonald, S.E., & Dale, M.R.T. 2002. The regeneration niche of white spruce following fire in the mixedwood boreal forest. *Silva Fennica* 36(1): 289–306.

## **Wildlife Comments**

**Issue:** Insufficient discussion as to how the Project site represents a self-sustaining landscape similar to conditions prior to mining for wildlife

**Reference:** General

**Comment:** Orano notes that the Cluff Lake Project is in the post-decommissioning phase and in 2019 was accepted by regulators as achieving the decommissioning objectives established during the 2003 federal comprehensive study review. The criteria used to demonstrate decommissioning success were presented in the introduction of this report. If the goal of decommissioning is to have a self-sustaining landscape that allows utilization for traditional purposes, it is not clear how that determination was supported without having indicators that reflect Indigenous perspective and use.

The main concern of the decommissioning objectives and the current Application is whether the water and land are safe to use by humans and wildlife due to risk of exposure from various radioactive and hazardous compounds associated with uranium mining. **ACFN should have these assessments reviewed by a qualified wildlife risk assessment expert to address adequacy and identify issues or concerns with the risk assessment.**

As for other decommissioning objectives, to evaluate decommissioning success at meeting a “self-sustaining landscape” that is “similar in appearance and land capability to that which existed prior to mining activities” would involve assessing the re-establishment of wildlife habitat, communities, and populations as part of a functioning ecosystem. This assessment and discussion are lacking in the Application documents and therefore we cannot verify whether Orano meets the decommissioning objectives from a wildlife perspective.

**Request/Recommendation:**

- a) **Please discuss how the existing wildlife data provides evidence of the re-establishment of wildlife habitat, communities and populations supports their assertion that decommissioning objectives have been met.**
- b) **Provide and discuss what wildlife indicators were used to determine that wildlife habitat use, and abundance of wildlife species are similar to what existed prior to mining activities.**

**Issue:** Lack of clarity on how ACFN input was incorporated into the LTMMP

**Reference:** CMD23-H8-1, pages 2-2 and 4-7

**Comment:** As part of this process, if the Application is approved (revocation of licence) and the responsibility transfers to the Province of Saskatchewan, there is concern that wildlife monitoring is not part of the Long-Term Monitoring and Maintenance Plan (LTMMP). The following statements would suggest that assessing wildlife such as habitat use, abundance and diversity in the post-decommissioned landscape is a component that is reasonably expected to be a part of understanding Project effects in the long term:

- The “**IC Program addresses all aspects of conventional closed mines** (emphasis added), *as well as the uranium-specific issues of radioactive waste management*” (CMD23-H8-1, pg. 2-2).
- “*The IC Program was developed to ensure the health, safety, and wellbeing of future generations, to provide greater certainty and closure for the mining industry **broadly** (emphasis added), and, specific to uranium mining, meet provincial, national, and international obligations for the storage of radioactive materials*” (CMD23-H8-1, pg. 2-2).

However, the information about the IC program focuses on monitoring for wildlife risk from exposure to radiological and hazardous substances and not necessarily other concerns such as whether the re-establishment of vegetation is creating diverse habitats that would support a diverse range of wildlife similar to pre-disturbance conditions.

ACFN did review the LTMMP and received responses from Orano (Letter dated October 5, 2022) but there is no context as to what, if any, input was integrated into the final LTMMP. Orano states that “*Orano has respected Indigenous community requests to review and suggest changes to the LTMMP to be implemented by the Province of Saskatchewan through the IC Program, providing the document for Indigenous review and organizing meetings, since its initial inception*” (pg. 4-7). Recommendations from the CNSC was stated as being incorporated into the LTMMP (pg. 2-3) but it is unclear how input from ACFN was incorporated to address their long-term concerns with the Project.

ACFN requested to review monitoring records for the presence of burrowing animals and potential new species. Orano indicated that impacts to wildlife were re-evaluated as part of the decommissioning plan and that a wildlife inventory was conducted to collect information for environmental risk monitoring for the Comprehensive Study Report (CNSC 2003). The CNSC Comprehensive Study Report (2003) does not provide the detailed information requested by ACFN.

#### **Request**

- a) **Please provide details as to how input from ACFN was integrated into the final LTMMP.**
- b) **Please provide detailed wildlife monitoring records that would indicate what species are using the Project area.**

**Issue:** Further ecological context needed to understand confidence in health risk predictions for wildlife

**Reference:** Environmental Protection Review report (2022), Section 3.2.4, pg. 35

**Comment:** Findings of the Ecological Risk Assessment (ERA) indicate that there are currently some effects to terrestrial animals that use Island Lake and the fen as a result from past operations and that there is a low likelihood, but some possibility, for effects to mink, muskrat, yellowlegs, and nighthawk that use the Snake Lake or Claude Lake area. It is predicted that these exposures are expected to be localized and temporary.

The modelling for common nighthawk, which is listed as Threatened under the *Species At Risk Act (SARA)*, indicates that there are current exceedances of the selenium benchmark for current exposures in the Island Lake and the Island Lake fen as a result of past operations but that it is predicted to decrease in the future with recovery. It is stated that the by using more conservative assumptions (e.g., assuming nighthawks only eat aquatic insects), the exposures are localized and temporary so that there is confidence that the risk is low. Overall, the “*potential for impacts to terrestrial environment is low and terrestrial biota area expected to remain protected*” (pg. 38) because the assessment had highly conservative assumptions regarding wildlife exposure pathways. The discussion would benefit by including more context as to the likelihood of species such as the common nighthawk, using habitat in the Project area (i.e., is preferred habitat available?) with verification from data collected during wildlife inventories and monitoring.

For example, common nighthawks will breed in a range of open and partially open habitats, including forest openings and post-fire habitats, prairies, bogs, rocky or sandy natural habitats and disturbed areas (COSEWIC 2018). Does the current Project area provide suitable habitat for Common nighthawks in comparison to the surrounding landscape? What wildlife surveys have been conducted to understand current presence of nighthawks in the site area? Given the current exceedances of selenium, what

approaches will be implemented to ensure that the prediction of low risk to a SARA listed species is validated.

**Request/Recommendation:**

- 1) **Please define what is meant by “temporary” to understand expectations for the timeline where selenium and other chemicals of concern are predicted to decline.**
- 2) **Map and discuss habitat availability in the current landscape for common nighthawks.**
- 3) **Provide further information as to the presence of nighthawks within the Project area as evidenced from wildlife inventories or monitoring throughout the life of the Project. What type of surveys were conducted that would capture wildlife presence and habitat use?**
- 4) **How will the proposed LTMMP monitoring provide evidence as to whether current exceedances of chemicals of concern pose a low risk to the health of SARA-listed and other wildlife species?**

**Literature**

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2018. Common Nighthawk (*Chordeiles minor*): COSEWIC assessment and status report 2018. [Common Nighthawk \(Chordeiles minor\): COSEWIC assessment and status report 2018 - Canada.ca](#)

**Issue:** Concerns that the LTMMP does not include wildlife monitoring

**Reference:** Environmental Protection Review report (2022), Section 2.3 pg. 20

**Comment:** The objective of the proposed LTMMP is to compare the site’s environmental performance against decommissioning objectives. It focuses on 4 key areas

- 1) *“geotechnical inspections to confirm stability of key decommissioning features, monitor areas for public safety concerns, monitor for low likelihood accident and malfunction scenarios, and monitor for indications of site use.*
- 2) *monitoring future risk, in order to validate the predicted environmental performance and recovery of the Island Creek and Cluff Creek watersheds. This will include the periodic monitoring of surface water at locations within the Island Creek and Cluff Creek watersheds for key COPCs identified in the ERA*
- 3) *monitoring for recovery, and includes monitoring of sediment, benthic invertebrates, fish, and vegetation (in 2030 and 2055), in order to document site recovery, provide a characterization of the environmental conditions at that time and inform interested stakeholders, and address stakeholder questions about future cover performance*
- 4) *incorporating some additional surface water sample locations in areas of interest to known land users to provide additional assurance that the water will remain safe over time” (pg. 20).*

Direct measurements of wildlife is not included in the list of components for monitoring the recovery of the site. It is unclear if monitoring for indications of use would be incidental observations of wildlife sign or if a rigorous effort will be undertaken. Incidental observations will not provide quantitative data that could be used in comparisons with wildlife presence, abundance or habitat use measures prior to mining activities or in reference areas in the surrounding landscape.

**Request/Recommendation**

- 1) **Provide rationale for not including direct wildlife monitoring parameters for monitoring the recovery of the site.**

- 2) **Please provide more details as to how “indications of site use” will be measured for wildlife and how that will be used to determine that the site is a functioning ecosystem.**

**Issue:** No discussion of how vegetation recovery is supporting the recovery wildlife populations

**Reference:** CMD23-H8-1, Section 2.2.3.2, pg. 2-7; Environmental Protection Review report (2022), Section 2.2.3 pg. 18; CNSC Comprehensive Study Report (2003) Section 8.2.8, pg. 8-125

**Comment:** The Application presents general descriptions of decommissioning efforts including revegetation. However, there is no detailed information as to how the success of the reclamation efforts have been at establishing wildlife habitat. As noted in the CSR (2003), the site wide revegetation plan objectives are listed as:

- 1) For the TMA and Claude waste rock pile soil covers – Orano re-vegetated with shallow grasses because this will slow natural vegetation invasion on the site until covers are stabilized then native vegetation can progressively invade the area.
- 2) Active planting of deciduous trees in other areas where Orano assumes that natural succession will re-establish vegetation.

In the CSR (2003), Orano discusses that natural invasion of local vegetation will be delayed in the TMA and Claude wasterock areas, but that overall, the reclamation plan will allow safe use of the area for hunting, trapping and fishing, which is consistent with previous and current land use in the area (CSR, Section 9.2.8, pg. 9-37). Some brief comments about wildlife were found in the CSR that indicate signs of deer, wolf, bear, and moose have been observed around and on the Claude Waste Rock Pile (CSR, Section 4.3.3, pg. 4-14). These species are generalist habitat species who are often observed on disturbed habitats. Orano also states that wildlife use outside of the immediate development areas appears to be similar to what pre-disturbance conditions (CSR, pg. 6-48). No other discussion is included that would support these statements.

Section 2.2.3 of the Environmental Protection Review Report states that the progress of revegetation indicates an increase in species richness of native plants on the cover and the presence of later successional tree and shrub species. The report suggests that this is evidence that revegetation efforts for the CWRP is moving from more early successional species to later successional species and that these trends will likely result in establishment of mature forests compatible with local ecosystems. **However, the details of these results were not provided as part of this review, and we would recommend that the ACFN request and review this information.** Prior to disturbance the Project area would have been home to diverse plant and wildlife communities but there is no evidence provided that the revegetation efforts will restore the reclaimed lands to an area similar to pre-disturbance. Given that patterns of plant species richness and composition of reclaimed stands do not resemble natural forested stands (see discussions in the Vegetation section of this review), this will likely develop into a novel landscape that has implications for the diversity and composition of wildlife.

Without clear evidence, the assumption about natural succession and the ability of this process to provide diverse vegetation stages that will support a varied wildlife species community similar to pre-disturbance conditions is questionable. Data from CEMA’s long term plot network and Early Successional Wildlife Dynamics (ESWD) in the oil sands region suggest that the successional trajectory of reclaimed plots is different from natural stands disturbed by fire (GDC 2006, Dhar et al., 2017, Pinno and Hawkes 2018) and that similarity of wildlife communities between reclaimed and mature forest plots varied greatly, even at 33 years since reclamation (Hawkes and Gerwing 2019). The ESWD study also focused on presence/absence of wildlife, which does not necessarily address whether the habitat is functioning to

support a wildlife population. Although some similarities in wildlife communities appear to occur between older reclaimed sites (33 years) and mature forest, it is clear that further research is needed to understand how wildlife communities are developing over time (e.g., do we see the return of the more specialist habitat species). Although some generalist wildlife species may be detected on reclaimed habitat, there is concern that wildlife communities will be different, and novel compared to pre-disturbance which will have consequences on Indigenous community cultural and traditional land use practices.

**Request/Recommendation**

- a) **Provide the report or research data that would support statements that revegetation efforts are developing into late successional species and plant communities similar to local conditions.**
- b) **Please discuss how qualitative measurements on wildlife presence will provide evidence of a functioning landscape similar to pre-disturbance conditions that can support wildlife populations and future traditional uses. Are there thresholds/targets that presence of wildlife species can be measured against?**

**Literature**

Dhar, A., Comeau, P.G., Karst, J., Pinno, B.D., Chang, S.X., Naeth, M.A., Vassov, R., Bampfylde, C., 2018. Plant community development following reclamation of oil sands mine sites in the boreal forest: A review. *Environ. Rev.* 26, 286–298.

GDC (Geographic Dynamics Corp). 2006. Investigation of natural ingress of species into reclaimed areas. Prepared for the Cumulative Environmental Management Association-Wood Buffalo Region, Reclamation Working Group, Soil/Vegetation Subgroup, Fort McMurray, Alberta, Geographic Dynamics Corp. Edmonton, Alberta.

Hawkes VC and TG Gerwing. 2019. Wildlife usage indicates increased similarity between reclaimed upland habitat and mature boreal forest in the Athabasca Oil Sands Region of Alberta, Canada. *PLOS ONE* <https://doi.org/10.1371/journal.pone.0217556>

Pinno, B.D., and Hawkes, V.C. 2015. Temporal trends of ecosystem development on different site types in reclaimed boreal forests. *Forests* 6: 2109-2124.

**Issue:** Further rationale needed regarding localized risk to amphibians

**Reference:** CMD23-H8-1, Environmental Protection Review report (2022) Section 3.2.3 pg. 33, End State Report for Provincial Institutional Control (2022), Section 2.4.6.I TMA Cover and Main Dam pg. 2-17 and Section 4.2 pg. 4-1

**Comment:** The TMA was the disposal location for all tailings produced for the Project. Some ephemeral ponds have been observed where the thickest amount of till was placed during decommissioning. A risk assessment predicts that no adverse risk is expected for terrestrial wildlife or species-at-risk that may use the TMA. Due to the ponding in the TMA that could be habitat used by amphibians, Orano included northern leopard frog in the ecological risk assessment. There is a “*small potential for nickel concentrations to be an issue for individual toads, no adverse effects are expected from an aquatic perspective*”. The aquatic assessment demonstrated while there may be a potential for nickel concentrations to be an issue for toads, the limited habitat and spatial extent of the areas of shallow ponded water on the TMA are not expected to result in population-level effects.

**Request/Recommendation:**

- a) **Provide more details as to the habitat availability for amphibians in the TMA area that would support statements that habitat is limited.**



- b) Discuss current population information for northern leopard frog and whether specific amphibian surveys were conducted as part of Project monitoring that would provide some insight into their presence in the area.**
- c) How will Orano or the LTMMP verify the assumption that impacts to amphibians from nickel will not result in population level effects?**

**Issue:** Request for more detailed wildlife information

**Reference:** CNSC Comprehensive Study Report (2003), Section 10.9.3 Baseline Wildlife Investigation Survey, pg. 10-13

**Comment:** At the end of operations in 2002, the decommissioning of the site underwent an environmental assessment (Comprehensive Study for Decommissioning (CSD, 2002) which informed a CNSC Comprehensive Study Report (CSR, 2003). A high-level review of the CSR (2003) was completed to provide a better understanding of wildlife conditions in the Project area to evaluate the predictions in the current Application. It was stated in the CSR that the company has committed to a “*comprehensive wildlife investigation at the Cluff Lake site upon cessation of operations*” with a key focus on presence/absence of muskrat and moose to address uncertainty with respect to the risks of exposure to the elevated levels of contaminants.

**Request/Recommendation**

- a) Please provide the ACFN with the reports from the comprehensive wildlife investigation that would assess presence/absence of wildlife such as moose and muskrat.**





# Orano Canada Inc.'s Decommissioning Surface Water Quality Objectives Cluff Lake Project (Long-Term Monitoring and Maintenance Plan) - Health Protection Assessment.

**January 15, 2023**

**To:** Callie Flett-Davies  
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**From:** Mandy Olgard, M.Sc., P. Biol.  
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## Introduction

Responses provided by Orano to address ACFN concerns on the efficacy of the LTMMMP for the decommissioned Cluff Lake Mine site were limited and insufficient to rectify the issues and requests (Orano, 2022; Olgard, M., 2022).

To understand limitations of the responses and the LTMMMP, Athabasca Chipewyan First Nation Dene Lands and Resource Management (ACFN DLRM) requested that Integrated Toxicology Solutions (ITS) undertake an assessment of the health protection of the proposed LTMMMP and approved Decommissioning Surface Water Quality Objectives (DSWQOs) through a comparison to published surface water quality standards for the protection of Indigenous people, aquatic ecosystems, and wildlife health.

The analysis was requested to support ACFN DLRM in future hearing proceedings regarding the proposed LTMMMP and how health risks to ACFN members from exposure to COPCs while exercising their s.35 Treaty Rights through various traditional land use activities in the vicinity of the decommissioned Cluff Lake site may be achieved and where revisions are required.



## Approach

The comparison is provided to identify potential discrepancies between the approved DSWQOs (accepted by regulators in 2019 as achieving the decommissioning objectives established during the 2003 federal comprehensive study review) and risk-based surface water quality guidelines which have been established to protect aquatic biota, wildlife, and humans.

Discrepancies between approved DSWQOs and published risk-based surface water quality standards currently used to regulate and protect surface water quality in North America provide an additional line of evidence to understand potential health risks from exposure to elevated constituents of potential concern (COPCs) such as molybdenum, selenium, uranium and the radionuclide radium-226, which Orano predicted to peak between the calendar years 2500 and 4000 in post decommissioning groundwater and surface waters and remain consistently elevated compared to current conditions, essentially in perpetuity.

In addition, DSWQOs were compared to Water Quality Criteria for the Protection of Indigenous Uses (WQCIU) which were previously developed to account for ACFN members reliance on and use of surface water and traditional foods and medicines and consider their expectations for healthy and safe aquatic environments to support their way of life.

ACFN community members consuming natural surface water and food and medicines from the land are at particular risk of exposure to chemicals. Using foods, medicines and water from the land is a Section 35 Treaty Right and a higher standard for water quality is needed to protect health of the environment and ACFN members (Olsgard, M. et. al., 2022)<sup>1</sup>.

The WQCIUs are unique from published surface water quality standards relied on by Canadian jurisdictions (provincial and federal governments) to regulate ambient surface water because they were developed to:

- Identify water use categories inextricably linked to the ACFN way of life and reliance on healthy safe water; traditional foods and drinking water, traditional medicines, aquatic ecosystem health, and wildlife health.

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<sup>1</sup> Available by request. Publications in process.



- Address gaps in current standards related to bioaccumulation and biomagnification of persistent substances, human health endpoints, and use of untreated natural water as a drinking water source for ACFN members.
- Account for ACFN members food and medicine consumption habits (i.e., amount, frequency, total consumption rates for consumed species).
- Provide specific criteria by Indigenous use category and generic criteria to protect all uses, to allow for flexibility in application to complex sites while ensuring a wide range of Indigenous water uses and receptors are protected.

Discrepancies between the DSWQOs and published surface water quality standards and WQCIU are reported as relative percent differences (RPD), according to the following formula:

$$RPD = [X_2 - X_1] / [(X_2 + X_1) / 2] * 100$$

where  $X_1$  is the DSWQO and  $X_2$  is the corresponding published surface water quality standards and WQCIU.

Differences reported as negative values indicate that the DSWQO is higher than the published standard or WQCIU and would likely underestimate potential risks to the health of aquatic biota, wildlife and humans and may limit the efficacy of managing risks from exposure to COPCs at the decommissioned site. Positive values indicate that the DSWQO is lower than the standard or WQCIU, is likely protective of aquatic biota, wildlife, or human health and could be effective in managing health risks.

The LTMMMP did not include predicted water quality for the project pit lakes or predicted sediment quality for the Cluff Creek or Island Creek watersheds. However, a similar comparison could be carried out for those water and sediment quality predictions, as included in the Technical Information Documents (TIDs)



## Results

Results of the comparison are provided in Appendix 1 and key findings are summarized below.

For several COPCs, humans are more sensitive to exposure than aquatic biota, these include arsenic, cadmium, molybdenum, and nickel (see Appendix 1). The approved DSWQOs for metals do not consider and offer limited protection to human health, specifically ACFN members consuming water from the Island and Cluff Creek Watersheds now and under the predicted future conditions. Potential health effects which could manifest if the surface water reaches predicted concentrations and through management with the DSWQOs include;

- Uranium: Nephrotoxicity is the primary clinically observed health effect related to uranium exposure with guidelines for drinking water are set at 20 ug/L (Health Canada, 2021). The DSWQO is almost 3 times this level (88 ug/L) and predicted concentrations in Island Lake (97 ug/L), Claude Lake (50 ug/L), and Claude Creek (152 ug/L) are all higher than the safe level established for drinking water.
- Arsenic: Carcinogenicity is the health protection endpoint for drinking water quality guidelines (10 ug/L; Health Canada 2021) but adverse effects have been observed to dermal, vascular, and neurological systems from elevated exposures. The DSWQO is 5 times the Health Canada (2021) guideline (50 ug/L) and ~275 times higher than the safe exposure level (0.18 ug/L) set by the US EPA for protection of people consuming water and aquatic organisms (fish, plants), which is even lower if the increased consumption of traditional foods and medicines by ACFN members is considered (0.03 ug/L). The predicted concentrations of arsenic in all surface water bodies impacted by contaminated groundwater from the decommissioned Cluff Mine Site are higher than the established health risk guidelines indicating potential risks of carcinogenicity and other systemic effects.
- Cadmium: Similar to uranium, the primary health effect observed from elevated exposure to cadmium is nephrotoxicity. This indicates a potential increased risk from additive or synergistic effects from exposure to multiple COPCs which target the kidneys. This has not been accounted for in the LTMMP. While the predicted concentrations of cadmium in waterbodies within the Cluff and Island Creek watersheds are below Health Canada guidelines (7 ug/L) it is unclear if this guideline is protective given the potential for additive effects from exposure to the complex mixture of COPCs reaching surface water from contaminated

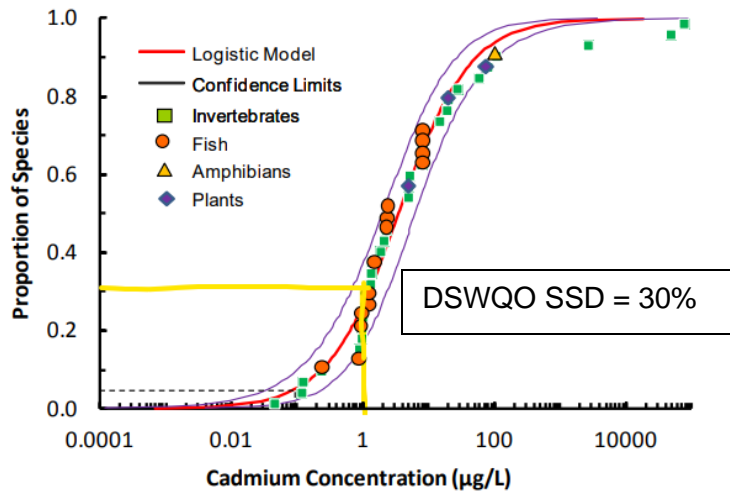


groundwater. attributed to the decommissioned Cluff Lake Mine site. Similar to arsenic, when accounting for potentially higher exposure of ACFN members from consumption of aquatic biota in traditional diets to derive a WQCIU (0.002 ug/L), a higher potential for adverse health risks is indicated by predicted concentrations of arsenic.

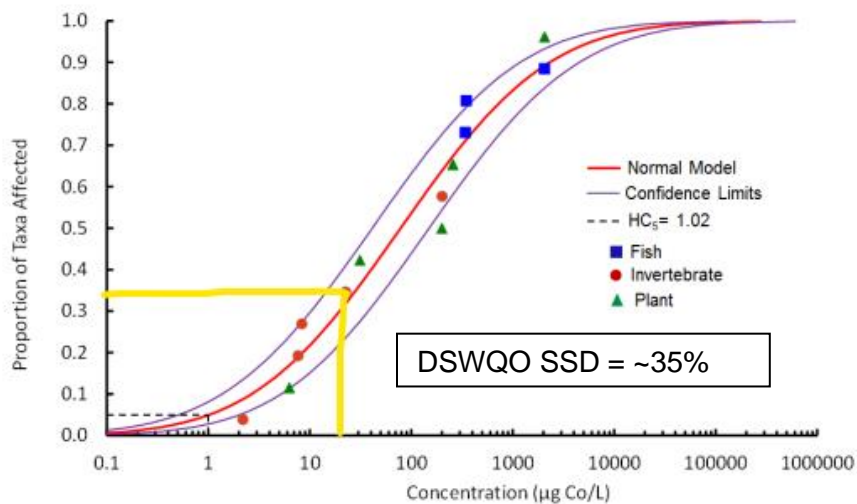
In addition to potential lack of health protection from direct exposure of ACFN community members to COPCs in drinking water and traditional foods and medicines, the DSWQOs for the protection of aquatic life are 10-200% higher than the concentrations which have been established to protect aquatic life from exposure to the identified COPCs, except for arsenic and nickel.

Potential population level effects on the survival, growth and reproduction of aquatic biota could be observed in waterbodies within the Cluff Creek and Island Lake watersheds from the predicted concentrations of COPCs and through application of the approved DSWQOs under the LTMMP. Specific effects attributed to each COPC are discussed below, however the risk is likely generalized to effects on survival, growth, and reproduction of various taxa. This is due to additive and synergistic effects of exposure to the complex mixture of COPCs which may act through similar modes of action to exert toxicity.

- Cadmium: The long-term surface water quality guideline was established to protect 95% of aquatic biota (0.09 ug/L SSD 5<sup>th</sup> percentile) using available toxicity data which reports feeding inhibition in *D. magna* as the most sensitive endpoint and species. The toxicity data also indicate that aquatic invertebrates are the most sensitive taxa followed by fish, plants/ algae, and amphibians (CCME, 2014). The DSWQO (1 ug/L) is ~ 10 times higher than the published guideline (0.08 ug/L; calculated using CCME equation and 44 mg/L hardness), indicating there is lowered health protection for aquatic biota managed under the DSWQO and the potential for adverse effects on the survival, growth, and reproduction of fish and invertebrates inhabiting Island Lake (1.3 ug/L), Claude Lake (0.47 ug/L) and Claude Creek (0.5 ug/L). These water bodies are predicted to exhibit elevated concentrations of cadmium as a result of contaminated groundwater at the decommissioned Cluff Lake site reaching these waterbodies. The figure below, modified from CCME (Figure 2; 2014), shows the difference in protection level, 95% are protected under the federal guideline (dashed line) compared to 70% (yellow line) with the DSWQO.



- Cobalt: Similar to cadmium, toxicity is hardness dependent, the long-term federal environmental quality guideline was established to protect the majority of species and endpoints using the 5<sup>th</sup> percentile SSD approach and aquatic invertebrate are the most sensitive species studies to date (Environment Canada, 2017) but the sensitivities of various taxa differ, with plants/algae reported as more sensitive to cobalt than fish (Table 2; GOC 2017. Again, the DSWQO established in the LTMMMP is much higher than the hardness adjusted (44 mg/L) FEQG (20 ug/l compared to 0.73 ug/L) indicating a lower degree of protection in Claude Lake (5.4 ug/L), Claude Creek (18 ug/L), Peter River (1.7 ug/L), and Cluff Lake (0.98 ug/L). These water bodies are predicted to be impacted by cobalt in groundwater migrating off the decommissioned Cluff Mine site. The figure below adapted from GOC (Figure 1;2017) illustrates the difference in protection of aquatic biota in waterbodies monitored and managed under the DSWQO.





- Copper: A fact sheet describing the toxicity data used to establish the CEQG for copper, however, using the online calculator, the DSWQO for (10 ug/L) is 5 times greater when calculated with a hardness of 44 mg/L<sup>2</sup>. Environment Canada (2021) provides guidance on establishing a long-term surface water quality guideline using the Biotic Ligan Model (BLM) based on SSD methods. This approach does not appear to have been relied on to develop the DSWQO. Predicted concentrations of copper in Claude Lake (2.8 ug/L) and Claude Creek (7.3 ug/L) exceed the long-term surface water guideline estimated from the CCME approach, indicating potential for adverse environmental effects in these areas from contaminated groundwater.
- Molybdenum: The long-term surface water quality guideline established for the protection of aquatic biota was derived from toxicity data for the sensitive species rainbow trout (73 ug/L; CCME 1999). The DSWQOs for Snake Lake and Cluff Creek adopt the CCME guideline while that for Island Lake is ~7 times greater. Predicted exceedances are noted in Island Lake (144 ug/L) which may be why a higher DSWQO was proposed. Regardless, there are potential risks to aquatic biota in this area.
- Selenium: CCME has established a long-term surface water quality guideline of 1 ug/L (1987) but a fact sheet describing toxicological data is not available. The DSWQO is ten times greater than the federal guideline and indicates a potential risk of selenium bioaccumulation in Island Lake from predicted water quality (1.2 ug/L). As discussed below, the DSWQO is 50 times greater than the surface water benchmark established to protect piscivorous wildlife indicating potential risks in Island Lake which require biomonitoring beyond that proposed in the LTMMP.
- Uranium: CCME (2011) has established a long-term surface water quality guideline for the protection of aquatic biota again using the 5th percentile SSD approach (15 ug/L) which is ~ 6 times lower than the DSWQO (88 ug/L). It is unclear how the DSWQO was derived as a hardness-based equation is not recommended by CCME. Notably the DSWQO is more than 2 times higher than the short-term (acute) federal guideline (33 ug/L). Table 17 (CCME, 2011) indicates that application of the DSWQO to manage waterbodies in the Island Creek and Cluff Creek watersheds are unlikely to protect aquatic invertebrates, plants, and algae but may be protective for fish species. This is concerning given the number of COPCs predicted to exceed federally established long-term water quality guidelines for the protection of aquatic biota in addition to the predicted exceedances for Uranium in Island Lake (97 ug/L), Claude Lake (50 ug/L), Claude

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<sup>2</sup> <http://st-ts.ccme.ca.vsd46.korax.net/en/index.html?lang=en&factsheet=71>



Creek (152 ug/L) and Peter River (25 ug/L) from contaminated groundwater intercepting these areas.

The DSWQO for selenium also exceeds concentrations which have been established to protect wildlife living in aquatic habitats and consuming surface water and aquatic biota and there could be adverse effects from selenosis in semi-aquatic mammals and birds (0.24 ug/L; Sample, B E; Opresko, D M; Suter, II, G W, 1996<sup>3</sup>).

## Conclusions

The DSWQOs for most COPCs as approved in the LTMMP are greater than federal guidelines for the long-term protection of aquatic life and drinking water quality guidelines for the protection of human health. The additive and synergistic effects from the presence of several COPCs with similar modes of action and target organs indicate potential for both adverse effects to aquatic biota and human health in Island Lake, Claude Lake, and Claude Creeks and to a lesser degree Snake Lake and Peter River.

The comparison also showed that the concentrations of COPCs (ug/L) established as DSWQOs were higher than WQCIUs established for the protection of ACFN members consuming surface water and traditional foods and medicines from the land for all COPCs except non-Uranium radionuclides.

Based on this analysis, it appears that the LTMMP lacks sufficient monitoring to assess and manage adverse effects on aquatic biota and aquatic ecosystem effects and neurotoxicity and carcinogenicity in Indigenous populations from exposure to COPCs entering local surface water bodies from contaminated groundwater and runoff from the decommissioned Cluff Lake Mine Site

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<sup>3</sup> Adopted from Appendix D Table 12, Endpoint Species River Otter NOAEL based benchmark for Selenate.



## Closing

This document was prepared under the direction of a professional biologist registered in the Province of Alberta.

Integrated Toxicology Solutions Ltd. trusts that it will provide ACFN DLRM with the information it requires to understand the degree of health protection under the proposed LTMMP and engage in ongoing discussions on management of the Cluff Lake site.

Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely,

A handwritten signature in black ink, appearing to be 'Mandy Olsgard', written over a horizontal line.

Mandy Olsgard, M.Sc., P. Biol.  
Principal/ Senior Toxicologist  
Integrated Toxicology Solutions Ltd.  
Edmonton, AB



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Appendix 1: Results of Comparison between DSWQOs, Published Surface Water Quality Guidelines for the Protection of Humans, Wildlife and Aquatic Biota, and Water Quality Criteria for Indigenous Use Protection.

