Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

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A Licence Revocation

Orano Canada Inc.

Cluff Lake Project

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

Commission Public Hearing

Scheduled for:

1-2 March 2023

Submitted by:

CNSC Staff

Révocation d'un permis

Orano Canada Inc.

Projet de Cluff Lake

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

Dates prévues :

Du 1er au 2 mars 2023

Soumis par :

Le personnel de la CCSN

e-Doc 6770891 (WORD)
e-Doc 6770896 (PDF)

Summary

This CMD presents information about the following matters of regulatory interest with respect to Orano Canada Inc.'s Cluff Lake Project:

- Application for the revocation of CNSC-issued licence UML-MINEMILL-CLUFF.00/2024, covering the Cluff Lake Project to facilitate transfer of the property to the Government of Saskatchewan's Institutional Control Program.

CNSC staff recommend the Commission consider taking the following actions:

- Revoke the CNSC issued licence UML-MINEMILL-CLUFF.00/2024
- Exempt the Government of Saskatchewan from licensing under the *Nuclear Safety and Control Act* for the properties currently covered by CNSC-issued licence UML-MINEMILL-CLUFF.00/2024 that are proposed for transfer to Saskatchewan's Institutional Control Program.

The following items are attached:

- Current licence UML-MINEMILL-CLUFF.00/2024
- Current licence conditions handbook LCH-MINEMILL-CLUFF.00/2024

Résumé

Le présent CMD fournit de l'information sur les questions d'ordre réglementaire suivantes concernant le projet de Cluff Lake d'Orano Canada Inc. :

- Demande de révocation du permis UML-MINEMILL-CLUFF.00/2024 délivré par la CCSN pour le projet de Cluff Lake afin de faciliter le transfert de la propriété au Programme de contrôle institutionnel du gouvernement de la Saskatchewan.

La Commission pourrait considérer prendre les mesures suivantes :

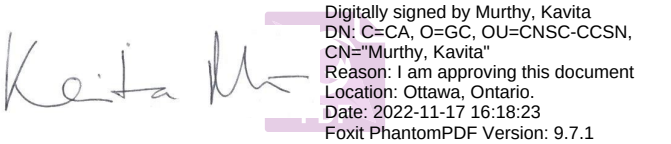
- Révoquer le permis UML-MINEMILL-CLUFF.00/2024 délivré par la CCSN.
- Exempter le gouvernement de la Saskatchewan de l'obligation de détenir un permis en vertu de la *Loi sur la sûreté et la réglementation nucléaires* pour les propriétés visées actuellement par le permis de la CCSN UML-MINEMILL-CLUFF.00/2024 et qu'on propose de transférer au Programme de contrôle institutionnel de la Saskatchewan.

Les pièces suivantes sont jointes :

- Le permis en vigueur UML-MINEMILL-CLUFF.00/2024
- Le manuel des conditions de permis en vigueur LCH-MINEMILL-Cluff.00/2024

Signed/Signé le

17 November 2022/17 novembre 2022



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PLAIN LANGUAGE SUMMARY

The decommissioned Cluff Lake uranium mine and mill site is located in northwestern Saskatchewan, approximately 250 kilometres by road to the nearest communities of Clearwater River Dene First Nation and the Métis community at La Loche. The Cluff Lake site is situated within Treaty 8 (1899) territory and the Homeland of the Métis and is within the traditional territories of the Dene, Cree, and Métis peoples.

Orano Canada Inc.'s (Orano) Cluff Lake Project is currently licensed by the Canadian Nuclear Safety Commission[1] under licence UML-MINEMILL-CLUFF.00/2024, which authorizes the licensee to possess, manage, and store nuclear substances that are associated with the historic Cluff Lake Project. In 2020, Orano requested that their licence be revoked, and that regulatory oversight for the Cluff Lake Project be transferred from the CNSC-issued licence to the Government of Saskatchewan's Institutional Control Program (ICP). The purpose of this Commission Member Document (CMD) is to inform the Commission of the results of CNSC staff's review of Orano's application, and to provide CNSC staff's recommendations.

Saskatchewan's provincial regulations establishing the ICP requires that the Government of Saskatchewan be exempt from licensing under the *Nuclear Safety and Control Act* (NSCA) for any properties entering the program. If the Commission accepts Orano's application to revoke the licence for the Cluff Lake Project, an exemption from CNSC licensing for the Government of Saskatchewan would also be needed to transfer the site to the ICP. The Commission can grant exemptions from licensing under section 7 of the NSCA, if doing so will not pose an unreasonable risk to persons or the environment. If the property enters the ICP, the Government of Saskatchewan will manage any monitoring and maintenance, as described in the Post-Decommissioning Monitoring Plan, as described in the Long-term Monitoring and Maintenance Plan, and will respond to any unforeseen events.

The ICP is designed to ensure that decommissioned mine and mill properties, in a passively stable state, are monitored and managed in perpetuity by a competent regulatory authority, that is, the Government of Saskatchewan. Like the CNSC, the Government of Saskatchewan is an agent of the Crown. Staff from both the CNSC and the Government of Saskatchewan have confirmed that the performance objectives and criteria established for the Cluff Lake Property decommissioning have been achieved. The site is protected and will remain so in the long term under the ICP.

[1] The Canadian Nuclear Safety Commission is referred to as the "CNSC" when referring to the organization and its staff in general, and as the "Commission" when referring to the tribunal component.

CNSC staff are recommending that the Commission consider taking the following actions:

- Revoke the CNSC-issued licence UML-MINEMILL-CLUFF.00/2024 to facilitate the transfer of the decommissioned Cluff Lake Project to Saskatchewan's Institutional Control Program.
- Exempt the Government of Saskatchewan from licensing under the NSCA for the Cluff Lake properties proposed for transfer into Saskatchewan's Institutional Control Program.

Referenced documents in this CMD are available to the public upon request, subject to confidentiality considerations.

PART ONE

This Commission Member Document (CMD) is presented in two parts.

Part One includes:

1. an overview of the matter being presented;
2. overall conclusions and overall recommendations;
3. general discussion pertaining to the safety and control areas (SCAs) that are relevant to this submission;
4. discussion about Indigenous engagement and other matters of regulatory interest;
5. addenda material that complements items 1 through 4.

Part Two provides all available information pertaining directly to the current request to revoke the CNSC-issued licence.

1. OVERVIEW

1.1 Background

The decommissioned Cluff Lake Project site area is owned and operated by Orano Canada Inc. (Orano or Licensee). During the lifetime of the project, Orano, underwent corporate changes and was previously referred to as Cogema and as AREVA. Located within the Athabasca Basin in northwestern Saskatchewan, the Cluff Lake Project is approximately 75 kilometres south of Lake Athabasca, 15 kilometres east of the Alberta border, and 900 kilometres north of Saskatoon (figure 1, on next page). Mining activity commenced at the Cluff Lake Project in 1980 and ceased in 2002. Primary decommissioning began at the site in 2004 and was completed in 2006.

The Cluff Lake Project consisted of 2 underground mines, 4 open pit mines, an above ground tailings management facility, a mill and other support facilities. These facilities were located within the boundaries of 2 watersheds:

- the **Cluff Creek Watershed** where the mines, waste rock piles and Germaine Camp facilities were located; and
- the **Island Creek Watershed** where the mill, tailings management area (TMA) and effluent treatment system were located.

Figure 1 – Cluff Lake Project – Location map

The following is a summary of the major decommissioning milestones for the Cluff Lake Project:

- 2000 – Comprehensive Study for Decommissioning (Cogema)
- 2003 – Comprehensive Study Report (CSR) (2003, CNSC), which established CNSC-accepted decommissioning objectives [2]
- 2004 to 2006 – primary decommissioning activities
- 2004 – partial surrender of provincial surface lease for lands unaffected by mining activities
- 2009 – submitted revised Detailed Decommissioning Plan, accepted by the Commission during licence renewal
- 2013 – physical decommissioning of remaining surface infrastructure, minor earthworks, continuous site presence discontinued
- 2015 – submitted the Cluff Lake Technical Information Documents demonstrating current and long-term achievement of decommissioning objectives
- 2015 – completion of Decommissioning Follow-Up Program detailed in the CSR [2]
- 2017 – environmental monitoring transitioned from 4 campaigns per year, to 1 campaign per year
- 2018 – completion of activities under Detailed Decommissioning Plan
- 2019 – submitted Detailed Post-Decommissioning Plan [4], accepted by the Commission during licence renewal [3]. Licence renewed for a period of 5 years to allow for potential transition to the ICP.
- 2022 – submitted End State Report [5]

Active decommissioning activities from 2004 to 2006 included demolition of the mill complex buildings, covering the TMA and Claude waste rock pile, backfilling the Claude Pit, flooding the DJX pit, and planting of trees. In 2013, a small residential camp, which included potable and sewage treatment plants, 2 steel outbuildings, and the Secondary Treatment System, were demolished as part of the decommissioning process. As a result, the Cluff Lake Project met the objectives identified in the Detailed Decommissioning Plan. As part of adaptive management, CNSC staff have continued to work with Orano to minimize the possible impacts of uncertainty in their long-term modelling (100 to 500 years), and to provide conservative measures to deal with the potential worst-case scenarios.

In 2019, Orano submitted a Detailed Post-Decommissioning Plan [4] to the Government of Saskatchewan and to the CNSC, which details the long-term environmental monitoring program. This includes, among other things, surface water monitoring downstream of Snake Lake and Claude Lake, to verify water quality and long-term predictions [9]. CNSC and the provincial staff have reviewed Orano's Detailed Post-Decommissioning Plan and have found it adequately addresses the predicted long-term needs of the site, persons and the environment.

1.2 Highlights

The decommissioned Cluff Lake Project site is accessible to the public, including for Indigenous traditional land use activities such as hunting, fishing and harvesting. The nearest community by road is La Loche which is approximately 4.5 hours driving (250 kilometres) from Cluff Lake. The nearest downstream community is Fort Chipewyan which is approximately 100 km by air. There is some seasonal activity near the site. Ongoing activities by Orano include annual monitoring and surveillance, and periodic maintenance of significant safety features. There have been no permanent licensee staff on site since 2013 and most maintenance and monitoring work is completed by contractors, with oversight from Orano.

Orano has met all decommissioning objectives established in the CSR [2]. The Commission accepted staff's assessment as part of the 2019 licensing renewal. Specifically, the objectives are discussed in section 7 of the CSR. Preparing for this CMD, CNSC staff have reviewed and accepted Orano's End State Report [5] which reaffirms compliance with the decommissioning objects.

The Cluff Lake decommissioning objectives are summarized here and include:

- the accepted Decommissioning Surface Water Quality Objectives (DSWQO) and other accepted decommissioning objectives at surface water and flooded pit locations - verified in section 2.1.1 of the Cluff Lake End-State Report [5]
- levels of gamma radiation, radon, and long-lived radioactive dust which pose no unacceptable risk to traditional land use, and which are consistent with application of the As Low As Reasonably Achievable (ALARA) principle, social and economic factors considered - verified in section 2.1.2 of the Cluff Lake End-State Report [5]
- a stable, self-sustaining landscape -verified in section 2.1.3 of the Cluff Lake End-State Report [5]
- a 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 - verified in section 2.1.4 of the Cluff Lake End-State Report [5]

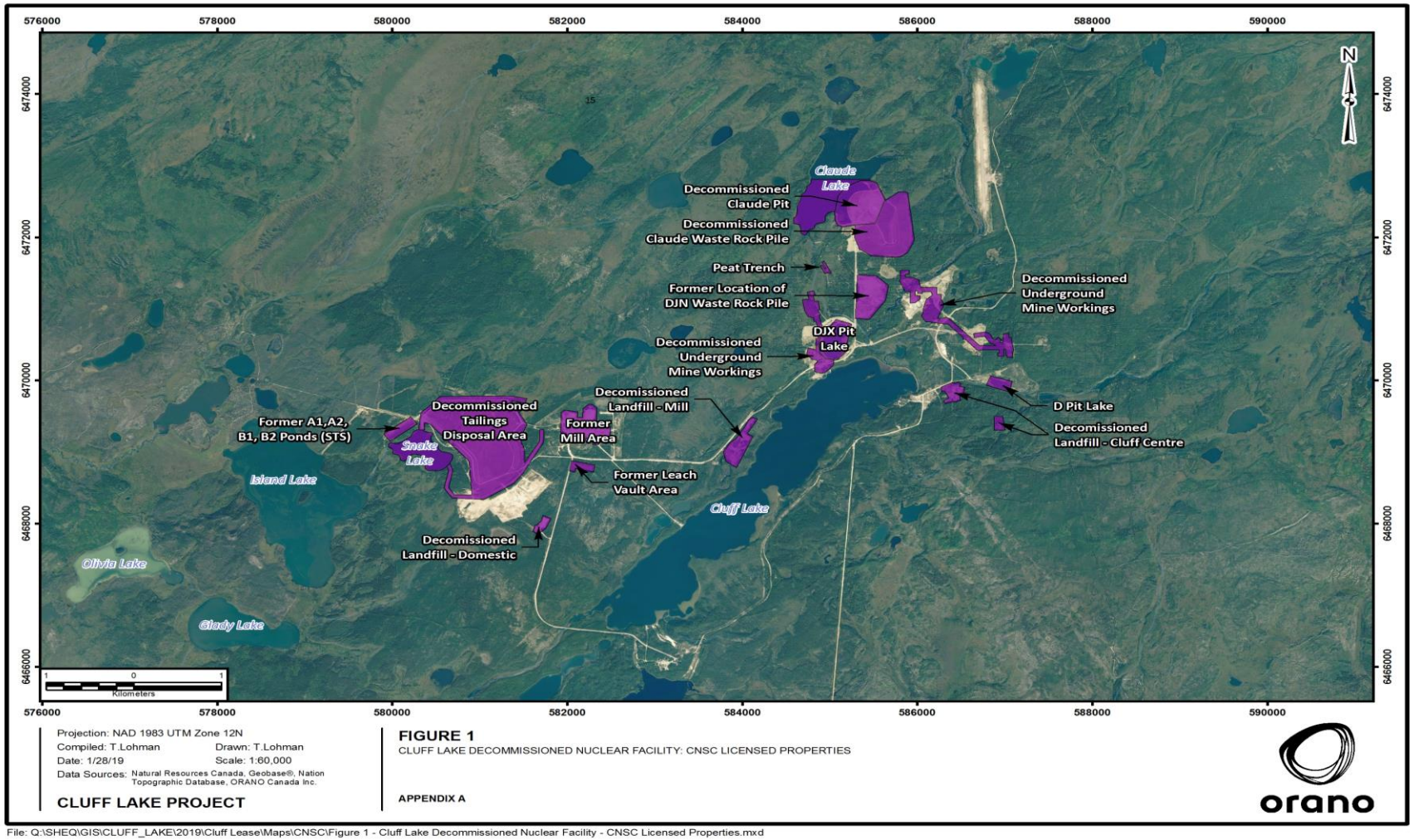
- a return of the site to an aesthetically acceptable state, similar in appearance and land capability as existed prior to mining activities, and that poses no unreasonable risk to persons or the environment -verified in section 2.1.5 of the Cluff Lake End-State Report [5]

The physical footprint of the CNSC licensed area, as depicted in appendix A of the licence (figure 3), is a reduction to those parcels of land which formed the core operations under the Cluff Lake Project lifecycle. These parcels, such as the TMA and the waste rock pile, either have licensable inventories of nuclear substances (primarily uranium and its daughter products) or will require future institutional controls (such as the backfilled underground mine workings or the decommissioned pits). The remainder of the parcels, which were not carried forward under the current licence, have been surveyed and verified by CNSC staff as below any regulatory limits with respect to CNSC licensable materials or activities. These parcels include roadways, service corridors, and the former residential camp site. The Government of Saskatchewan has no provisions or requirements to bring these parcels into its ICP and so they have been free released. For ease of administration some of these parcels may be included in the ICP polygon but no active monitoring and maintenance will be conducted as a result of the long term monitoring and maintenance plan. Figure 2 displays a sequence of aerial photographs of the TMA over time, while figure 3 shows the licensed areas under the current licence.

Figure 2: Cluff Lake Project – aerial photographs of the Cluff Lake tailings management area from 2001 to 2017

Source: Orano Canada Inc.

Figure 3: Cluff Lake Project – CNSC Licensed Properties (from appendix A of the current licence)



Source: Orano Canada Inc.

1.3 ICP Overview, Release and Transfer Process

An overview of the ICP and transfer process was presented on October 3, 2018, by CNSC staff at a Commission meeting (CMD 18-M38)[12]. Pertinent information from the ICP CMD has been included within this section along with a summary of the release and ICP transfer process in order to provide information relevant to Orano's current application.

1.3.1 ICP Overview

Established in 2007 by the Government of Saskatchewan, the ICP implements the process for the long-term monitoring and maintenance of former mine/mill sites located on provincial Crown land. This process occurs after mining/milling activities have ended, decommissioning has been completed, and post closure monitoring has demonstrated the site is protected and stable. Sufficient funds must also be provided by the property holder for long term monitoring and maintenance and for unforeseen events.

The Government of Saskatchewan states that the primary objectives of the ICP are to:

- protect human health and safety
- protect the environment
- ensure future generations are not burdened with the costs of long-term monitoring and maintenance for current mining development
- be sustainable
- recognize federal jurisdiction, regulatory roles and responsibilities for national and international obligations.

With respect to former uranium mine/mill properties, the Government of Saskatchewan has crafted the ICP with a view of Canada's obligations under the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* (Joint Convention). Under the Joint Convention, to which Canada is a signatory, institutional measures with respect to record-keeping, monitoring and access control may be required. The ICP satisfies this convention as well as other relevant international recommendations and guidance, as outlined in CMD 18-M38.

Administration of the ICP, including monitoring and maintenance, is by the Saskatchewan Ministry of Energy and Resources (SMER). According to provincial regulations, the licensee requesting the transfer of properties from their oversight to provincial oversight under the ICP must provide the Government of Saskatchewan with sufficient funds to conduct long term monitoring and maintenance and financial assurance to address unforeseen events. This requirement is separate from the financial guarantees for decommissioning required by the Commission. The requirement to have funds for monitoring, maintenance and unforeseen events as a condition of entry into the ICP ensures that sufficient funds are readily available to carry out any necessary future work on the properties.

When a decommissioned and reclaimed uranium mine/mill site enters the ICP Registry, the Government of Saskatchewan will be responsible for the long-term oversight and maintenance of the property. The CNSC would no longer exercise regulatory oversight by virtue of the exemption from the application of the NSCA, a prerequisite for entry into the ICP.

The primary components of the ICP are the Institutional Control Registry (Registry) and 2 Institutional Control funds: the Institutional Control Monitoring and Maintenance Fund (ICMMF) and the Institutional Control Unforeseen Events Fund (ICUEF).

The ICP Registry includes the maintenance of records, including:

- location of closed property/site
- description of former operator(s)
- site description
- historical records of activities
- description of the site monitoring and maintenance obligations
- description of surface land use and mineral disposition restrictions.

The ICMMF is for future monitoring and maintenance costs in perpetuity. The monies in this fund can only be used for monitoring and maintenance of the closed property to which that account is associated.

The ICUEF is for costs associated with future unforeseen events. This fund is for any maintenance obligation, including the determination of maintenance costs, that were not covered by the ICMMF.

These 2 institutional control funds, provided by Orano to the Government of Saskatchewan, will satisfy the intent of the financial guarantee required through CNSC licensing once the property holder/licensee is released from regulatory oversight by the Commission.

Through this approach, assurance is maintained that sufficient funds are available to carry out any necessary work as detailed in the post-decommissioning long-term monitoring and maintenance plan accepted. SMER has temporarily implemented a licensee-backed financial assurance requirement for the ICUEF. This financial assurance requirement will remain in place until the Government of Saskatchewan determines that there are sufficient funds available in the ICUEF to manage the total costs for unforeseen events. This measure is to minimize the ICP's financial risk. The assurance amount is based on the cost to remedy a maximum failure event at a site and can only be used for the site for which it was established. The maximum failure event will depend on the residual structures and risks at a site [13]. An example could be the failure of the TMA main dam or engineered cover due to an extreme rainfall event. For the Cluff Lake Project, this type of event has been assessed by Orano as being extremely unlikely.

Payment of both the ICMMF and ICUEF are made by the site holder who requested the transfer into the ICP. The 2 funds are separate from the financial guarantees/assurances that were in place during mine/mill operations to ensure proper decommissioning, reclamation and closure. The ICMMF and ICUEF amounts do not require approval by the Commission. Administration of the ICP, including monitoring and maintenance, is managed by the SMER.

A well-structured, informed, and sustainable program must be in place to ensure future safety and financial surety for a successful ICP. The Government of Saskatchewan has implemented such a program and manages the long-term monitoring and maintenance for uranium mine/mill sites within the ICP.

The ICP has been shown to be effective in ensuring that properties accepted into the program are protected, secure and stable, and will not in the future: pose an unreasonable risk to the environment or the health and safety of persons, pose an unreasonable risk to national security, or result in a failure to achieve conformity with measures of control and international obligations to which Canada has agreed.

The ICP ensures that properties in the program will continue to meet the above-noted requirements in the long term, through monitoring and maintenance of the properties as well as land use controls. The ICP provides assurance to the Commission, Indigenous persons and the public that the process for the release of properties from CNSC licensing and the granting of exemptions are conducted in accordance with the requirements specified in the NSCA and associated regulations.

1.3.2 Release and Transfer Process

A condition of acceptance by the Government of Saskatchewan to transfer properties/sites into the ICP is that closed uranium mine/mill properties receive a release from any and all of Government of Canada issued licences including those issued by the CNSC pursuant to the NSCA, thus reverting total custodial responsibility back to the Government of Saskatchewan. The Commission has the authority to grant an exemption from the application of the NSCA pursuant to section 7 of the NSCA

Section 11 of the *General Nuclear Safety and Control Regulations* provides that the Commission may grant an exemption from licensing if doing so will not

(a) pose an unreasonable risk to the environment or the health and safety of persons;

(b) pose an unreasonable risk to national security; or

(c) result in a failure to achieve conformity with measures of control and international obligations to which Canada has agreed.

There is a well-defined process to be followed when properties are to be released from licensing, and exemptions from future licensing granted, in order to transfer properties to the ICP. The process, as related to the current request from Orano, is summarized below.

Application and review of release request

In order to transfer a property into the ICP, Orano must first submit an application to the CNSC and provincial government. It is then required that this application is reviewed by staff from both the CNSC and the Government of Saskatchewan. The Saskatchewan Ministry of Environment (SMOE) and the SMER are the primary provincial agencies involved in any transfers of properties to the ICP.

Staff from both CNSC and the Government of Saskatchewan must agree that the application meets the established criteria. If these criteria are met, CNSC staff will recommend that the Commission release the properties from CNSC licensing and exempt the Government of Saskatchewan from licensing to possess, manage and store nuclear substances under the NSCA. This has been received by the CNSC [1].

Province signifies properties can be transferred to the ICP

If the application is acceptable to the Government of Saskatchewan, SMOE will issue a letter of intent to grant a *Release from Decommissioning and Reclamation Requirements* as per *The Mineral Industry Environmental Protection Regulations, 1996* section 22 to the licensee. SMER will also confirm that the properties proposed are all eligible for transfer to the ICP. This has been received by the CNSC [15].

Commission considers release from licensing, exemption from future licensing

Once the Government of Saskatchewan has confirmed that the properties are eligible for transfer to the ICP, a Commission decision is required. The properties must be released from the current CNSC-issued licence and the Government of Saskatchewan must be exempted from requirement to hold a licence to possess, manage or store nuclear substances under the NSCA in order for the properties to be transferred into the ICP. Such a request for release from licensing and exemption from future licensing is usually considered by the Commission during a public hearing.

Transfer of properties to the ICP

The licensee receives approval from the Government of Saskatchewan for the properties to be added to the ICP Registry. As part of the process, the properties are removed from the provincial surface lease and the licensee's mineral rights are surrendered. Also, the funding components must be satisfied which include: funds for the long-term monitoring and maintenance of the site; funds to address any unforeseen events; and, a financial assurance to address a maximum failure event.

Long term monitoring and management

The Government of Saskatchewan assumes sole regulatory authority and manages the administrative controls over the properties as well as the monitoring and maintenance requirements.

1.4 Current Request

Orano submitted an application to the Commission on February 28, 2020, requesting the revocation of the CNSC licence for the Cluff Lake Project which will facilitate the transfer of regulatory responsibility from the CNSC to the Government of Saskatchewan.

Orano has subsequently submitted the Cluff Lake End State Report [5] which contains all of the information necessary to reaffirm the achievement of the accepted decommissioning objectives assigned during the Comprehensive Study Report (2003) [2].

The Government of Saskatchewan has indicated that it will accept the Cluff Lake Project into the ICP [15].

1.5 Overall Conclusions

Orano has submitted an application to have the CNSC licence for the Cluff Lake Project revoked. Orano has stated that the performance objectives [2] for the decommissioned Cluff Lake Project have been met.

- the environment is protected for use by human and non-human biota
- the reclaimed landscape is chemically and physically stable
- the self-sustaining landscape allows utilization for traditional purposes
- the potential constraints on future land use are minimized

Performance indicators and regulatory acceptance criteria were defined to ensure these performance objectives were met. CNSC staff's assessment concluded that the applicable performance indicators and criteria have been achieved.

CNSC staff have evaluated Orano's documentation and inspected the Cluff Lake Project site, and on that basis support the request to revoke the CNSC licence for the Cluff Lake Project.

CNSC staff have confirmed that the site is protected and will remain so in perpetuity, as Orano's Cluff Lake Project will continue to be monitored and maintained under the ICP. The Government of Saskatchewan is an agent of the Crown and a competent authority with resources in place to monitor and manage these properties in perpetuity.

1.6 Overall Recommendations

CNSC staff recommend the Commission consider taking the following actions:

- Revoke the CNSC-issued licence UML-MINEMILL-CLUFF.00/2024.
- Exempt the Government of Saskatchewan from licensing under the *Nuclear Safety and Control Act* for the properties currently covered by CNSC-issued licence UML-MINEMILL-CLUFF.00/2024 that are proposed for transfer to Saskatchewan's Institutional Control Program.

2. ENVIRONMENTAL REVIEW

CNSC staff reviewed Orano's licence application to identify the type of environmental review required. As part of this process, CNSC staff must assess whether an impact assessment under the Impact Assessment Act (IAA) is required. For this licence application, an impact assessment is not required because the application does not include activities listed in the IAA's *Physical Activities Regulations* that require an impact assessment, or that meet the definition of a project on federal lands.

CNSC staff conduct environmental protection reviews (EPRs) for all licence applications with potential environmental interactions, in accordance with CNSC's mandate under the NSCA and associated regulations. The EPRs inform the Commission's conclusion on whether the proposal provides adequate protection of the environment and the health of people.

An EPR was conducted for the requested licence application. The report focuses on items that are of Indigenous, public, and regulatory interest, such as potential environmental interactions, as well as risk of radiological and hazardous substances to the receiving environment. CNSC staff's assessment included a review of the licence application, past environmental performance and supporting documents, such as the Environmental Risk Assessment (ERA). The EPR report, which contains the results of this assessment, including a summary of past environmental reviews for the Cluff Lake Project, can be found in Addendum D of this CMD.

CNSC staff's assessment found that the potential risks from radiological and hazardous sources are low to negligible and are similar to the natural background. Therefore, CNSC staff have found that Orano has implemented and maintained effective environmental protection measures to adequately protect the environment and the health of persons.

CNSC staff are confident that the site is protected and will remain so in perpetuity, as Orano's Cluff Lake Project will continue to be monitored and maintained under the ICP. The ICP, which was established in accordance with Canada's international obligations, will ensure that any risks to the environment and the health and safety of persons will be managed in the future.

3. GENERAL ASSESSMENT OF SCAS

3.1 Relevant Safety and Control Areas (SCAs)

The functional areas of any licensed facility or activity consist of a standard set of safety and control areas (SCAs). Each SCA is comprised of "specific areas" of regulatory interest; however, the specific areas associated with each SCA vary between facility types. See Addendum C, "Safety and Control Framework", for further information about SCAs.

In the following table:

1. The risk ranking column indicates the overall level of risk associated with each SCA at the Cluff Lake Project (refer to Addendum A , "Risk Ranking").
2. The relevance of each SCA to this CMD is indicated.
3. The rating level for each relevant SCA indicates Orano's overall compliance with regulatory requirements for implementation (refer to Addendum B, "Rating Levels").

When considering the current Cluff Lake Project it is evident that most SCAs are not relevant to this post-decommissioning site.

The Cluff Lake Project ceased mining and milling operations in 2002, with the majority of decommissioning activities completed by the end of 2006. Permanent site presence by the licensee was discontinued in 2013 and the site has been open to unrestricted access since. For the SCAs marked 'N/A' in the following table, there are no licence conditions in the current Cluff Lake Project licence, therefore they are not part of the licensing basis for the Cluff Lake Project.

Table 3.1 – Relevant Safety and Control Areas

Functional Area	Safety and Control Area	Risk Ranking	Relevant to this CMD?	Rating Level
Management	Management System	**L**	**Yes**	**SA**
	Human Performance Management	N/A	No	N/A
	Operating Performance	N/A	No	N/A
Facility and Equipment	Safety Analysis	N/A	No	N/A
	Physical Design	N/A	No	N/A
	Fitness for Service	N/A	No	N/A
Core Control Processes	Radiation Protection	**L**	**Yes**	**SA**
	Conventional Health and Safety	**L**	**Yes**	**SA**
	Environmental Protection	**L**	**Yes**	**SA**
	Emergency Management and Fire Protection	N/A	No	N/A
	Waste Management	N/A	No	N/A
	Security	N/A	No	N/A
	Safeguards and Non-Proliferation	N/A	No	N/A
	Packaging and Transport	N/A	No	N/A

L = Low; N/A = not applicable; SA = Satisfactory

3.2 Management System

The management system SCA covers the framework that establishes the processes and programs required to ensure an organization achieves its safety objectives, monitors its performance against these objectives and fosters a healthy safety culture. Orano has an acceptable quality management program to ensure an effective management system. Orano's Cluff Lake Project Integrated Management System (IMS) provides the safe operating practices and procedures for the management of the Cluff Lake Project. The IMS provides the main documentation of the management system. Orano has indicated that all licensed activities at the site will adhere to the IMS.

3.2.1 Trends

The following table indicates the overall rating trends for the IMS over the current licensing period of 2019 to 2022:

TRENDS FOR MANAGEMENT SYSTEM			
Overall Compliance Ratings			
2019	**2020**	**2021**	**2022**
SA	SA	SA	SA
Comments			
There have been no event reports for which this SCA was the main contributing factor during the current licence term. The licensee's program in respect of this SCA remains satisfactory.			

3.2.2 Discussion

The Cluff Lake IMS has not changed since the licence renewal in 2019. As the site has continued to be demonstrable of stable closure, fewer systems and procedures actively apply. Orano continues to implement their IMS as required.

Since 2019 CNSC staff have reviewed Orano's IMS and concluded that appropriate organization and management structures are in place, as well as well-defined corporate practices, programs and training requirements to manage the hazards and risks encountered at the Cluff Lake Project.

CNSC staff have interviewed Orano staff to confirm what procedures/work instructions have been used for campaign monitoring.

3.2.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

3.2.3.1 Past Performance

The licensee's program in respect of this SCA has remained satisfactory.

3.2.3.2 Regulatory Focus

Paragraph 3(1)(k) of the *General Nuclear Safety and Control Regulations* requires that a licence application contain information on the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the associated regulations, including the internal allocation of functions, responsibilities and authority.

Orano has continued to submit to CNSC staff annual compliance reports each year, covering the operation of the previous year, which are reviewed and assessed in detail by CNSC staff.

A CNSC type II inspection was conducted in September 2022 [15], which was scheduled at the same time as a site visit for Indigenous Nations and communities and SMER. CNSC staff observed that the site was reverting to a natural environment with encroachment of trees and grasses. Numerous signs of animals were present as were a number of indications that persons were using the site for hunting.

3.2.4 Conclusion

Orano continues to maintain a management system applicable to the decreasing risks associated with the site. Orano's corporate structure is being maintained, and as processes are no longer applicable, these are described in their annual reports. CNSC staff have reviewed the Cluff Lake management system and concluded that Orano is performing satisfactorily with respect to this SCA.

3.2.5 Recommendation

Orano continues to perform satisfactorily with respect to this SCA, therefore CNSC staff have no further recommendations.

3.3 Radiation Protection

The radiation protection SCA covers the implementation of a radiation protection program in accordance with the *Radiation Protection Regulations*. This program must ensure that contamination levels and radiation doses received are monitored, controlled, and kept ALARA with social and economic factors being taken into account. With the completion of decommissioning activities at the site (involving remediation of work areas and removal of radiological hazards) and cessation of site occupancy in 2014, Orano entered into a post-decommissioning state. Nevertheless, radiological monitoring of the remediated areas continued until 2019 throughout the site to demonstrate that post-decommissioning radiological conditions (i.e., gamma and radon) are stable and levels of airborne contaminants are at background levels. Given the stable annual results this activity ceased in 2019.

Due to the low risks posed by the site, including the low risks posed by radiation exposure, the Cluff Lake Project has been open to the public for casual use and traditional activities since 2013. The need for a radiation protection program applies only to periodic Orano staff and contractors on site. Since 2013 the activities of these contractors have not required them to be designated as Nuclear Energy Workers (NEWs).

From 2014 to present, Orano staff and contractor presence at the site has been for short periods of monitoring activity or for specific work campaigns. These work campaigns, related to non-radiological physical works such as removal of culverts from unused roads, have been assessed for potential radiological risk relative to their CNSC radiation protection requirements as part of Orano's work planning. Worker doses are monitored and measured if work plans predict workers coming in contact with contaminated materials. Considering the activities performed on site and submitted radiological monitoring documentation, CNSC staff concur with Orano's conclusions.

3.3.1 Trends

The following table indicates the overall rating trends for the radiation protection SCA over the current licensing period:

TRENDS FOR RADIATION PROTECTION			
OVERALL COMPLIANCE RATINGS			
2019	**2020**	**2021**	**2022**
SA	SA	SA	SA
COMMENTS			
There have been no event reports for which this SCA was the main contributing factor during the current licence term. The licensee's program in respect of this SCA remains satisfactory.			

3.3.2 Discussion

Historical monitoring of workers during late decommissioning phases (2009 to 2012) showed that workers received radiation doses well below the public dose limit. Since that time dosimetry has not been assigned as predicted radiation doses for workers involved in environmental monitoring were less than the 0.1 mSv criteria.

Radiological area monitoring was maintained by Orano until 2019 to provide assurance that the final decommissioning activities are behaving as predicted. This includes area monitoring for gamma and radon, which has consistently demonstrated that post-decommissioning radiological conditions are stable, and that ambient levels of airborne contaminants are at background levels. This monitoring has demonstrated that radiation doses to those on site are well below the annual public dose limit of 1 mSv.

As decommissioning proceeded at the Cluff Lake site, a series of gamma clearance surveys were conducted of various land parcels to measure the effectiveness of the remediation activities. These surveys took place between 2007 and 2018 and the results are summarized in Orano's End State Report, 2022 [5]. CNSC and Government of Saskatchewan staff believe that the site now meets release to ICP criteria.

3.3.3 Summary

During the current licence term, there were no event reports for which the radiation protection SCA was the main contributory factor.

The licensee's program in respect of this SCA remains satisfactory.

3.3.3.1 Past Performance

The licensee's program in respect of the radiation protection SCA has remained satisfactory.

3.3.3.2 Regulatory Focus

Worker exposure to radiation had been at background levels for several years before routine worker radiation protection monitoring ceased in 2013 with the transition to campaign monitoring. There are no full-time workers at the Cluff Lake site. Estimated radiation doses to workers are well below the regulatory public dose limit of 1 mSv/year; therefore, as per the *Radiation Protection Regulations*, Workers are not required to wear dosimetry unless they are working with radiologically contaminated materials.

3.3.4 Conclusion

Orano continues to maintain a radiation protection program applicable to the decreasing risks associated with the site. CNSC staff have reviewed the Cluff Lake radiation protection program and concluded that Orano is performing satisfactorily with respect to this SCA

3.3.5 Recommendation

Orano continues to perform satisfactorily with respect to the radiation protection SCA, therefore CNSC staff have no further recommendations.

3.4 Conventional Health and Safety

The conventional health and safety SCA covers the implementation of a program to manage workplace safety hazards and to protect personnel and equipment.

This SCA is included as an indicator of overall site safety. Although meant to assess worker safety, since 2013 the number of workers, and therefore the number of individuals exposed to potential workplace hazards, has been very low. Because the Cluff Lake Project is licensed as a uranium mine it has continued to be held to the relevant standards set out in various federal and provincial codes and regulations.

The regulation of non-radiological health and safety at uranium mines and mills is governed by the *Canada Labour Code Part II*, which is administered by Employment and Social Development Canada. However, the *Saskatchewan Uranium Mines and Mills Exclusion Regulations* (SOR/2001-115) defer the regulation of occupational health and safety in Saskatchewan uranium mines and mills to the Government of Saskatchewan in accordance with the requirements of *The Mines Regulations, 2018* Part II *Revised Regulations of Saskatchewan*.

The CNSC also has regulatory responsibilities for the oversight of the protection of the health and safety of workers. The CNSC harmonizes the oversight of conventional health and safety with the Saskatchewan Ministry of Labour Relations and Workplace Safety.

3.4.1 Trends

The following table indicates the overall rating trends for the conventional health and safety SCA over the current licensing period:

TRENDS FOR CONVENTIONAL HEALTH AND SAFETY			
Overall Compliance Ratings			
2019	**2020**	**2021**	**2022**
SA	SA	SA	SA
Comments			
The licensee's program in respect of this SCA remains satisfactory.			

3.4.2 Discussion

Orano's health and safety activities for the Cluff Lake Project were conducted in accordance with programs defined within the Cluff Lake IMS. Since 2017, the Health and Safety Program has been overseen by the Orano Campaign Coordinator for campaign monitoring and by the Cluff Lake Advisor for the earthworks program.

The primary health and safety program activities at the Cluff Lake Project included:

- workers received a health and safety orientation at the start of the work
- pre-project drug and alcohol testing
- risk management through creation of safe work plans and job hazard analysis
- communication through daily tool-box meetings
- trained first aid workers on site during campaigns
- an Emergency Response Plan
- record keeping and reporting.

3.4.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

3.4.3.1 Past Performance

From 2018 to 2022 there were 0 lost-time injuries (LTIs), 1 injury, 0 medical incidents, 1 first aid incident, and no dangerous occurrences reported.

The 1 injury took place in 2020. A member of the vegetation recovery survey crew (contractor) sustained an injury which resulted in a broken right foot. The injury occurred at the external camp used for over-night accommodations when the contractor slipped while using the steps. Because this injury occurred at the camp, CNSC staff assessed that it was not related to the licensed onsite activity and therefore did not capture it as an LTI under the licence.

The single first aid treatment occurred in 2019. During the June 2019 campaign monitoring field work, a consultant field crew member injured their ankle while trying to free a quad vehicle which became stuck in the mud. No time was lost as a result of this injury.

The following table provides historical incident data from 2019 to 2022 for the Cluff Lake Project. While injuries to Orano staff and to contractors are shown separately, they are both considered to be 'workers' under the NSCA and so CNSC staff do not distinguish between these 2 categories when performing licensing and compliance activities.

Table 3.2 -Historical incident data, 2019-2022

Year	2019	2020	2021	2022
Orano	0	0	0	0
Contractor	1	1	0	0
Total	1	1	0	0
Days Lost	0	0	0	0

3.4.3.2 Regulatory Focus

Conventional health and safety is observed by CNSC staff during all onsite visits and inspections. The last CNSC inspection of the Cluff Lake site was in September 2022. Orano was observed demonstrating a very mature safety culture. All persons attending the inspection were informed of potential site hazards before boarding the plane (weather, ground conditions, potential wildlife, and moving vehicles). All persons attending the inspection were issued with hi-visibility vests to be worn at all times on site. All attendees were issued with a small pack with food, water, maps, sun block, insect repellant, toilet paper, sanitary wipes, N95 masks and disinfectant. During the moving of attendees around the site any potential hazard (uneven ground, steep slopes, wet areas) was verbally communicated. The group was kept together and head counts were performed frequently.

3.4.4 Conclusion

Since the last update to the Commission, when the Commission renewed the Cluff Lake licence, Orano has continued to meet relevant requirements and CNSC staff's expectations with respect to the conventional health and safety SCA. CNSC staff concluded that Orano is performing satisfactorily with respect to this SCA.

3.4.5 Recommendation

Orano continues to perform satisfactorily with respect to the conventional health and safety SCA. Therefore, CNSC staff have no further recommendations.

3.5 Environmental Protection

The environmental protection SCA covers programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities. Orano maintains an environmental protection program.

CNSC staff have reviewed Orano's ongoing monitoring results as part of their review of annual compliance reports and have concluded that Orano continues to meet relevant requirements.

CNSC staff have reviewed the Detailed Post-Decommissioning Plan [4] and found that Orano's Cluff Lake Project is achieving the DSWQO and is predicted to continue to achieve the DSWQOs in the long-term.

3.5.1 Trends

The following table indicates the overall rating trends for the environmental protection SCA over the current licensing period:

TRENDS FOR ENVIRONMENTAL PROTECTION			
Overall Compliance Ratings			
2019	**2020**	**2021**	**2022**
SA	SA	SA	SA
Comments			
The Licensee's program in respect of this SCA remains satisfactory.			

3.5.2 Environmental Risk Assessment

As part of Orano's Environmental Performance Technical Information Document, they submitted an ERA [10, 11] which evaluated current and future risk from the site. The ERA indicated that there are still elevated contaminants of potential concern concentrations in water and sediments in the Island Creek and Cluff Creek watersheds, but the system is recovering and will continue to do so into the future. Any remnant potential effects in both watersheds are limited spatially and the area will remain protected for continued traditional land use. CNSC staff reviewed the Environmental Protection Technical Information Document and accepted the conclusions that environmental impacts were limited and that the environment and human health would be protected into the future. In addition to the Environmental Performance Technical Information Document, vegetation modeling to predict contaminant movement under varying vegetation regrowth scenarios on the waste rock concluded that maximum likely impacts could be considered very low and localized.

CNSC staff also reviewed the Long-term Monitoring and Maintenance Plan which will form the basis of monitoring under the ICP. Following CNSC review and comments, the Long-term Monitoring and Maintenance Plan was modified to include additional sampling locations and an increase in the financial instruments to ensure the environment and human health remain protected throughout the ICP period.

3.5.3 Long term stability of waste management features

The main dam and its extension at the Cluff Lake TMA were designed and rehabilitated to meet the requirements of the Canadian Dam Safety Guidelines, and all are stable and safe. The main dam and its extension structures were constructed with compacted sandy gravelly till and a soil bentonite core and cut-off that extended to bedrock. The main dam was buttressed in 2006 and the exterior slope gradient was reduced to improve its stability and reduce potential for slope erosion. The factors of safety of the dam were calculated to be 2.22 for a toe failure and 2.60 for an overall dam failure, which exceeded the minimum factor of safety of 1.5 recommended by the Canadian Dam Association Guidelines (2007, revised 2013). A spillway that can route a derived probable maximum flood event was established to passively release surface water from the TMA to the environment before it comes in contact with the contaminated tailings. Therefore, the main dam and its extension will be geotechnically stable in the long term. The exterior slope of the dam was hydro-seeded in 2006 and vegetation of grasses and lichens have been gradually established on the dam's downstream slope, which reduce the erosion potential on the dam. Inspections conducted by the licensee and CNSC staff since 2016 have identified no erosion on the dam slopes.

Low areas in the tailings cover, were backfilled to eliminate areas where water might pool within the TMA. The area was covered with a minimum 1 meter thick glacial till cover and graded to direct excess water runoff away from the TMA to ensure unsaturated tailings conditions. The drainage provisions were designed to prevent erosion and the till cover was seeded to quickly establish vegetation to limit erosion. The glacial till cover also provides a surcharge load to help consolidate the tailings and ensure the long-term stability of the TMA cover. The 1-meter TMA cover provided a media for vegetation growth and also prevented extensive roots from extending beyond the base of the TMA cover. In addition, the North and South freshwater drainage ditches intercept and direct upland water runoff around the TMA.

The Claude waste rock pile (CWRP) was designed for stability under passive care. A 1-meter till cover was installed on the compacted waste rock surface of the CWRP in 2006. The slope of the waste rock pile was flattened which would provide a factor of safety against a major slope failure within the waste rock. The till cover was seeded, and vegetation was gradually established, which provided erosion protection of the cover. Inspections conducted since 2016 by the licensee and CNSC staff have confirmed vegetation such as grasses, lichens and mosses were growing on the slope and some trees and shrubs were naturally invading. No slumping and erosion features were observed during the inspections. The cover performance data collected since 2006 was used to update the groundwater flow and contaminant transport models. All data and observations indicated that the CWRP cover appears to be performing as designed and has a low probability of failure.

3.5.4 Summary

3.5.4.1 Past Performance

During the current licence term, the site has remained passive and stable. Desktop reviews by CNSC staff of annual reports and periodic submissions in support of a licence renewal, have identified no areas of interest. CNSC staff concluded that since the last licence renewal Orano has continued to demonstrate that the Cluff Lake Project is protective of the environment.

3.5.4.2 Regulatory Focus

CNSC staff last verified compliance of Orano's Cluff Lake Project environmental protection program during their 2021 review of the Cluff Lake Annual Report and during a 2022 onsite inspection. Orano continues to demonstrate compliance with the NSCA and their licence.

3.5.5 CNSC's Independent Environmental Monitoring Program (IEMP)

To complement ongoing compliance activities, the CNSC implements an Independent Environmental Monitoring Program (IEMP) to independently verify that the public and the environment around licensed nuclear facilities are protected. The IEMP involves taking samples from public areas around the facilities and measuring and analyzing the amount of nuclear and hazardous substances in those samples.

In 2017, CNSC staff carried out the IEMP in publicly accessible areas in the vicinity of the Cluff Lake Project. CNSC staff took samples of fish, surface water, blueberries, Labrador tea, and radon in ambient air. The IEMP results indicate that the public and the environment in the vicinity of the Cluff Lake site are protected, and there are no expected health impacts as a result of past or present operations at the site. The results were reported to the Commission during the 2019 licence renewal hearing (CMD-19-H02), and are publicly available on the CNSC web site

3.5.6 Conclusion

Since the last update to the Commission, Orano continued to meet relevant requirements and CNSC staff's expectations with respect to the environmental protection SCA. CNSC staff concluded that Orano is performing satisfactorily with respect to this SCA.

3.5.7 Recommendation

Orano continues to perform satisfactorily with respect to the environmental protection SCA, therefore CNSC staff have no further recommendations.

4. INDIGENOUS AND PUBLIC CONSULTATION AND ENGAGEMENT

4.1 Indigenous Consultation and Engagement

The common-law duty to consult with Indigenous Nations and communities applies when the Crown contemplates actions that may adversely affect potential or established Indigenous and/or treaty rights. The CNSC ensures that all of its licence decisions under the NSCA uphold the honour of the Crown and consider Indigenous peoples' potential or established Indigenous and/or treaty rights pursuant to section 35 of the Constitution Act, 1982.

4.1.1 Discussion

CNSC staff have identified the Indigenous Nations and communities who may have an interest in the Cluff Lake Property application. These Indigenous Nations and communities include:

- Athabasca Chipewyan First Nation (ACFN)
- Birch Narrows Dene Nation (BNDN)
- Black Lake Denesuline First Nation (BLFN)
- Buffalo River Dene Nation (BRDN)
- Clearwater River Dene Nation (CRDN)
- Fond du Lac Denesuline First Nation (FDLFN)
- Meadow Lake Tribal Council (MLTC)
- Métis Nation – Saskatchewan (MN-S/Northern Region II)
- Ya'thi Néné Lands and Resource Office (YNLR)

These Indigenous Nations and communities were identified due to the proximity of their communities, treaty areas and/or traditional territories to the Cluff Lake Property, or due to previously expressed interest in being kept informed of CNSC licensed activities occurring in or proximal to their territories.

CNSC Staff Consultation and Engagement Activities

CNSC staff have been engaging with a number of the identified Indigenous Nations and communities regarding the Cluff Lake Property since its decommissioning in 2005. Following the 2019 licence renewal of the Cluff Lake Property, CNSC staff have continued to provide opportunities for interested Indigenous Nations and communities to meet and discuss their concerns regarding the Cluff Lake Property including the 2020 uranium mines and mills regulatory oversight report that discussed all historic and decommissioned uranium mills across Canada and included the Cluff Lake Project.

In 2021, CNSC staff coordinated a multiparty meeting with CRDN, Orano, and the Government of Saskatchewan to discuss the Cluff Lake Property ICP application. CNSC staff also held follow-up meetings with CRDN in the spring and summer of 2022. During these engagement meetings, and the Cluff Lake 2019 licence renewal CRDN outlined their key interests and concerns with regards to the Cluff Lake Project decommissioning. CRDN outlined a number of concerns regarding existing fear and avoidance around the Cluff Lake Property impacting the ability to practice traditional activities and the perceived effectiveness of the decommissioning efforts over the long term. Additionally, concerns were raised on the levels of engagement and transparency for sites in ICP and CRDN's inclusion in long-term monitoring of the site, including Indigenous knowledge and local land use practices. As part of these meetings CNSC staff provided CRDN with several options to help address the concerns raised. These included collaboration on future monitoring activities in the region with CNSC staff, education, and engagement activities to help address fears regarding uranium activities and the impacts of radiation and building and formalizing a long-term relationship between the CNSC and CRDN. CNSC staff also encouraged the Government of Saskatchewan and Orano to work with CRDN, and other Indigenous Nations and communities to identify ways that they could help address the concerns raised to date and over the long-term.

CNSC staff have also worked to include community representatives on site tours, respond to questions and concerns, provide information on monitoring and inspections and discuss CNSC's review of Orano's decommissioning work and ICP application. During the week of June 20, 2022, CNSC staff undertook a tour of Indigenous Nations and communities in the western Athabasca basin of Saskatchewan including CRDN, BNDN, BRDN and MN-S communities to discuss the NexGen Environmental Assessment, as well as other CNSC projects and activities in the region, including Cluff Lake. CNSC staff heard from some community members including those from Métis Local #39 that there remain concerns regarding the safety of the environment at the Cluff Lake Project. CNSC staff indicated that both Orano's and the CNSC's sampling shows that people and the environment remain protected, and that carrying out traditional activities such as hunting and fishing can be carried out at the site.

CNSC staff sent notification letters on July 14, 2022, to the list of Indigenous Nations and communities. The letters provided information regarding the proposed release of the licensed property to the provincial ICP, advanced notice of participant funding to facilitate participation in the regulatory review process, and how to participate in the Commission's public hearing process. On August 9, 2022, CNSC staff sent emails to the identified Indigenous Nations and communities to inform them that the participant funding opportunity was available, provided details regarding the dates and location of the Commission hearing and offered to organize a meeting to discuss Orano's application. CNSC staff conducted follow-up phone calls and emails with the identified Indigenous Nations and communities in August and September of 2022 to ensure they had received the letters of notification and to answer any questions about the regulatory process, including how to get involved in the Commission proceeding, and the availability of participant funding through the CNSC's Participant Funding Program (PFP).

CNSC staff worked with Orano to invite interested Indigenous Nations and communities to participate in a site visit and observe a CNSC staff inspection of the Cluff Lake site on September 9, 2022. CRDN participated in the site visit. CNSC staff and Orano staff were able to answer all questions raised by the CRDN participant and demonstrate how the CNSC confirms that the Cluff Lake Project continues to be appropriately remediated and that poses no unreasonable risk to persons or the environment.

On September 6 and 7, 2022, CNSC staff participated in multiple meetings with Elders, leadership and members of the Athabasca Chipewyan First Nation (ACFN) in the community of Fort Chipewyan. As part of these meetings CNSC staff provided a presentation that included an update on the Cluff Lake Project and Orano's ICP application. CNSC staff heard a number of concerns with regards to the current and long-term safety of the Cluff Lake Project and how it may impact traditional activities conducted by ACFN members on and around the Cluff Lake Project. CNSC staff were able to respond to all questions and concerns raised with regards to the Cluff Lake Project and analysis with regards to the long-term safety of the site. CNSC staff committed to continuing to engage with ACFN with regards to the Cluff Lake Project and encouraged ACFN to continue to be engaged in the regulatory review process for Orano's ICP application.

On September 15, 2022, CNSC staff hosted Indigenous Nations and communities at an engagement session in Saskatoon to summarize the 2021 Regulatory Oversight Report on uranium mines and mills, and to discuss topics that Indigenous Nations and communities may have about the Regulatory Oversight Report or any other issue related to the CNSC's mandate. One topic that was discussed was related to the long-term management and oversight of the Cluff Lake Project. The Government of Saskatchewan staff responsible for the ICP program and CNSC staff were on hand and answered questions regarding Orano's ICP application for the Cluff Lake Property.

In October 2022, CNSC staff conducted additional follow-up outreach to confirm if interested Indigenous Nations and communities would like to meet with CNSC staff to further discuss the Cluff Lake ICP application and any concerns they have and identify any solutions to help address them in advance of the Commission hearing in March 2023.

Issues and Concerns Raised by Indigenous Nations and Communities

Throughout these consultation and engagement activities CNSC staff heard that Indigenous Nations and communities feel that the Cluff Lake Property is not currently safe and will not remain safe for traditional practices over the long-term and that they do not feel that the ICP process will be adequate in terms of sufficient regulatory oversight, engagement, or transparency to address their remaining concerns with the Cluff Lake Property. A number of Indigenous Nations and communities expressed that they would like to participate in the design and operation of the long-term monitoring of the site and that the monitoring should include and be reflective of local Indigenous knowledge and traditional land use activities. CNSC staff indicated that from CNSC staff's analysis and perspective that the Cluff Lake Property was appropriately remediated and poses no unreasonable risk to persons or the environment and will continue to be monitored over the long-term under the Government of Saskatchewan's ICP.

CNSC staff encourage the Government of Saskatchewan to continue to work with the identified Indigenous Nations and communities to include them in long-term monitoring activities as part of the ICP and continue with engagement activities to ensure that communities can build trust in the safety of the site for traditional activities and practices over the long-term.

In addition, all of the identified Indigenous Nations and communities have been encouraged to participate in the regulatory review process and in the public hearing to advise the Commission directly of any concerns they may have in relation to this application. CNSC staff have remained committed to meeting and working with Indigenous Nations and communities to discuss the Cluff Lake Project with the aim of addressing outstanding concerns to the greatest extent possible prior to any transfer to the ICP.

CNSC staff are committed to collaborating with Indigenous Nations and communities to gather information about land use activities, Indigenous knowledge and perspectives and address the concerns raised. CNSC staff have and will continue to provide opportunities for meaningful long-term relationships with an aim of building trust with interested Indigenous Nations and communities to address existing fears with regards to any CNSC regulated sites and activities within their territories.

Licensee Engagement Activities

CNSC REGDOC-3.2.2, *Indigenous Engagement*, sets out requirements and guidance for licensees whose proposed projects may raise the Crown's duty to consult. While the CNSC cannot delegate its obligation, it can delegate procedural aspects of the consultation process to licensees, where appropriate. The information collected, and measures proposed by licensees to avoid, mitigate, or offset adverse impacts from the proposed licence renewal, may be used by CNSC staff in helping to meet its consultation obligations.

Orano prepared an Indigenous Engagement Report [6] as per REGDOC-3.2.2, which includes a list of Indigenous Nations and communities identified for engagement, a summary of any Indigenous engagement activities conducted to date, and a description of planned Indigenous engagement activities. Progress against this plan was and continues to be monitored by CNSC staff through scheduled meetings and information updates from Orano.

Orano has indicated that the primary concerns brought up to date by Indigenous Nations and communities they have engaged with include the perception of risk related to conducting traditional activities due to contamination, uranium core storage boxes and radioactive signs located at the site, and involvement in the long-term monitoring of the Cluff Lake site and surrounding area.

The Indigenous Nations and communities near the Cluff Lake Project are also target audiences in Orano's Public Information Program, which commits to keeping the Nations and communities informed, offering further engagement, and responding to requests.

CNSC staff acknowledges that Orano demonstrates and prioritizes their commitment to maintain their established relationships with Indigenous Nations and communities in relation to their ICP application. CNSC encourages Orano to continue to engage and work with identified Nations and communities to address their concerns including involving the Province in related discussions as appropriate.

4.1.2 Conclusion

Based on the information received and reviewed, when taking into consideration that from CNSC staff's perspective that the Cluff Lake Property has been adequately remediated and poses no unreasonable risk to persons or the environment, that the Government of Saskatchewan will continue monitoring and maintaining the site through the ICP, and that the CNSC is committed to meaningful, ongoing engagement with Indigenous Nations and communities to address ongoing concerns with regards to CNSC licensed uranium activities in their territory. CNSC staff do not expect this application to cause any new adverse impacts to potential or established Indigenous and/or Treaty rights.

Since the 2019 licence renewal, CNSC staff have conducted ongoing consultation and engagement activities with regards to the Cluff Lake Property and Orano's ICP application with all identified Indigenous Nations and communities in order to hear their concerns, provide responses to the concerns raised and work collaboratively to find solutions to address the concerns raised. In addition, the identified Indigenous Nations and communities have been notified and encouraged to participate in the process and in the Commission's public hearing, thus providing them the opportunity to advise the Commission directly of any concerns they may have in relation to this request.

Additionally, Orano has informed and engaged with several of the Indigenous Nations and communities of their application to release the Cluff Lake Property to Saskatchewan's ICP.

CNSC staff encourage the Government of Saskatchewan to continue to engage with Indigenous Nations and communities with regards to their ICP program. Specifically with regards to the Cluff Lake Project, this could include collaborating on future monitoring activities and incorporating Indigenous knowledge and local land use considerations where possible, as part of its ICP oversight of the site.

4.2 Public Consultation and Engagement

The area of public engagement has 2 aspects, activities carried out directly by CNSC staff, and activities carried out by Orano for its Cluff Lake site.

All uranium mines and mills are required to maintain and implement public information and disclosure programs, in accordance with regulatory document REGDOC-3.2.1, *Public Information and Disclosure* (PIDP). These programs are supported by disclosure protocols that outline the type of facility information to be shared with the public as well as details on how that information is to be shared. This ensures that timely information about the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities, is effectively communicated to the public.

CNSC staff monitor Orano's implementation of its PIDP for the Cluff Lake site to verify that it communicates regularly with its audiences in a way that is meaningful to them. CNSC staff also review yearly program updates to verify Orano is taking audience feedback into consideration and taking steps to implement program adjustments to meet the evolving needs of its audiences.

CNSC staff reviewed PIDP and deemed it in compliance, meeting requirements under REGDOC 3.2.1. In its review, CNSC staff took into account the unique audience challenges Orano faces with the remote community surrounding its Cluff Lake site and the application submitted to transition to institutional control.

4.2.1 Discussion

CNSC staff have reviewed Orano's PIDP and deemed it in compliance, meeting requirements under REGDOC 3.2.1. In its review, CNSC staff took into account the remote community surrounding Orano's Cluff Lake site and their application submitted to transition to institutional control.

As described in Orano's PIDP and annual report for its Cluff Lake site, Orano's communication activities included:

- posting its public disclosure protocol on its website
- regular updates to Orano's website and social media with the latest information on its Cluff Lake site
- tracking public inquiries through a dedicated database
- conducting annual surveys of surrounding communities and Saskatchewan residents on uranium mining and milling to gain better understanding of the local community and providing results on its website
- hosting ongoing engagement activities, including community meetings, presentations and site tours for the local community
- providing various feedback mechanisms for the local community to comment or ask questions, as well as for Orano to respond to issues raised
- engagement with local and national media, as requested.

4.2.2 Conclusion

After reviewing Orano's PIDP for its Cluff Lake Project CNSC staff concluded Orano meets CNSC requirements. CSNC staff found that in Orano's PIDP, Orano demonstrated communications activities of appropriate and timely health and safety information to the public and community members.

4.3 Participant Funding Program

The CNSC made funding available through its Participant Funding Program (PFP) to assist Indigenous Nations and communities, members of the public, and stakeholders in participating in the regulatory process for the application to release the Cluff Lake Property to the ICP and to provide value-added information to the Commission through informed and topic-specific interventions. This funding was offered to review Orano's application and associated documents and to prepare for, and participate in, the Commission's public hearing.

4.3.1 Discussion

The Notice of Public Hearing, posted on August 9, 2022, included notification of the PFP opportunity. The participant funding opportunity was also advertised on the CNSC website and was included in notification emails sent to Indigenous Nations and communities. Those interested in obtaining participant funding were able to submit a completed participant funding application from that date until September 30, 2022. A Funding Review Committee (FRC), independent from the CNSC staff, reviewed the applications received, and made recommendations on the allocation of funding to eligible applicants. Based on recommendations from the FRC, the CNSC awarded participant funding to the following recipients, as shown on table 4.1.

Table 4.1: Cluff Lake Project – PFP funding awarded

Applicant	Maximum Amount of Available Funding
Saskatchewan Environmental Society	$6,435.00
Birch Narrows Dene Nation	$32,466.50
Clearwater River Dene Nation	$47,200.00
Athabasca Chipewyan First Nation	$54,500.00
Métis Nation - Saskatchewan	$33,350.00
Ya'thi Nene Land and Resource Office	$27,747.50
TOTAL	**$201,699.00**

4.3.2 Conclusion

CNSC staff encourage the public and Indigenous Nations and communities to participate in the Commission's public hearing. The PFP was offered to assist interested members of the public, Indigenous Nations and communities, and other stakeholders to prepare for, and participate in, the Commission's public hearing.

5. OTHER MATTERS OF REGULATORY INTEREST

The following table identifies other matters that are relevant to this CMD.

OTHER MATTERS OF REGULATORY INTEREST	
Area	**Relevant to this CMD?**
Cost Recovery	Yes
Financial Guarantees	Yes
Improvement Plans and Significant Future Activities	No
Nuclear Liability Insurance	No

5.1 Regulatory and Technical Basis

The regulatory and technical basis for the matters discussed in this CMD are provided in Addendum B to this document.

5.2 Cost Recovery

Orano Canada Inc. is in good standing with the CNSC with respect to the payment of licensing fees for the Cluff Lake Project.

5.3 Financial Guarantees

Based on the information provided in section 7 and appendix A of the Detailed Post Decommissioning Plan [4], the proposed financial guarantee for the Post-Closure Monitoring and Maintenance is adequate until the end of the licence term, that is, until 2024. Orano currently provides a surety bond in the amount of C$3.5 million for its financial guarantee [8], as approved by the Commission at the time of the 2019 licence renewal.

6. OVERALL CONCLUSIONS AND RECOMMENDATIONS

6.1 Overall Conclusions

Orano submitted an application to revoke the CNSC-issued licence UML-MINEMILL-CLUFF.00/2024, and to exempt the Government of Saskatchewan from the requirement to hold a CNSC licence to possess, manage or store nuclear substances for the properties currently covered by CNSC -issued licence UML-MINEMILL-CLUFF.00/2024 that are accepted for transfer into Saskatchewan's ICP.

During the 2019 licence renewal process, Orano demonstrated that the Cluff Lake Project meets the performance objectives for the decommission site [3]. This was reaffirmed through Orano's End State Report [5] submitted in 2022.

CNSC staff have completed their technical review and concur with the request to revoke the CNSC licence for Orano's Cluff Lake Project and exempt the Government of Saskatchewan from CNSC licensing for that site. According to section 3(f) of *The Reclaimed Industrial Sites Regulations* an exemption is required for the Provincial Government before properties can be transferred into the ICP.

CNSC staff concluded that there has been, and will continue to be, adequate provision for the protection of persons and the environment as a result of the release of these properties from licensing under the NSCA.

6.2 Overall Recommendations

CNSC staff recommend the Commission consider taking the following actions, in order to facilitate the transfer of the decommissioned Cluff Lake Project site to Saskatchewan's ICP:

- Revoke the CNSC-issued licence UML-MINEMILL-CLUFF.00/2024.
- Exempt the Government of Saskatchewan from licensing under the *Nuclear Safety and Control Act* for the properties currently covered by CNSC-issued licence UML-MINEMILL-CLUFF.00/2024 that are proposed for transfer to Saskatchewan's Institutional Control Program.

REFERENCES

1. Correspondence to Mr. M. Leblanc (CNSC) from Mr. V. Laniece (Orano), "Application to Enable Transfer of Responsibility for the Cluff Lake Property to the Province of Saskatchewan Institutional Control Program" dated February 28, 2020 (e-Doc 6249654)
2. Comprehensive Study Report, Cluff Lake Decommissioning Project, CNSC 2003 (e-Doc 4858588)
3. Record of Decision, Licence Renewal for Cluff Lake Project, CNSC 2019 (e-Doc 5941005)
4. Detailed Post-Decommissioning Plan, part of the licence renewal in 2019
5. End State Report, Orano 2022 (e-Doc 6879291)
6. Indigenous Engagement Report, Orano 2022 (e-Doc 6879295)
7. Follow-up Program, part of the licence renewal in 2019
8. Financial Guarantee, part of the licence renewal in 2019
9. Orano Canada Inc., (Orano). Hydrogeology and Groundwater Modelling Technical Information Document, Version 02. October 2019.
10. AREVA Resources Canada Inc. (AREVA). Environmental Performance Technical Information Document. Volume 1. August 2015
11. Orano Canada Inc., (Orano). Environmental Performance Technical Information Document, Volume 1, Version 02. March 2022.
12. AREVA Resources Canada Inc. (AREVA). 2007a. Submission for Gamma Radiation Clearance – Cluff Lake Project. November 2007. CMD 18-M38
13. Canadian Standards Association Guideline CAN/CSA-Q850, Risk Management: Guideline for Decision Makers
14. CNSC Compliance Inspection Report AREVA-CL-2017-01 (e-Doc 5337484)
15. CNSC Compliance Inspection Report ORANO-CL-2022-01 (e-Doc 6879834)
16. Letter of Intent to Accept Cluff Lake Closed Site into Saskatchewan's Institutional Control Program. Correspondence to R. Stenson (CNSC) from D. Zmetana (Government of Saskatchewan), dated October 11, 2022.

GLOSSARY

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the Regulations made under it, and in CNSC regulatory documents and other publications.

Additional terms and acronyms used in this CMD are listed below.

ALARA	As Low As Reasonably Achievable
ACFN	Athabasca Chipewyan First Nation
BNDN	Birch Narrows Dene Nation
BLFN	Black Lake Denesuline First Nation
BRDN	Buffalo River Dene Nation
CRDN	Clearwater River Dene Nation
CMD	Commission Member Document
CNSC	Canadian Nuclear Safety Commission
CSR	Comprehensive Study Report
CWRP	Claude Waste Rock Pile
DSWQO	Decommissioning Surface Water Quality Objectives
EPR	Environmental Protection Review
ERA	Environmental Risk Assessment
FDLFN	Fond du Lac Denesuline First Nation
FRC	Funding Review Committee
ICMMF	Institutional Control Monitoring and Maintenance Fund
ICP	Institutional Control Program
ICUEF	Institutional Control Unforeseen Events Fund
IMS	Integrated Management System
Licensee	Orano Canada Inc.
LTI	Lost-Time Injury
MLTC	Meadow Lake Tribal Council
MN-S	Metis Nation Saskatchewan
NSCA	*Nuclear Safety and Control Act*
Orano	Orano Canada Inc.
PFP	Participant Funding Program
PIDP	Public Information and Disclosure Program
SA	Satisfactory
SCA	Safety and Control Area
SMER	Saskatchewan Ministry of Energy and Resources
SMOE	Saskatchewan Ministry of Environment
YNRL	Ya'thi Néné Lands and Resource Office

A. SAFETY PERFORMANCE RATING LEVELS

Satisfactory (SA)

Licensee meets all of the following criteria:

- Performance meets CNSC staff expectations
- Licensee non-compliances or performance issues, if any, are not risk-significant
- Any non-compliances or performance issues have been, or are being, adequately corrected

Below Expectations (BE)

One or more of the following criteria apply:

- Performance does not meet CNSC staff expectations
- Licensee has risk-significant non-compliance(s) or performance issue(s)
- Non-compliances or performance issues are not being adequately corrected

Unacceptable (UA)

One or both of the following criteria apply:

- Risk associated with a non-compliance or performance issue is unreasonable
- At least one significant non-compliance or performance issue exists with no associated corrective action

B. BASIS FOR THE RECOMMENDATION(S)

B.1 Regulatory Basis

The regulatory basis for the matters that are relevant to this CMD are as follows.

Nuclear Safety and Control Act

Section 7 of the *Nuclear Safety and Control Act* states that the Commission may, in accordance with the regulations, exempt any activity, person, class of person or quantity of a nuclear substance, temporarily or permanently, from the application of this Act or the regulations or any provision thereof.

Paragraph 24(2)(a)(b) of the *Nuclear Safety Control Act* provides that the Commission may issue, renew, suspend in whole or in part, amend, revoke or replace a licence, or authorize its transfer, on receipt of an application; (a) in the prescribed form; (b) containing the prescribed information and undertakings and accompanied by the prescribed documents.

Subsection 24(5) of the *Nuclear Safety Control Act* provides that a licence may contain any term or condition that the Commission considers necessary for the purposes of this Act., including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.

General Nuclear Safety and Control Regulations

Section 11 of the *General Nuclear Safety and Control Regulations* states that for the purpose of section 7 of the Act, the Commission may grant an exemption if doing so will not

(a) pose an unreasonable risk to the environment or the health and safety of persons;

(b) pose an unreasonable risk to national security; or

(c) result in a failure to achieve conformity with measures of control and international obligations to which Canada has agreed.

B.2 Technical Basis

Staff's recommendations to the Commission within this CMD are supported on a technical basis and comparison by the following documents:

- CNSC REGDOC-2.11.1: *Waste Management, Volume I: Management of Radioactive Waste* (January 2021) *and* *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* (November 2018), Canadian Nuclear Safety Commission.
- *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, International Atomic Energy Agency, June 2001.

- Management of Radioactive Waste from the Mining and Milling of Ores, Safety Guide Safety Standards Series No. WS-G-1.2, International Atomic Energy Agency, March 2002.
- *Monitoring and Surveillance of Residues from the Mining and Milling of Uranium and Thorium*, Safety Report Series No. 27, International Atomic Energy Agency, 2002.
- *Disposal of Radioactive Waste*, Specific Safety Requirements No. SSR-5, International Atomic Energy Agency, 2011.
- *Near Surface Disposal of Radioactive Waste*, Specific Safety Guide No. SSG-29, International Atomic Energy Agency, March 2014.
- *Release of Sites from Regulatory Control on Termination of Practices*, Safety Guide No. WS-G-5.1, International Atomic Energy Agency, March 2006.
- *Decommissioning of Facilities*, General Safety Requirements Part 6 No. GSR Part 6, International Atomic Energy Agency, March 2014.

C. SAFETY AND CONTROL AREA FRAMEWORK

C.1 Safety and Control Areas Defined

The safety and control areas identified in section 2.2 and discussed in summary in sections 3.1 through 3.14 are comprised of specific areas of regulatory interest which vary between facility types.

The following table provides a high-level definition of each SCA. The specific areas within each SCA are to be identified by the CMD preparation team in the respective areas within section 3 of this CMD

SAFETY AND CONTROL AREA FRAMEWORK		
Functional Area	**Safety and Control Area**	**Definition**
Management	Management System	Covers the framework which establishes the processes and programs required to ensure an organization achieves its safety objectives and continuously monitors its performance against these objectives and fostering a healthy safety culture.
	Human Performance Management	Covers activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee personnel are in relevant job areas and have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties.
	Operating Performance	This includes an overall review of the conduct of the licensed activities and the activities that enable effective performance.
Facility and Equipment	Safety Analysis	Maintenance of the safety analysis that supports that overall safety case for the facility. Safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards.
	Physical Design	Relates to activities that impact on the ability of systems, components and structures to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account.
	Fitness for Service	Covers activities that impact on the physical condition of systems, components and structures to ensure that they remain effective over time. This includes programs that ensure all equipment is available to perform its intended design function when called upon to do so.

SAFETY AND CONTROL AREA FRAMEWORK		
Functional Area	**Safety and Control Area**	**Definition**
Core Control Processes	Radiation Protection	Covers the implementation of a radiation protection program in accordance with the Radiation Protection Regulations. This program must ensure that contamination and radiation doses received are monitored and controlled and maintained ALARA.
	Conventional Health and Safety	Covers the implementation of a program to manage workplace safety hazards and to protect workers.
	Environmental Protection	Covers programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities.
	Emergency Management and Fire Protection	Covers emergency plans and emergency preparedness programs which exist for emergencies and for non-routine conditions. This also includes any results of exercise participation.
	Waste Management	Covers internal waste-related programs which form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. Also covers the planning for decommissioning.
	Security	Covers the programs required to implement and support the security requirements stipulated in the regulations, in their licence, in orders, or in expectations for their facility or activity.
	Safeguards and Non-Proliferation	Covers the programs and activities required for the successful implementation of the obligations arising from the Canada/IAEA safeguards agreements as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons*.
	Packaging and Transport	Programs that cover the safe packaging and transport of nuclear substances and radiation devices to and from the licensed facility.

C.2 Specific Areas for this Facility Type

The following table identifies the specific areas that comprise each SCA for Orano Canada Inc.'s Cluff Lake Project:

SPECIFIC AREAS FOR THIS FACILITY TYPE		
Functional Area	**Safety and Control Area**	**Specific Areas**
Management	Management System	▪ Management System ▪ Organization ▪ Performance Assessment, Improvement and Management Review ▪ Operating Experience (OPEX) ▪ Change Management ▪ Safety Culture ▪ Configuration Management ▪ Records Management ▪ Management of Contractors ▪ Business Continuity
Core Control Processes	Radiation Protection	▪ Application of ALARA ▪ Worker Dose Control ▪ Radiation Protection Program Performance ▪ Radiological Hazard Control
	Conventional Health and Safety	▪ Performance ▪ Practices ▪ Awareness
	Environmental Protection	▪ Effluent and Emissions Control (releases) ▪ Protection of People ▪ Environmental Management System (EMS) ▪ Assessment and Monitoring ▪ Environmental Risk Assessment

D. ENVIRONMENTAL PROTECTION REVIEW REPORT

Canada's Nuclear Regulator

Environmental Protection Review Report:
Cluff Lake Project

November 2022

e-Doc: 6857509 (Word)
e-Doc: 6898777 (PDF)

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Environmental Protection Review Report: Cluff Lake Project

Revision history

The following table identifies the revision history of this document.

Revision number	Change	Summary of changes	Date
000	Initial release	N/A	March 2019
001	Licence revocation application	Updated information based on CNSC staff directions and related documentation submitted by Orano Canada Inc.	November 2022

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Executive summary

The Canadian Nuclear Safety Commission (CNSC) conducts environmental protection reviews (EPRs) for all nuclear facilities with potential interactions with the environment, in accordance with its mandate under the *Nuclear Safety and Control Act* to ensure the protection of the environment and the health and safety of persons. An EPR is a science-based environmental technical assessment conducted by CNSC staff. The fulfillment of other aspects of the CNSC's mandate is met through other oversight activities.

This EPR report was written by CNSC staff to describe the scientific and evidence-based findings from their review of the environmental protection measures put in place by Orano Canada Inc. (Orano), formerly Areva Resources Canada Inc., for the Cluff Lake Project. The Cluff Lake Project is located on Treaty 8 territory within the homeland of the Métis, and within the traditional territories of the Dene, Cree, and Métis peoples. CNSC staff have also considered Orano's application to revoke the Cluff Lake Project's current licence, UML-MINEMILL-CLUFF.00/2024, in order to transfer the regulatory oversight for the property, in northwestern Saskatchewan, from the CNSC to the Province of Saskatchewan's Institutional Control Program (ICP).

CNSC staff's EPR report focuses on items that are of Indigenous, public, and regulatory interest, such as the risk of radioactive nuclear (radiological) substances and hazardous (non-radiological) substances to the receiving environment, valued components, and species at risk.

This EPR report includes CNSC staff's assessment of documents submitted by the licensee from 2019 to 2022 and the results of CNSC staff's compliance activities, including the following:

- the results of Orano's environmental monitoring, as reported in Cluff Lake Annual Compliance Monitoring Reports
- Orano's 2019 Technical Information Document – Environmental Performance Volume 2 – Version 02 (Environmental Risk Assessment)
- Orano's 2019 Technical Information Document – Hydrogeology and Groundwater Modelling – Version 02
- Orano's 2022 Technical Information Document – Environmental Performance Volume 1 – Version 02
- the results of the CNSC's Independent Environmental Monitoring Program
- the results from studies (including those completed by other levels of government) in proximity to Orano's Cluff Lake Project

Based on their assessment and evaluation of Orano's documentation and data, CNSC staff have found that the potential risks from radiological and hazardous expsoure in the atmospheric, terrestrial, aquatic, and human environments are low to negligible, and that concentrations in the receiving environment are at levels similar to natural background or in line with the 2019 environmental risk assessment (ERA) predictions. CNSC staff are confident that in the future, the potential risks to the different components of the environment from the Cluff Lake Project will remain low to negligible. Furthermore, human health is not impacted by the Cluff Lake Project, and the health outcomes are indistiguishable from health outcomes found in similar northern Saskatchewan communities. CNSC staff have also found that Orano continues to

implement and maintain effective environmental protection measures that meet regulatory requirements and adequately protect the environment and the health and safety of persons.

Should the Commission decide to revoke Orano's Cluff Lake Project licence, the Government of Saskatchewan assumes sole regulatory authority and manages the administrative controls over the properties, as well as the monitoring and maintenance requirements, to ensure the environment remains protected through the provincial ICP. CNSC staff are confident that the ICP, which was established in accordance with Canada's international obligations, will ensure that any risks to the environment and the health and safety of persons will be managed in the future.

CNSC staff's findings in this report do not represent the Commission's conclusions. The Commission's decisions will be informed by submissions from CNSC staff, the licensee, Indigenous Nations and communities, and the public, as well as through any interventions made during public hearings on licensing matters.

For more information on the Cluff Lake Project, visit the CNSC's web page and Orano's web page. References used throughout this document are available upon request, subject to confidentiality considerations, and requests can be sent to ea-ee@cnsc-ccsn.gc.ca.

1.0 Introduction

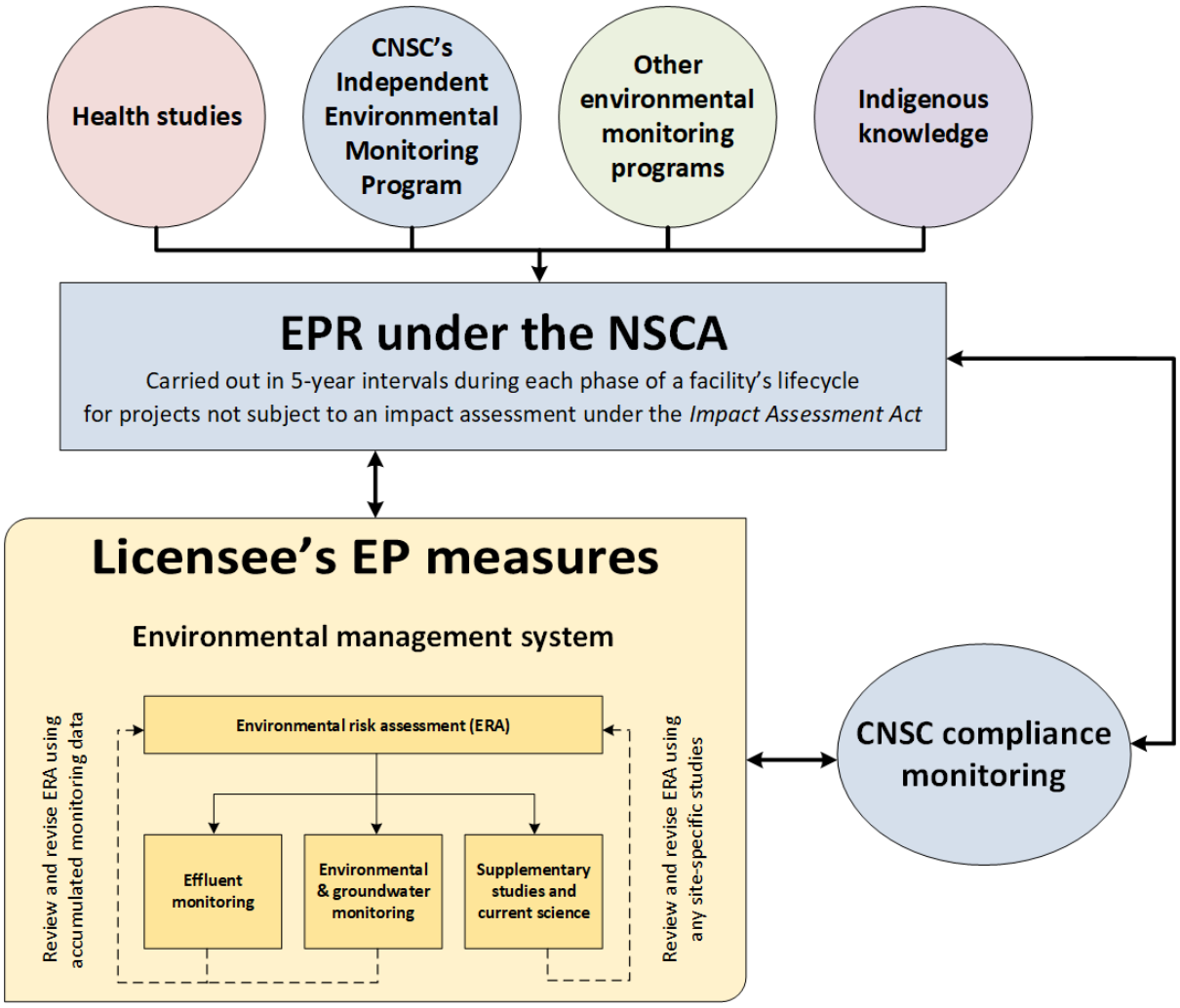
1.1 Purpose

The Canadian Nuclear Safety Commission (CNSC) conducts environmental protection reviews (EPRs) for all nuclear facilities with potential interactions with the environment, in accordance with its mandate under the *Nuclear Safety and Control Act* (NSCA) [1]. CNSC staff assess the environmental and health effects of nuclear facilities and/or activities during every phase of a facility's lifecycle. As shown in figure 1.1, an EPR is a science-based environmental technical assessment conducted by CNSC staff to support the CNSC's mandate for the protection of the environment as well as human health and safety as set out in the NSCA. The fulfillment of other aspects of the CNSC's mandate is met through other regulatory oversight activities and is outside the scope of this report. Each EPR is typically conducted every 5 years, based on the submission or update of an ERA, or a licensing action that warrants additional detail around CNSC staff's assessment. The reports are informed by the licensee's environmental protection (EP) program and documentation submitted by licensees as per regulatory reporting requirements.

As per the CNSC's Indigenous Knowledge Policy Framework [2], the CNSC recognizes the importance of considering and including Indigenous knowledge in all aspects of its regulatory processes. A summary of CNSC staff's consultation and engagement activities relating to the Cluff Lake Project, as well as issues and concerns raised by Indigenous Nations and Communities, are described in section 4 of Commission member document (CMD) 23-H8 [3]. CNSC staff are committed to working directly with Indigenous Nations and communities and knowledge holders on integrating their knowledge, values, land use information, and perspectives, where appropriate and when shared with the licensee and the CNSC.

The purpose of this EPR is to report the outcome of CNSC staff's assessment of Orano Canada Inc.'s (Orano's) EP measures and CNSC staff's health science and environmental compliance activities for the Cluff Lake Project. This review serves to assess whether Orano's environmental protection measures at the Cluff Lake Project adequately protect the environment and health and safety of persons.

Figure 1.1: EPR framework



CNSC staff's findings inform and support recommendations to the Commission in licensing and regulatory decision making, as well as inform CNSC staff's compliance verification activities. CNSC staff's findings do not represent the Commission's conclusions. The Commission is an independent, quasi-judicial administrative tribunal and court of record. The Commission's conclusions and decisions are informed by information submitted by CNSC staff, the licensee, Indigenous Nations and communities, and the public, as well as through any interventions made during public hearings on licensing matters. The information in this EPR report is also intended to inform Indigenous Nations and communities, members of the public, and interested stakeholders. CNSC staff may use the EPR reports as reference material when engaging with interested Indigenous Nations and communities, members of the public, and stakeholders.

This EPR report is informed by documentation and information submitted by Orano, compliance activities completed by CNSC staff from 2019 to 2022, as well as the following:

- regulatory oversight activities (section 2.0)
- CNSC staff's review of Orano's annual compliance monitoring reports for EP [4] [5] [6]

- Orano's 2019 Technical Information Document – Environmental Performance Volume 2 – Version 02 (Environmental Risk Assessment) [7] (section 3.2)
- Orano's 2019 Technical Information Document – Hydrogeology and Groundwater Modelling – Version 02 [8] (section 3.2)
- Orano's 2022 Technical Information Document – Environmental Performance Volume 1 – Version 02 [9] (section 3.2)
- the CNSC's Independent Environmental Monitoring Program (IEMP) results, including discussions with Indigenous Nations and communities (section 4.0)
- health studies with relevance to the Cluff Lake Project (section 5.0)
- other environmental monitoring programs in proximity to the Cluff Lake Project (section 6.0)

This EPR report focuses on topics related to the environmental performance of the facility, including atmospheric (emission) and liquid (effluent) releases to the environment, the potential transfer of contaminants of potential concern (COPCs) through key environmental pathways and associated potential exposures and/or effects on valued components (VCs), including human and non-human biota. VCs refer to environmental, biophysical, or human features that may be impacted by a project. The value of a component relates not only to its role in the ecosystem, but also to the value people place on it (for example, it may have scientific, social, cultural, economic, historical, archaeological, or aesthetic importance). The focus of this report is on radiological and hazardous substances associated with activities undertaken at the Cluff Lake Project, with additional information provided on other topics of Indigenous, public, and regulatory interest. CNSC staff also present information on relevant regional health monitoring, including studies conducted by the CNSC (such as the IEMP).

1.2 Facility overview

This section of the report provides general information on the Cluff Lake Project, including a description of the site location and a basic history of site activities and licensing. This information is intended to provide context for later sections of this report, which discuss completed and ongoing environmental and regulatory oversight activities.

1.2.1 Site description

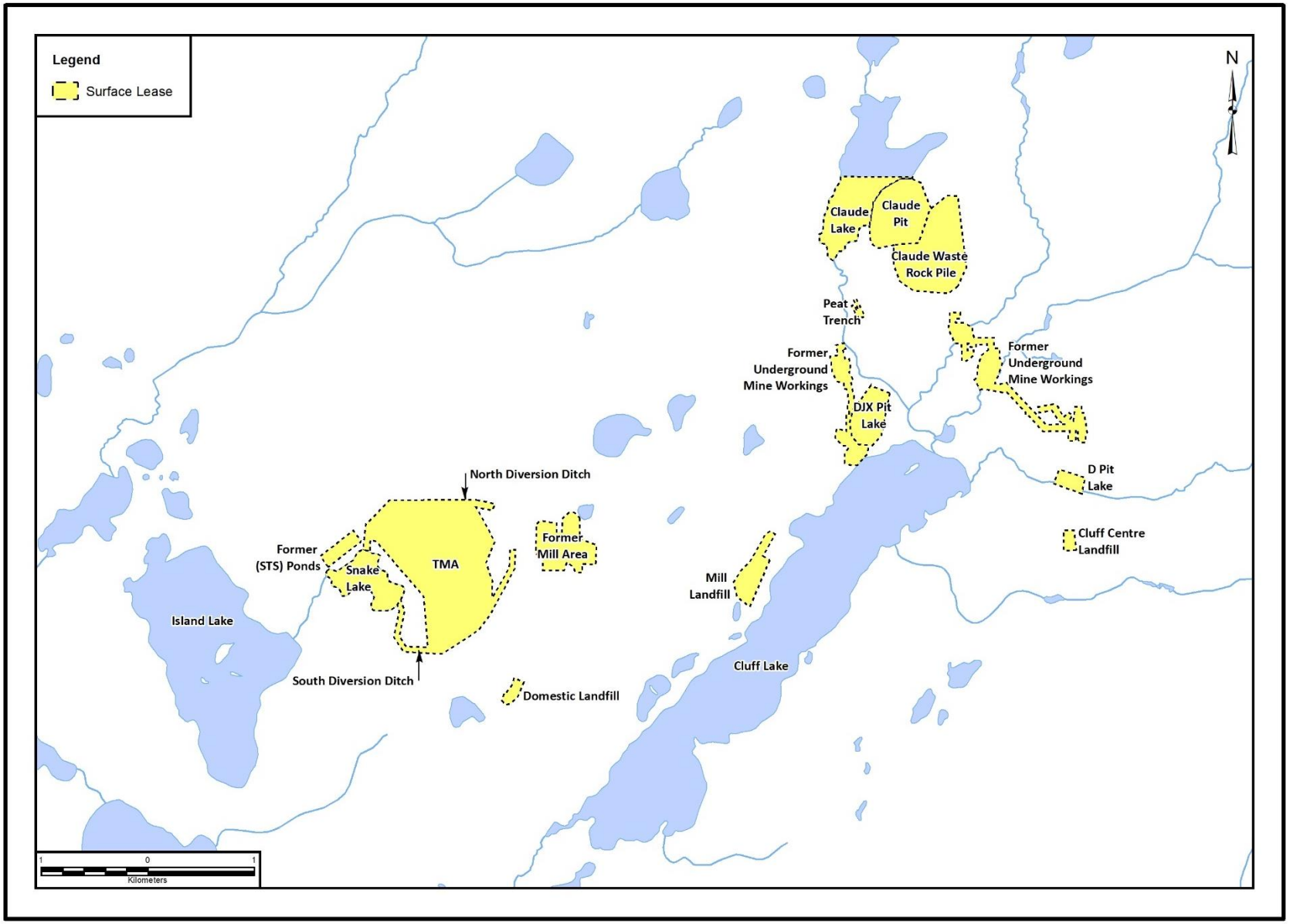
The Cluff Lake Project is a decommissioned uranium mine and mill site in northwestern Saskatchewan, approximately 75 kilometres (km) south of Lake Athabasca and 15 km east of the border with the Province of Alberta (figure 1.2). The Cluff Lake Project is located on Treaty 8 territory, the Homeland of the Métis, and is within the traditional territories of the Dene, Cree, and Métis peoples. Owned and operated by Orano, the Cluff Lake Project is located approximately 100 km from the closest community of Fort Chipewyan, Alberta (although there is no direct road) and 250 km by road from the communities of Clearwater River Dene First Nation and La Loche.

The former facilities at the Cluff Lake Project included 3 open pit mines, 2 underground mines, a central mill, a tailings management area (TMA) with a 2-stage liquid effluent treatment system, associated rock piles, and site infrastructure, including an airstrip and a residential camp. The Cluff Lake Project was fully decommissioned in 2018 and the site is currently accessible by Indigenous

Nations and communities and members of the public for hunting, fishing, camping, and harvesting (figure 1.3).

Figure 1.2: Location of the Cluff Lake Project [7]

Figure 1.3: Aerial view of the current surface lease for the Cluff Lake Project [10]



1.2.2 Project background

Uranium mining and milling operations commenced at the Cluff Lake Project in 1980 and continued until 2002, producing 28 million kilograms (kg) of uranium concentration throughout the facility's 22-year operating life. Uranium concentrate was extracted from 5 ore bodies using both underground and open pit mining techniques. While in operation, the Cluff Lake Project mine was the largest industrial employer in northwestern Saskatchewan.

At the Cluff Lake Project, there are 2 watersheds (figure 1.4). The first is the Island Lake watershed, where milling occurred and where tailings were disposed into a depressional area adjacent to Snake Lake, which is now the TMA. It should be noted that during operations, liquid effluent was discharged directly into Island Lake and no effluent was discharged into Snake Lake. Water from Island Lake flows toward the Island Lake fen, where one channel discharges directly into Island Creek and the other channel discharges into Agnes Lake, which is upstream of Island Creek. The second watershed is the Cluff Lake watershed, where four mining activities occurred, including: The D open pit mine area, the Claude open pit mine area, the DJ underground mine, and the DJX open pit mine area. The Claude Waste Rock Pile (CWRP) is the main remaining mining feature which was covered to reduce infiltration of rainwater and reduce contaminant leaching to the groundwater. Groundwater discharges into Claude Lake, Claude Creek, which is downstream of Claude Lake, and into the Peter River, which then discharges into Cluff Lake. On figure 1.4, the red arrows indicate seepage and the blue arrows indicate the flow direction of the water.

Figure 1.4: Aerial overview of the Cluff Lake Project watersheds

1.2.3 Decommissioning of the Cluff Lake Project

The planning for decommissioning the Cluff Lake Project began in 1998 and a licence for decommissioning was granted by the CNSC in April 2004. Most physical decommissioning activities were completed by 2006, including demolition of the mill complex buildings, backfilling of the Claude pit with waste rock from the DJX pit, flooding of the DJN and DJX pits (now referred to collectively as the DJX pit), grading, and revegetation. Some mining infrastructure, such as underground mine raises and declines, were decommissioned earlier, following the cessation of underground mining activities. By 2018, the final physical works described in the detailed decommissioning plan (DDP) were completed. More information on the decommissioning strategies for various infrastructure at the Cluff Lake Project can be found in the subsections below.

Surface infrastructure

Orano's decommissioning strategy for the surface infrastructure (including the mill complex) at the Cluff Lake Project was to:

- re-use components that were in good condition (that is, usable components of the mill were sent to the McClean Lake Operation)
- dispose of reagents
- demolish surface infrastructure
- vegetate the disturbed area

The decommissioning of the mill area was completed in 2005 and the demolition material was disposed of in the Claude pit. The area was then covered with glacial till, graded, and vegetated with tree seedlings. The decommissioning of the camp and remaining warehouses was completed in 2013, along with on-site roads and culverts (the last of which were removed in 2018).

Tailings

During operations of the Cluff Lake Project, Orano placed the tailings into the TMA along with solid wastes to facilitate consolidation. Water was treated in both primary and secondary water treatment plants and the tailings were isolated from the surface throughout the operations phase. At decommissioning, the tailings were covered with glacial till, the liquids pond was backfilled, storm water management features were constructed, the main dam was verified to ensure long-term stability under passive care, surface features were removed, and the till cover was seeded.

D and DJX pit lakes

During decommissioning at the Cluff Lake Project, Orano created pit lakes with stable chemoclines to ensure that high quality water is available at the surface of the lakes and that the lakes remain disconnected from the rest of the surface watershed. A chemocline refers to layers of liquid with different properties, which are characterized by a vertical chemical gradient. D-Pit was flooded in 1983 and the chemocline that was established during the flooding remains stable. DJX pit was flooded with water from Cluff Lake in 2006 and the chemocline was established within the same year and remains stable.

Waste rock

Orano's decommissioning strategy for the waste rock at the Cluff Lake Project was to utilize in-pit disposal whenever possible. The DJN waste rock was disposed of within the Claude pit,

which was then backfilled with waste rock and demolition material, covered with till, and seeded with trees and shrubs. The waste rock piles were also re-contoured and compacted prior to covering with till, in an effort to limit the amount of precipitation infiltrating the pile.

Underground mine areas

Orano's decommissioning of the DJ and OP/DP underground mine areas at the Cluff Lake Project included backfilling 8 raises, covering with reinforced concrete caps, and covering with glacial till. In addition, 2 declines were backfilled to protect against crown pillar failure, covered with concrete plugs, and covered with glacial till.

2.0 Regulatory oversight

The CNSC regulates nuclear facilities and activities in Canada to protect the environment and the health and safety of persons in a manner that is consistent with applicable legislation and regulations, environmental policies, and Canada's international obligations. The CNSC assesses the effects of nuclear facilities and activities on human health and the environment during every phase of a facility's lifecycle. This section of the EPR report discusses the CNSC's regulatory oversight of Orano's EP measures for the Cluff Lake Project.

To meet the CNSC's regulatory requirements and according to the licensing basis for the Cluff Lake Project, Orano is responsible for implementing and maintaining EP measures that identify, control, and (where necessary) monitor releases of radiological and hazardous substances and their effects on human health and the environment. These EP measures must comply with, or have implementation plans in place to comply with, the regulatory requirements found in Orano's licence and licence condition handbook (LCH). The relevant regulatory requirements for Orano's Cluff Lake Project are outlined in this section of the report.

2.1 Environmental protection reviews and assessments

To date, 4 joint federal–provincial environmental assessments (EAs) and two EPRs (including this one) have been carried out for the Cluff Lake Project. Subsection 2.1.1 provides a description of the EAs conducted under provincial and federal legislation, including the Environmental Assessment and Review Process (EARP) [11] and the *Canadian Environmental Assessment Act* (CEAA 1992) [12], predecessor to the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) [13]. Subsection 2.1.2 provides information on the EPR conducted for the Cluff Lake Project. In 2019, the *Impact Assessment Act* (IAA) [14] came into force, replacing CEAA 2012. Orano's current activities at the Cluff Lake Project do not require an impact assessment under the IAA's *Physical Activities Regulations* [15]. The purpose of any one of these legislations and assessments is to identify the possible impacts of a proposed project or activity and to determine whether those effects can be adequately mitigated to protect the environment and the health and safety of persons.

Table 2.1: Federal environmental assessments completed for the Cluff Lake Project

Project	Applicable EA process and/or legislation	EA start date	EA decision date
Development of the Cluff Lake Project – Phase I	Environmental Assessment and Review Process	1976	1978
Development of the Cluff Lake Project – Phase II	Saskatchewan Environmental Assessment Policy	1982	1983 & 1986
Extension of the DJ mining operation	Environmental Assessment and Review Process	1992	1997

Decommissioning of the Cluff Lake Project	*Canadian Environmental Assessment Act* (1992)	2000	2004

2.1.1 Previous EAs completed under federal and provincial legislation

Development of the Cluff Lake Project – Phase I

Exploration activities initially began in the Cluff Lake area in the 1960s by Amok Ltd. (Amok, the original proponent for the Cluff Lake Project). In 1976, Amok submitted an environmental assessment and safety report (EASR) [16] to the Province of Saskatchewan's Department of Environment following the discovery of the D ore body. The report proposed the development of a uranium mine and mill (phase I) around Cluff Lake. At the time of Amok's request, the Atomic Energy Control Board (AECB, predecessor to the CNSC) required that proponents provide certain information related to the operations of the proposed facility and the surrounding physical environment that may be affected by it, to support the licensing assessment. This information was provided by Amok within the EASR, which the federal Minister of Environment provided to the Board of Inquiry (often referred to as the Bayda Commission) for review. The Board of Inquiry was responsible for reviewing the implications and potential effects of expanding the uranium mining and milling industry in northern Saskatchewan. Following their review of the EASR and written interventions, along with public meetings and formal hearings, the Board of Inquiry recommended that the development of the Cluff Lake Project mine and mill be approved [17]. A licence was then granted by the AECB for the Cluff Lake Project.

Development of the Cluff Lake Project – Phase II

Phase II of the Cluff Lake site development was subject to a provincial EA under the Saskatchewan Environmental Assessment Policy (EAP) [18]. The assessment for the phase II development of the Cluff Lake site included the extraction of the uranium reserves known as the Claude, N, N40, OP, and Dominique-Peter (DP) ore bodies [19]. The EA was also reviewed by the AECB as a federal expert and was approved in June 1983. In 1985, Amok discovered a new ore body, known as the Dominique-Janine (DJ) ore body, which was deemed more appropriate for development than the N and N40 ore bodies. In late 1986, the federal and provincial regulatory agencies concluded that Amok could proceed with the development of the newly discovered DJ ore body, which was added to the existing operational licence.

Extension of the DJ mining operation

Following further investigations to delineate the DJ ore body, Amok found that the uranium mineralization extended further south toward the edge of Cluff Lake than originally identified. Amok's subsequent proposed extension of the DJ mining operation coincided with several other uranium mining projects being proposed in northern Saskatchewan by various proponents, including Midwest, McArthur River Operation, Cigar Lake Operation, and McClean Lake Operation. In response to these proposals, the Government of Canada and the Government of Saskatchewan appointed a joint Federal–Provincial Environmental Assessment Review Panel (Joint Panel) under their respective EA legislation (that is, the EARP and the provincial EAP). The mandate of the Joint Panel was to review the environmental, health, safety, and socioeconomic impacts of the proposed projects and assess their acceptability.

In 1993, following their review, the Joint Panel recommended to the Government of Canada and the Government of Saskatchewan that the proposed projects should be allowed to proceed [20].

During the Joint Panel's federal review under the EARP, CEAA 1992 came into force, repealing the EARP as the current federal EA legislation. However, CEAA 1992 contained provisions to maintain valid EAs being conducted (or recently conducted) under the previous legislation, allowing the Joint Panel to complete their review under the EARP. Following the Joint Panel's review, the proposed extension of the DJ mining operation at the Cluff Lake site proceeded with the licensing process.

Decommissioning of the Cluff Lake Project

In anticipation of decommissioning activities at the Cluff Lake Project, COGEMA Resources Inc. (COGEMA, predecessor to Orano) provided a DDP [21] to the CNSC in order to obtain a decommissioning licence. However, before the CNSC could consider granting said licence, COGEMA's decommissioning proposal required a comprehensive study under CEAA 1992, pursuant to the Comprehensive Study List Regulations [22] , along with a provincial environmental assessment. COGEMA submitted the Cluff Lake Project comprehensive study for decommissioning (CSD) to federal and provincial agencies in 2000 [23], along with relevant technical supporting documents. The CSD concluded that there were two ways in which the decommissioning of the Cluff Lake Project could impact the environment, namely through groundwater transport of contaminants from the TMA into the Island Creek watershed and through acid rock drainage and groundwater transport of contaminants from the Claude waste rock pile into Claude Lake, Claude Creek, and the Peter River systems. The CSD proposed mitigation measures to address the potential impacts, including the installation of a dry soil cover over the TMA and the construction of an engineered dry cover over the Claude waste rock pile. COGEMA determined in the CSD that the proposed project would not cause significant adverse environmental effects, considering the proposed mitigation measures outlined in the CSD.

In support of the decommissioning EA, CNSC staff developed a comprehensive study report (CSR) in 2003 [24] under CEAA 1992 [12]. The CSR was submitted to the federal Minister of Environment and the Canadian Environmental Assessment Agency to fulfill the CNSC's obligations as the Responsible Authority for the Cluff Lake Decommissioning Project under CEAA 1992. The CSR provided CNSC staffs assessment of the environmental effects of the proposed project, including long-term predictions of environmental quality.

The CSR also proposed a number of decommissioning objectives. These included Decommissioning Surface Water Quality Objectives (DSWQOs) and Decommissioning Sediment Quality Objectives (DSQOs) protective of water bodies in both the Island Lake and Cluff Lake watersheds. Radiological decommissioning objectives proposed included keeping radiation doses to nuclear workers and the general public below the regulatory limits and as low as reasonably achievable, through the final decommissioning and post-decommissioning phases. Decommissioning objectives were proposed for the post-decommissioning landscape to ensure the site was stable with a self-sustaining landscape. The objectives included that the site should be left in a relatively stable, self-sustaining and aesthetically acceptable state, similar in appearance and land capability as existed prior to mining activities, and that posed no unreasonable risk to humans or the environment [24] [25].

A decommissioning licence was granted in 2004 by the CNSC and an Approval to Operate Pollutant Control Facilities licence was granted by the Saskatchewan Ministry of Environment.

2.1.2 Previous EPR completed under the NSCA

In September 2018, Orano submitted a licence application to the CNSC to request a licence renewal for a 5-year term [26]. Orano's licence application included requests to:

- reduce the CNSC-licensed area to include only parcels of land where mining activities occurred and where radionuclide inventories were above exemption quantities
- reduce the financial guarantee to reflect the completion of decommissioning and the ongoing monitoring and maintenance activities proposed in the detailed PDP
- modernize the licence to reflect the post-closure activities on site

CNSC staff conducted an EPR under the NSCA to assess Orano's licence application and the documents submitted in support of compliance verification activities conducted at the Cluff Lake Project by CNSC staff. CNSC staff's EPR report for the Cluff Lake Project was posted in March 2019 as appendix D in CMD 19-H3 [25] and found that Orano had taken adequate provisions for the health and safety of persons and for the protection of the environment and would continue to do so in the future. CNSC staff also found that the Cluff Lake Project continued to meet the decommissioning objectives set out in the CSR, as previously discussed [24]. These decommissioning objectives, as well as their status at the time of the 2019 licence renewal, are described in more detail in the 2019 EPR report [25].

Within the EPR report, CNSC staff also directed Orano to:

- adopt the Canadian Council of Ministers of the Environment (CCME) guideline for uranium as a screening tool and present conclusions in the upcoming ERA regarding the risks of uranium in surface water bodies
- submit an updated hydrogeology and groundwater modelling technical information document with more information regarding the effectiveness of the soil covers and the re-vegetation works on the CWRP
- submit an updated hydrogeology and groundwater modelling technical information document with more information regarding the performance of horizontal drains installed at the Claude Pit cover to eliminate ponding water and also bound the incremental contaminant loading from the drains to allow CNSC staff to assess if the drains are performing as designed

Orano submitted the updated documentation, which was reviewed and accepted by CNSC staff. CNSC staff's review and assessment of this documentation is discussed in more detail in section 3.2 of this report.

The Commission concluded that Orano was qualified to carry out the activities within the proposed licence and the Cluff Lake Project was granted a uranium mill licence (UML) for a period of five years, expiring on July 31, 2024 [27].

Through ongoing licensing and compliance reviews, as well as independent verification through consideration of IEMP results and regional health studies, CNSC staff would continue to confirm and ensure that the environment and health of persons was protected at, and around, the Cluff Lake Project.

2.2 Environmental regulatory framework and protection measures

The CNSC has a comprehensive EP regulatory framework that includes both radioactive nuclear and hazardous substances, physical stressors (such as noise), and the protection of Indigenous Nations and communities, the public, and the environment. Public dose is considered under the EP framework, as well as from a radiation protection standpoint. The focus of this section of the EPR report is on the EP regulatory framework and the status of Orano's environmental protection program (EPP) for the Cluff Lake Project. The results derived from this EPP are detailed in section 3.0 of this report.

Orano's EPP for the Cluff Lake Project was designed and implemented in accordance with regulatory document REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures (2017) [28] , as well as the CSA Group's (Canadian Standards Association) environmental protection standards listed in table 2.2.

Table 2.2: Status of EP measures to implement regulatory documents and standards

Regulatory document or standard	Status
CSA N288.4-10, *Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills* [29]	Implemented
CSA N288.6-12, *Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills* [30]	Implemented
CNSC REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures,* (2017) [28]	Implemented

CNSC staff confirm that Orano has implemented programs that are in compliance with the relevant EP regulatory documents and standards.

Licensees are also required to regularly report on the results of their EPPs. Reporting requirements are specified in REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills [31], the *Radiation Protection Regulations* [32] (for example, for action levels or dose limit exceedances), and the LCH [33].

Orano is required to submit annual reports as per REGDOC-3.1.2. These reports are reviewed by CNSC staff for compliance verification, as well as trending.

CNSC staff regularly report on licensee performance to the Commission for activities conducted at the Cluff Lake Project. For example, CNSC staff regulatory oversight reports (RORs) are a standard mechanism for updating the Commission, Indigenous Nations and communities, and the public on the operation and regulatory performance of licensed facilities. Previous RORs are available on the CNSC regulatory oversight reports web page [34]. CNSC staff may also report to the Commission on events, such as unplanned releases to the environment, through an initial event report.

2.2.1 Environmental protection measures

To meet the CNSC's regulatory requirements under REGDOC-2.9.1 (2017) [28], Orano is responsible for implementing and maintaining EP measures that identify, control, and monitor releases of radioactive nuclear substances and hazardous substances from the Cluff Lake Project,

and the effects of those substances on human health and the environment. EP measures are an important component of the overall requirement for licensees to make adequate provisions to protect the environment and the health and safety of persons.

This subsection and the following ones under section 2.2 summarize Orano's EPP for the Cluff Lake Project and the status of each specific EP measure, relative to the requirements or guidance outlined in the latest regulatory document or CSA Group standard. Section 3.0 of this EPR report summarizes the results of these programs or measures against relevant regulatory limits, environmental quality objectives or guidelines, and ERA predictions; it also discusses, where applicable, any notable trends.

Orano is required to implement an environmental management system (EMS) that conforms to REGDOC-2.9.1 (2017) [28] and to submit an EPP for the Cluff Lake Project. Orano's EPP includes the following components to meet the requirements and guidance as outlined in REGDOC-2.9.1 (2017):

- EMS
- environmental risk assessment (ERA)
- environmental monitoring program (EMP)
    - soil and terrestrial vegetation monitoring
    - surface water monitoring
    - groundwater monitoring

Effluent and emissions control and monitoring is not applicable for the Cluff Lake Project because it is a decommissioned site with no releases to the environment.

2.2.2 Environmental management system

An EMS refers to the management of an organization's environmental policies, programs, and procedures in a comprehensive, systematic, planned, and documented manner. It includes the organizational structure as well as the planning and resources to develop, implement, and maintain an EP policy. An EMS requires a facility to continuously improve its EPP; this includes periodic updates to the ERA. The results from the ERA updates determine whether the facility's effluent monitoring and EMP are effective. The EMS serves as a management tool to integrate all of a licensee's EP measures in a documented, managed, and auditable process to:

- identify and manage non-compliances and corrective actions within the activities, through internal and external inspections and audits
- summarize and report the performance of these activities both internally (licensee management) and externally (Indigenous Nations and communities, the public, interested stakeholders, and the Commission)
- train personnel involved in these activities
- ensure the availability of resources (that is, qualified personnel, organizational infrastructure, technology, and financial resources)
- define and delegate roles, responsibilities, and authorities essential to effective management

Orano established and implemented an integrated management system (IMS) for the Cluff Lake Project in accordance with REGDOC-2.9.1 (2017) [28]. One of the components of Orano's IMS is environmental protection and serves the role of an EMS at the Cluff Lake Project. CNSC staff review the implementation of the EMS as part of their review of the annual reports on EP.

The results of these reviews demonstrate that Orano's EMS for the Cluff Lake Project meets CNSC requirements as outlined in REGDOC-2.9.1 (2017) [28]. The implementation of the EMS ensures that Orano continues to improve environmental performance at the Cluff Lake Project.

2.2.3 Environmental risk assessment

An ERA of nuclear facilities is a systematic and cyclical process used by licensees to identify, quantify, and characterize the risk posed by contaminants and physical stressors in the environment on human and other biological receptors, including the magnitude and extent of the potential effects associated with a facility. The ERA serves as the basis for the development of site-specific EP control measures and EMPs. The results of these programs, in turn, inform and refine future revisions of the ERA.

The first comprehensive ERA for the Cluff Lake Project was incorporated within the Cluff Lake Project CSD [23], which considered the operational history of the project and simulated the effects of decommissioning of the project on the environment. The CSD provided a comprehensive evaluation of potential effects to VCs, emphasizing site-specific information and receptor characteristics, and made a number of long-term predictions of the receiving environment. The output from the 2000 CSD was used to support the EA conclusions that the Cluff Lake Project decommissioning was not likely to cause significant adverse environmental effects.

In 2015, AREVA (predecessor to Orano) submitted to the CNSC the Cluff Lake Project – Environmental Performance Technical Information Document – Volume 1 (2015 EP TID Volume 1) [35] and the Cluff Lake Project Environmental Performance Technical Information Document – Volume 2 Environmental Risk Assessment Update (2015 EP TID Volume 2) [36]. The EP TID Volume 1 described the state of the environment of the Cluff Lake Project from 1979 pre-operational baseline conditions up until 2014. The EP TID Volume 2 provided an update to the 2000 ERA submitted as part of the CSD, describing the anticipated ecological and human health risks based on the updated environmental monitoring information, and evaluated the long-term performance of the decommissioned Cluff Lake Project. The 2015 updated ERA included an ecological risk assessment (EcoRA) and a human health risk assessment (HHRA) for radiological and hazardous contaminants and physical stressors. CNSC staff reviewed AREVA's ERA and found it to be compliant with CSA N288.6-12 [30].

In 2019, Orano submitted an update to 2015 EP TID Volume 2, the 2019 EP TID Volume 2 [7], in accordance with the requirements set out in CSA N288.6-12 [30]. The 2019 ERA was submitted to support Orano's application to transfer the site into institutional control. This submission addressed the first recommendation made under the 2019 EPR report under the NSCA, that Orano adopt the CCME guideline for uranium as a screening tool and present conclusions in the upcoming ERA regarding the risks of uranium in surface water bodies.

In addition, Orano submitted an update to the Cluff Lake Project Technical Information Document – Hydrogeology and Groundwater Modelling (2019 Groundwater TID) [8], which describes the nature of the tailings, waste rock, and groundwater flows, and how the groundwater

model is used to make the predictions of the movement of metals and radioactive elements in the environment. It is a key supporting document used to inform the ERA. This submission addressed the final two recommendations made under the 2019 EPR report under the NSCA:

- submit an updated hydrogeology and groundwater modelling technical information document with more information regarding the effectiveness of the soil covers and the re-vegetation works on the CWRP
- submit an updated hydrogeology and groundwater modelling technical information document with more information regarding the performance of horizontal drains installed at the Claude Pit cover to eliminate ponding water and also bound the incremental contaminant loading from the drains to allow CNSC staff to assess if the drains are performing as designed

In response to the CNSC recommendation that more information be provided on the effectiveness of the CWRP soil cover to revegetate and limit infiltration of precipitation into the CWRP, Orano provided, in the 2019 Groundwater TID and supporting documentation, a detailed description on the progress of revegetation to date, including the increase in species richness of native plants on the cover and the presence of later successional tree and shrub species. The progress of vegetation to date suggests that the CWRP is moving away from many species which are considered early successional (species with traits such as fast growth, short life span, abundant seed production, and shade-intolerance) and moving towards those species which are considered later-successional (species with longer life spans, more extensive root systems, production of larger seeds, and more shade tolerance). These trends will likely result in establishment of mature forests compatible with local ecosystems.

In response to the CNSC recommendation that additional information regarding the performance of horizontal drains installed at the Claude Pit cover be provided, the 2019 Groundwater TID and supporting documentation included information on how the groundwater model was calibrated to account for flow and mass flux through the horizontal drains, as well as the backfill material and associated grain size distribution curves that were used to determine the expected hydraulic conductivity applied in the groundwater model.

CNSC staff provided their technical review comments in 2020, followed by a number of technical meetings. CNSC staff found the 2019 update of the ERA and 2019 Groundwater TID to be acceptable and that Orano had addressed staff's technical comments and recommendations, including incorporating additional monitoring as part of the long-term monitoring and maintenance plan (LTMMP) [37] [38] [39].

In 2022, Orano submitted an update to the 2015 EP TID Volume 1, entitled Cluff Lake Project - Environmental Performance Technical Information Document Volume 1 – Version 02 (2022 EP TID Volume 1) [9]. This update summarizes the results of monitoring conducted between 2015 and 2021.

The most recent ERA results and the findings of the 2019 review of the ERA and 2022 EP TID Volume 1 are discussed further in section 3.2.

2.2.4 Effluent and emissions control and monitoring

The Cluff Lake Project is a decommissioned uranium mine site with no liquid effluent discharge or atmospheric emissions. Therefore, Orano is not required to have an effluent monitoring program in place for the Cluff Lake Project.

2.2.5 Environmental monitoring program

The CNSC requires each licensee to design and implement an EMP that is specific to the monitoring and assessment requirements of the licensed facility and its surrounding environment. The program is required to:

- measure contaminants in the environmental media surrounding the facility or site
- determine the effects, if any, of the facility or site operations on people and the environment
- serve as a secondary support to emission monitoring programs to demonstrate the effectiveness of emission controls

More specifically, the program must gather the necessary environmental data to calculate public dose and demonstrate compliance with the public dose limit found in the *Radiation Protection Regulations* [32] of 1 millisievert (mSv) per year. The program design must also address the potential environmental interactions identified at the facility or site. Hazardous substances are the major focus at the Cluff Lake Project, though radionuclides were included within monitoring activities associated with liquid discharges and air emissions when the Cluff Lake Project was in operation. Orano's EMP for the Cluff Lake Project consists of the following components:

- soil and terrestrial vegetation monitoring
- surface water monitoring

Monitoring frequency is specified in the EMP. Surface water monitoring is conducted annually, while soil and terrestrial vegetation monitoring are conducted every 5 years. Groundwater monitoring was removed from the EMP in 2022 with CNSC staff's approval.

Orano's EMP is required to comply with REGDOC-2.9.1 (2017) [28] and relevant standards, including CSA N288.4-10 [29].

Based on compliance activities, CNSC staff have found that Orano is compliant with REGDOC-2.9.1 (2017) [28] and continues to implement and maintain an effective EMP for the Cluff Lake Project that adequately protects the environment and the health and safety of persons.

2.3 Orano's request to move to Provincial regulatory oversight and its impacts on environmental protection

In February 2020, Orano requested the transfer of regulatory oversight for the Cluff Lake Project from the CNSC-issued licence to the Province of Saskatchewan's Intitutional Control Program (ICP), which is subject to a Commission decision [40]. In this application, Orano is applying to the CNSC to transfer responsibility for the currently licensed activities to possess, manage, and store radioactive waste at the Cluff Lake Project (that is, in-situ decommissioned waste rock and tailings) to the Province of Saskatchewan and exempt the Cluff Lake Project from licensing by the CNSC. A CNSC exemption from the obligation to hold a licence under the NSCA must be

granted to the Government of Sasktachewan, as it is a prescribed condition for acceptance of the decommissioned Cluff Lake Project property into the Province of Saskatchewan's ICP.

The Province of Saskatchewan's ICP defines and implements a process for the long-term monitoring and maintenance of decommissioned mine and/or mill sites located on provincial Crown land in Saskatcehwan. Institutional control refers to the control of residual risks at a site after it has been decomissioned and can include active measures (such as water treatment, monitoring, maintenance) and passive measures (such as land use restrictions, markers), in perpetuity. The definition of institutional control recognizes that regulatory oversight is required; however, if the appropriate mechanisms are in place, CNSC licensing may no longer be required and oversight may be given to a competent provincial or territorial agency.

2.3.1 Long-term monitoring and maintenance plan

Orano has proposed a robust LTMMP to be administered under the ICP by the Province of Saskatchewan. The LTMMP is proposed to continue for decades, at a sample frequency focused on confirming the site's environmental performance against predicted performance and relative to decommissioning objectives. The scope and complexity of the LTMMP is informed by the 2019 update to the ERA and supporting documentation (discussed in section 3.2) and has taken into account CNSC staff recommendations.

The LTMMP focuses on 4 key areas. The first area is 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. In addition, with the design for stability under passive care, maintenance is expected to be limited to potential settling of landfills and potential minor erosion repair on covers. Required maintenance would be identified during scheduled geotechnical inspections.

The second area of focus of the LTMMP is on 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.

The third area considers 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.

The fourth area of focus of the LTMMP is on 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.

3.0 Status of the environment

This section provides a summary of the status of the environment around the Cluff Lake Project. It includes a description of the radiological and hazardous releases to the environment (section 3.1), followed by a description of the environment surrounding the Cluff Lake Project and an assessment of any potential effects to the different components of the environment as a result of exposure to these contaminants (section 3.2).

CNSC staff regularly review the potential effects to environmental components through annual reporting requirements and compliance verification activities, as detailed in other areas of this report. Environmental information is regularly reported to the Commission in the EP safety and control area section in licensing CMDs and annual RORs.

3.1 Releases to the environment

Radioactive nuclear and hazardous substances that have the potential to cause an adverse effect to ecological or human receptors are identified as COPCs. During the operation and decommissioning of the Cluff Lake Project site, routine releases of treated effluent to Island Lake occurred from the Wastewater Treatment Plant until effluent releases ceased in October 2005 and the plant was completely decommissioned in 2013. In addition, with decommissioning activities having been completed, atmospheric emissions have also ceased.

As discussed in section 2.2.1, there are currently no releases to the environment (that is, air or surface water) from the Cluff Lake Project. As there are no releases, there are also no licence limits for releases to the environment in Orano's CNSC licence for the facility. The only pathways for COPCs to enter the receiving environment are from the very slow migration (over several thousands of years) of contaminants contained within the covered tailings or covered waste rock, into groundwater, and through the subsurface environment until it enters a surface water body, which is further discussed in section 3.2.2.

3.2 Environmental effects assessment

This section presents an overview of the assessment of predicted effects from licensed activities on the environment and the health of persons.

Orano conducted a detailed ERA in 2019, to assess both the short-term and long-term effects on human health and the environment, based on the current site conditions and evolution of the site over time. The assessment applied a conservative long-term groundwater model to predict concentrations of contaminants (metals and radionuclides) that will migrate slowly over the long-term through the covered tailings and covered waste rock masses and into the surface water environment [7] [8]. Based on the predictions of water quality from the groundwater model over several thousand years, Orano assessed the potential risk to human health and ecological receptors and concluded that environmental impacts were limited and that the environment and human health would be protected into the future.

CNSC staff reviewed Orano's assessment of current and predicted effects on the environment and health of persons due to licensed activities included in the ERA (see subsection 2.2.3). The 2019 ERA was performed in a stepwise manner, as follows:

- identify the environmental interactions of COPCs, and COPC exposure pathways in the environment
- identify predicted COPC exposure for ecological and human receptors
- identify potential effects to receptors
- determine whether the environment and health of persons is and will continue to be protected

To inform this section of the report, CNSC staff reviewed Orano's 2019 ERA [7], along with the Groundwater TID [8].

While CNSC staff conducted a review for all environmental components, only a selection of components is presented in detail in the following subsections. The environmental components were selected based on licensing requirements; certain components were also selected because they have historically been of interest to the Commission, Indigenous Nations and communities, and the public.

3.2.1 Atmospheric environment

During the construction, operation and active decommissioning of the facility, activities resulted in releases of nuclear and hazardous substances to the atmospheric environment. However, as the site has been decommissioned and active decommissioning activities were completed by 2006, the impact on air now and in the future is negligible.

Air quality monitoring, including monitoring of radon emanating from the site, was removed from the site-wide monitoring program in 2019, as previous monitoring had demonstrated that air quality had returned to background.

The updated ERA does consider exposure of VCs (that is, terrestrial environment) from the deposition of historic atmospheric emissions on soil and vegetation, but no impacts were identified.

Findings

Based on the review of Orano's ERA and the results of historic atmospheric monitoring, CNSC staff have found that ambient air quality has returned to background and is at levels protective of human health and the environment.

3.2.2 Geological and hydrogeological environment

This section discusses the geological and hydrogeological environment around the Cluff Lake Project that is used in the development of the groundwater and contaminant transport model used to simulate the migration of radionuclides to the receiving environment and informs the ERA.

Geological Conditions

The Cluff Lake Project is located in an area known as the Carswell Structure, a unique geological phenomenon located on the west side of the Athabasca sedimentary basin. In the Athabasca basin, the Athabasca Group rock formation unconformably overlies the Canadian Shield basement rock. The Carswell Structure is probably one of the most conspicuous, large diameter ring-type geological structures in Canada. In the Carswell Structure, the local geology is dramatically disturbed by what appears to be an upward thrust, which caused Aphebian

basement rock to punch out the sandstone cover, turning it upside down. The origin of this structure is thought to be a meteorite impact that occurred during Ordovician time (485.4 to 443.8 million years ago). The Athabasca sandstone surrounds the Carswell Structure. Very few sedimentary blocks are encountered within the structure, as erosion has removed most of them. A major intricated and faulty circular zone encloses the Carswell Structure. A network of faults and fractures have developed around the Carswell Structure and play an important role in controlling groundwater flow in the bedrock.

Around the TMA, the overburden stratigraphy typically consists of sandy glacial till directly overlying the sandstone bedrock. This area is bounded to the northeast by lower hydraulic conductivity Archean basement rock (4,000 to 2,500 million years old), to the southwest by lower conductivity Douglas Formation dolomite and siltstone, and the northwest and southeast by the Bridle Lake fault system and the Cluff Lake fault system, respectively [41].

Around the mining area, the surficial geology consists of a continuous cover of permeable, drumulinized sandy till, interspersed with glaciofluvial and glaciolacustrine deposits [42]. Underlying the overburden are the low permeability Peter River, Earl Creek, and transition zone gneisses, with the upper 10 m being weathered and, therefore, having a higher permeability than deeper, unweathered bedrock.

Hydrogeological conditions

Regionally, deep groundwater flow across the Athabasca basin is generally northward to the lower elevations of Lake Athabasca. In the area around the Carswell Structure, the regional flow is disrupted due to the low permeability Archean core of the structure and the numerous structural discontinuities surrounding the core. As a result, deep groundwater flow in the Cluff TMA region is south-westward and that in the mining area generally flows from north to south, discharging at Cluff Lake.

Uplands are present across the area northeast of the TMA, whereas lowlands exist coincident with the Cluff Lake and Bridle Creek Fault systems to the southeast and northwest of the TMA, respectively. These lowlands lead toward a major lowland associated with the Douglas River valley to the southwest of the TMA. The uplands are groundwater recharge areas and the lowlands are groundwater discharge areas. The TMA exists on the margin of the regional lowland in the groundwater discharge area.

Field investigations have been conducted for the Cluff Lake Project to characterize hydraulic properties of the various formations. The Archean basement and the Douglas Formation siltstone (pelitic sandstone) are estimated to have the lowest hydraulic conductivities based on their lithology. This means that groundwater will move slower in these units. The sandstone is estimated to have a higher hydraulic conductivity and the Cluff Lake and Bridle Lake Fault systems are estimated to have the highest hydraulic conductivity due to the abundance of late structural discontinuities within these entities. The contact zone between the Archean basement and the sandstone is expected to have variable hydraulic conductivities due to intense silicification along parts of the contact zone and lack of secondary silicification in other parts of the zone. Stratigraphic units with high hydraulic conductivities tend to be the preferential pathways for groundwater flow. Therefore, groundwater will tend to flow through the sandstone unit and Cluff Lake and Bridle Lake Fault systems.

Tailings management area

The pelitic sandstone unit, which underlies two thirds of the TMA, acts as a low permeability barrier to groundwater flow. Consequently, groundwater flow across the pelitic sandstone is under sub-artesian or artesian pressures. Groundwater discharge occurs in the topographically low areas within the pelitic sandstone. Groundwater recharge occurs on the uplands adjacent to the TMA and immediately south of the pelitic sandstone contact and in the Liquids Pond area.

Snake Lake and the TMA lie within the Island Lake drainage basin, and Snake Lake forms a major groundwater discharge for the watershed. Groundwater flow within the basin is radial toward the TMA and Snake Lake.

Both upward and downward vertical hydraulic head gradients are present at the site. Downstream from the Main Dam, the vertical hydraulic head gradients are generally upward, and artesian conditions exist at several locations. Artesian conditions are also present beneath the western half of the TMA (figure 1.4). At the southeast extension of the Main Dam and along the east side of the TMA, the vertical gradient is downward. Although artesian and sub-artesian conditions were found in some areas, they are not expected to impact groundwater flow through the tailings.

Mining area

In the mining area, surface drainage, topography, and bedrock structure control shallow groundwater flow. Cluff Lake is the ultimate receptor for groundwater and surface water flows. Shallow groundwater flow discharges into various streams such as Boulder Creek, Claude Creek, Earl Creek, and Peter River.

A groundwater divide is present beneath the CWRP, resulting in groundwater flowpaths towards Claude Lake, Claude Creek, and Peter River. Groundwater in the vicinity of the batch plant and OP/DP areas flows towards Earl Creek, while groundwater in the vicinity of D-Pit flows towards Boulder Creek. In the DJX pit area, groundwater flows towards Cluff Lake.

Groundwater flow and contaminant transport modeling

With an understanding of climate, topography, geology, hydrogeology, and source terms, Orano conducted groundwater flow and contaminant transport modeling exercises to simulate the groundwater flow path and the mass flux moving from sources to various receptors. The predicted mass flux to various receptors has served as input to surface water models to predict long-term surface water quality in downstream receptors, which subsequently informs the EcoRA and HHRA.

The particle path analysis indicates that contaminants originating from the TMA are transported through the underlying till and sandstone in groundwater toward Snake Lake.

The groundwater flow modelling indicates that a groundwater divide is present beneath the CWRP. The particle path analysis shows that potential contaminants of concern on the east side of the groundwater divide travel to Peter River and Earl Creek, and potential contaminants of concern originating from the west side of the groundwater divide travel to Claude Lake and Claude Creek. Potential contaminants of concern originating from the south side of the pile travel to Cluff Lake.

The particle path analysis also indicates that potential contaminants of concern originating from the Claude pit travel only to Claude Lake, and potential contaminants of concern originating in the DJX pit lake travel only to Cluff Lake.

The modelling results are consistent with the groundwater monitoring results.

The covered CWRP and TMA are key engineered features for the containment of contaminants on the site. The engineered covers will limit the infiltration of precipitation into the waste rock mass and tailings mass; however, over time, some precipitation will infiltrate. Infiltrated precipitation will migrate through the waste rock and tailings and into the surrounding geological environment, resulting in a slow discharge of contaminants into groundwater and subsequently into the respective surface water bodies.

As depicted in figure 1.4, groundwater will flow through CWRP and discharge into Claude Lake, Claude Creek, and Peter River, where contaminants will eventually make their way to Cluff Lake. Likewise, groundwater passing through the TMA will discharge into Snake Lake, with contaminants eventually making their way into Island Lake and migrating further downstream.

It is important to note that as contaminants flow through groundwater and into surface water, they will pass through the sediment layer in both Snake Lake and Claude Lake, which provides attenuation by removing some COPCs, such as uranium, before mobilizing in surface waters.

In order to assess the potential environmental impacts, Orano conducted an assessment of the predicted long-term contaminant loading to the surface water from these pathways through a base case scenario. In doing so, Orano took into consideration the expected performance of the engineered cover to limit infiltration, the anticipated groundwater flows over time, and the solute concentrations of contaminants in waste rock and tailings pore water.

The migration of COPCs via groundwater to surface water will occur over various time periods based on their mobility, attenuation, and decay characteristics, and on advective and diffusive transport mechanisms. Movement of COPCs from the CWRP and the TMA to groundwater and subsequently to surface water will continue for hundreds to thousands of years after decommissioning [8]. This slow movement of contaminants in groundwater to the receiving environment (surface waters and sediment), and the subsequent exposure to ecological receptors and people, was simulated from the calendar year 2018 to the calendar year 7000.

In order to assess whether the receiving environment would be protected now and in the future, the predicted concentrations in surface waters and sediment in exposed areas around the Cluff Lake Project site were compared to the DSWQOs and Sediment Quality Guidelines (SQGs). In addition, the predicted exposures to ecological receptors in the aquatic and terrestrial environments were compared to protective benchmark values, while predicted exposures to people were compared to the radiological public dose limit. The results of these assessments are discussed in the sections that follow.

Orano also conducted bounding cases to compare to the base case and determine a future range of performance. In the bounding cases, less likely model assumptions or accident and malfunction scenarios were considered, to bound the assessment results [8]. These bounding cases consider an increase in net percolation into the covers because of climate change, cover damage, lower cover performance, and a decrease in the attenuation rates of sediments.

Findings

CNSC staff reviewed Orano's post-decommissioning predictions of groundwater discharge and contaminant transport modelling for both the base case and bounding cases and found them acceptable. However, given the very long-time frame associated with the predictions, CNSC

staff requested that additional surface water monitoring be incorporated in the LTMMP at locations where groundwater is expected to discharge into surface waters, to provide an early indication of the performance of containments and to validate the accuracy of the model predictions. In response, Orano has included 4 additional surface water quality monitoring stations, 2 located at Claude Lake and 2 located in Cluff Lake, near the points of groundwater discharge [38].

3.2.3 Aquatic environment

An assessment of potential effects on aquatic biota at the Cluff Lake Project and the surrounding area consists of characterizing the local habitat and species (including considering federal and provincial species at risk) and assessing the possibility of their exposure to radiological and hazardous substances, as well as physical stressors that may be disruptive to ecological receptors.

Surface water quality

The potential effects of the project on water quality in the receiving environment were evaluated by comparing predicted COPC concentrations in water to available water quality guidelines (WQGs). As described in section 2.1.1, the CNSC CSR included long-term water quality predictions and proposed DSWQOs for several water bodies in both the Island Creek and Cluff Creek watersheds, including Snake Lake, Island Lake, Claude Lake, Claude Creek, Peter River, Earl Creek, Cluff Lake, and the flooded pits [12].

Since the time of the CSR, some WQGs have been revised and others established. As part of the 2019 Cluff Lake project licence renewal, CNSC staff directed Orano to adopt the uranium CCME environmental water quality guideline for the protection of aquatic life of 15 µg/L as a screening tool and apply it in the next update to the ERA. This WQG was used as a screening tool in the 2019 ERA update [7].

Island Creek watershed

The Island Creek watershed is influenced by the past release of treated effluent during the operational period. Since cessation of operations in 2006, it has demonstrated strong recovery, with decreasing contaminant concentrations. In the future, once contaminants migrating in groundwater from the decommissioned TMA make their way into sediments and surface water, it is predicted that there will be an increase in the concentration of some contaminants in the Island Creek watershed over the post-decommissioning period. In both Snake Lake and Island Lake, monitoring to date has shown that the DSWQOs are currently being met (table 3.1) and they are expected to continue to be achieved in the future based on long-term modelling results. Under the Cover Erosion and Climate Change bounding scenarios, marginal exceedances of the Ra-226 DSWQO of 0.11 becquerels per litre (Bq/L) were predicted in Snake Lake at a peak mean concentrations of 0.12 Bq/L. Given the unlikelihood of these events, and the level of the exceedance, any potential impacts would be negligible.

Cluff Creek watershed

The Cluff Creek watershed was not influenced by operational releases but is, and is expected to continue to be, influenced by groundwater contaminant transport through the waste rock piles, most notably the CWRP. Monitoring data has demonstrated that current DSWQOs in the Cluff Lake watershed are being met (table 3.1). Predicted peak concentrations are expected to remain below DSWQOs, as demonstrated by long-term modelling results. Some exceedances were

predicted for the bounding cases. Under the Cover Erosion bounding scenario, exceedances of nickel and uranium DSWQOs in Claude Creek were predicted. In the Climate Change bounding scenario, exceedances of the uranium DSWQO in Claude Creek was predicted. In the sediment attenuation scenarios, cobalt, copper, nickel, and uranium DSWQOs in Claude Lake and Claude Creek were predicted. In all cases, the peak mean concentrations were less than an order of magnitude above the DSWQOs and were predicted to decrease back to below the DSWQOs. Given the low probability of the scenarios occurring, the inherent conservativeness in the modelling assumptions and assessment approach, and the magnitude of the exceedances, any potential impacts would be low, temporary, and highly unlikely.

Peak mean surface water quality predictions for the base case scenario are presented in table 3.2 and compared to DSWQOs and current WQGs. The results show that there are localized (that is, to an individual water body) and temporary exceedances of current WQGs. In the Island Creek watershed, current exceedances of sulphate selenium, uranium, and iron resulting from historical effluent discharges, are expected to drop below current WQGs in the immediate future.

In the Island Creek watershed, short-term exceedances of predicted chloride in Snake Lake and selenium in Island Lake are expected to quickly drop below their WGQs by the year 2030 and 2050, respectively. Uranium exceedances in Island Lake is expected to drop below the CCME WQG of 15 micrograms per litre (µg/L) in approximately 150 years (that is, calendar year 2170). Only iron is anticipated to exceed the current surface WQGs in Snake Lake beyond the modelled period; however, iron is naturally present at levels that exceed the WQGs in Snake Lake.

In the Cluff Creek watershed, future exceedances of WQGs are predicted for cadmium, copper, cobalt, nickel, and uranium. Cadmium and copper are expected to exceed WQGs in Claude Lake and Claude Creek around the year 2050 and are expected to decrease below WQGs by the year 3100. Cobalt is expected to exceed the WQG in Claude Creek around the year 2200 and return below the WQG by the year 2700. Nickel in Claude Creek, which currently exceeds the WQG, is expected to recover below WQGs in approximately 2600. Uranium is predicted to exceed WQGs in Claude Creek by the year 2050 and return to below the WQG by the year 3800.

These localized and temporal exceedances of the current WQGs are not expected to impact aquatic life, as the WQGs are conservative. The water and sediment quality guidelines represent conservative levels considered to be protective of aquatic species. Exceedances of these benchmarks, including the CCME WQG for uranium, do not indicate that negative effects will occur; rather, exceedances are used as a screening tool to guide the EcoRA and flag COPCs that need to be examined further with respect to potential effects on aquatic species, to better understand the potential magnitude and extent of potential effects. The long-term predictions show that there are several areas where the surface water quality currently exceeds or is predicted to exceed WQG due to decommissioning groundwater contaminant transport and/or residual contamination from the operational period. Orano further assessed the WQG exceedances through its ERA to improve understanding of the potential effects on the aquatic and terrestrial communities. CNSC staff's assessment of these potential effects are described in section 3.23 and 3.24, respectively.

Table 3.1: 2020 and 2021 surface water monitoring results in the Island Creek and Cluff Creek watersheds [4]

Parameter	DSWQOs	Current WQGs	Island Creek watershed				Cluff Creek watershed					
			Snake Lake		Island Lake		Claude Lake		Claude Creek		Cluff Lake	
Year	N/A	N/A	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Chloride (mg/L)	-	120[d]	28	40	51	31	1	2	1	2	2.5	3.2
Sulphate (mg/L)	-	128-429[bf]	60	67	65	41	76	120	140	230	8.4	9.4
Arsenic (µg/L)	50	5[a]	0.3	0.3	0.7	1	0.4	0.4	0.4	0.5	0.1	0.1
Cadmium (µg/L)	1	0.04-0.37[bd]	0.01	0.02	0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01
Cobalt (µg/L)	20[g]	0.73[e]	0.2	0.4	<0.1	0.1	1	1	2.2	4.6	<0.1	<0.1
Copper (µg/L)	10	2-4[ab]	<1	1.6	<0.2	<0.2	0.2	<0.2	0.5	0.3	0.2	<0.2
Iron (mg/L)	3.2 (Snake Lake) 1.0 (Island Lake)	0.3[a]	1.4	2.53	0.1	0.2	1.5	0.4	0.6	1.1	0.2	0.2
Molybdenum (µg/L)	73 (500 Island Lake)	31,000[a]	1.7	1.1	93	73	0.2	0.2	<0.1	0.1	0.2	0.2
Nickel (µg/L)	25	25-150[ab]	2.8	2.2	1.4	1.4	8.2	13	16	46	1.1	1.6
Selenium (µg/L)	10	1[a]	<0.1	<0.1	0.5	0.6	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Uranium (µg/L)	88[b]/274[h]	15[a]	1.7	2.3	24	15	2.3	4.3	0.7	0.8	0.4	0.4
Polonium-210 (Bq/L)	-	0.1[c]	0.02	<0.01	<0.01	<0.01	<0.005	0.007	<0.005	<0.005	<0.005	<0.005
Lead-210 (Bq/L)	-	0.2[c]	<0.04	<0.04	<0.04	<0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Radium-226 (Bq/L)	0.11	0.11[a]	0.01	0.02	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005
Thorium-230 (Bq/L)	-	0.6[c]	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Definition of units: mg/L = milligrams per litre; ug/L = micrograms per litre; Bq/L = becquerels per litre.
[a] Saskatchewan Environmental Quality Guidelines [43].

[b] Objective depends on hardness. Guideline values correspond to a hardness of 44 mg/L (based on levels at reference stations).
[c] Thorium-230, Lead-210 and Polonium-210 objectives based on Canadian Drinking Water Quality Guidelines [44].
[d] Cadmium and chloride objectives based on federal guideline value [45].
[e] Cobalt objective based on the Federal Environmental Quality Guidelines [46]; calculated based on a hardness of 44 mg/L.
[f] Sulphate objective based on British Columbia's Water Quality Guideline to Protect Aquatic Life [47].
[g] For dissolved fraction.
[h] Not considered to exceed DSWQO [7]. The hardness dependent criteria were selected using a regional background hardness of 44 mg/L (DSWQO = 2xhardness); however, the average hardness measured in Island Lake (at station ISL4000S) over the recent period (2013 to 2017) was substantially higher, at 230 mg/L. A short-term hardness of 137 mg/L was adopted for the initial long-term period as this represents a hardness half-way between the current hardness (230 mg/L) and the regional background hardness (44 mg/L), in other words a hardness half-way to recovery to background levels. Concentrations of uranium in Island Lake are currently around 120 µg/L, which is substantially below the DSWQO corresponding to the hardness selected for the initial long-term period. Therefore, it is not expected that the uranium levels in Island Lake will exceed the appropriate hardness-dependent DSWQO during any given year.

Table 3.2: Predicted future peak mean surface water quality in the Island Creek and Cluff Creek watersheds [7]

Parameter	DSWQOs	Current WQGs	Island Creek watershed		Cluff Creek watershed			
			Snake Lake	Island Lake	Claude Lake	Claude Creek	Peter River	Cluff Lake
Year	-	120[d]	72	65	3.2	3.1	1.8	3.7
Chloride (mg/L)	-	128-429[bf]	133	117	202**	196**	21	12
Sulphate (mg/L)	50	5[a]	1.1	1.3	0.8	1.1	0.19	0.13
Arsenic (µg/L)	1	0.04-0.37[bd]	0.02	0.04	0.47**	0.5	0.05	0.03
Cadmium (µg/L)	20[g]	0.73[e]	0.16	0.19	5.4**	18**	1.7**	0.98**
Cobalt (µg/L)	10	2-4[ab]	0.24	0.2	2.8	7.3**	0.86	0.49
Copper (µg/L)	3.2 (Snake Lake) 1.0 (Island Lake)	0.3[a]	1**	0.21	-	-	-	-
Iron (mg/L)	73 (500 Island Lake)	31,000[a]	27	144	7.2	8.6	0.93	0.47
Nickel	25	25-150[ab]	0.91	2.3	18	126[h]	13	6.8
Molybdenum (µg/L)	10	1[a]	0.6	1.2**	0.32	0.45	0.15	0.12
Nickel (µg/L)	88[b]/274[h]	15[a]	8.4	97**[h]	50**	152**[i]	25**	11
Selenium (µg/L)	-	0.1[c]	0.02	0.04	9.0E-03	9.0E-03	4.0E-03	6.0E-03
Uranium (µg/L)	-	0.2[c]	0.03	0.04	0.02	0.02	0.02	0.02
Polonium-210 (Bq/L)	0.11	0.11[a]	0.11	0.05	8.0E-03	8.0E-03	6.0E-03	6.0E-03
Lead-210 (Bq/L)	-	0.6[c]	0.01	0.02	8.0E-03	8.0E-03	0.01	0.01

** values indicate peak exceedances of current WQGs.
Definition of units: mg/L = milligrams per litre; ug/L = micrograms per litre; Bq/L = becquerels per litre.
[a] Saskatchewan Environmental Quality Guidelines [43].
[b] Objective depends on hardness. Guideline values correspond to a hardness of 44 mg/L (based on levels at reference stations).
[c] Thorium-230, Lead-210 and Polonium-210 objectives based on Canadian Drinking Water Quality Guidelines [44].
[d] Cadmium and chloride objectives based on federal guideline value [45].
[e] Cobalt objective based on Federal Environmental Quality Guidelines [46]; calculated based on a hardness of 44 mg/L.
[f] Sulphate objective based on British Columbia's Water Quality Guideline to Protect Aquatic Life [47].
[g] For dissolved fraction.
[h] Not considered to exceed DSWQO [7]. The hardness dependent criteria were selected using a regional background hardness of 44 mg/L (DSWQO = 2xhardness); however, the average hardness measured in Island Lake (at station ISL4000S) over the recent period (2013 to 2017) was substantially higher, at 230 mg/L. A short-term hardness of 137 mg/L was adopted for the initial long-term period as this represents a hardness half-way between the current hardness (230 mg/L) and the regional background hardness (44 mg/L), in other words a hardness half-way to recovery to background levels. Concentrations of uranium in Island Lake are currently around 120 µg/L, which is substantially below the DSWQO corresponding to the hardness selected for the initial long-term period. Therefore, it is not expected that the uranium levels in Island Lake will exceed the appropriate hardness-dependent DSWQO during any given year.

Sediment quality

The potential effects of the site on sediment quality in the receiving environment were evaluated by comparing predicted COPC concentrations in sediment to SQGs. Due to the uncertainty surrounding SQGs, several guidelines are considered for evaluating predicted COPC sediment concentrations in the long term. These include the Lowest Effect Level (LEL) and Severe Effects Level (SEL) [65].

Island Creek watershed

Island Creek watershed received liquid effluent during operations and contaminants have accumulated in sediments in Island Lake. With the end of liquid effluent discharge, the contaminated sediments are predicted to recover, as clean sediments accumulate on top of the contaminated sediment. This has been supported by recent improvements to sediment quality in the exposure lakes relative to previous years. In the Cluff Creek watershed, widespread negative effects on the benthic community in the Island Creek watershed are not expected.

Table 3.3 provides a list of the SQGs as well as the peak mean sediment quality predictions for the base case scenarios.

Within the Island Creek watershed, future exceedances of the LELs are predicted for arsenic, molybdenum, nickel, selenium, uranium, radium-226, lead-210, and polonium-210 at some locations. No mean levels are expected to exceed the SEL values except in the case of selenium at the very beginning of the modelled period in Island Lake and Island Lake fen. Predictions indicate that by the end of the modelled period (that is, calendar year 7000), concentrations of COPCs will have dropped below guidelines.

Cluff Creek watershed

Within the Cluff Creek watershed, sediment predictions expected to exceed the applicable sediment LEL values at the maximum means are arsenic, copper, molybdenum, nickel, selenium, and uranium in Claude Lake and arsenic, nickel, selenium, and uranium in Cluff Lake. With the exception of selenium, all sediment predictions are expected to fall below the LEL value before the year 3500. Background concentrations of selenium in sediment are close to the LEL values, thus the additional groundwater load, although small, results in the concentration slightly exceeding the LEL. No mean levels are expected to exceed the SEL values. Predictions indicate that by the end of the modelled period, concentrations of COPCs will have dropped below guidelines.

As discussed earlier, exceedances of these benchmarks do not indicate that negative effects will occur but are instead used to identify those COPCs that require a more detailed analysis to better understand the potential magnitude and extent of potential effects on aquatic species and the benthic community.

Table 3.3: Predicted future peak mean sediment quality in the Island Creek and Cluff Creek watersheds [7]

Parameter	Canadian interim sediment quality guidelines for the protection of aquatic life [45]	Canadian Probable Effects level sediment quality guidelines [45]	LEL [48]	SEL [48]	No effect level[(a)]	Island Creek watershed			Cluff Creek watershed	
						Snake Lake	Island Lake	Island Lake fen	Claude Lake	Cluff Lake
Arsenic (µg/g)	5.9	17	9.8	346.4	522	10.6	12.5	24	8.8	32
Copper (µg/g)	35.7	197	22.2	268.8	-	8.8	12	3.7	36	23
Molybdenum (µg/g)	-	-	13.8	1238.5	245	115	467	548	57	7.4
Nickel (µg/g)	-	-	23.4	484	326	21	42	12	318	111
Selenium (µg/g)	-	-	1.9	16.1	29.7	7.6	22*	19*	2.6	2.1
Uranium (µg/g)	-	-	104.4	874.1	2296	64	395	355	489	137
Lead-210 (Bq/g)	-	-	0.9	20.8	-	0.72	0.21	0.2	0.06	0.4
Polonium-210 (Bq/g)	-	-	0.8	12.1	-	0.63	0.34	0.39	0.17	0.68
Radium-226 (Bq/g)	-	-	0.6	14.4	-	0.8	0.44	0.41	0.25	0.68

* values represent those above the SEL.

(a) NE2 stands for "No Effect Level" and represents site-specific benchmark values that should be protective of aquatic habitats and populations in general, although may not be protective of individual species [7].

Aquatic habitat and species

An assessment of potential effects on aquatic biota at the Cluff Lake Project and the surrounding area consists of characterizing the local habitat and species (including considering federal species at risk) and assessing the possibility of their exposure to radiological and hazardous substances, as well as physical stressors that may be disruptive to ecological receptors.

The list of relevant VCs for the aquatic environment that were considered in the assessment included aquatic plants (as primary food consumed by moose, muskrat, and other animals) phytoplankton, zooplankton, benthic invertebrates that live and feed within sediments, and forage fish (including lake whitefish (*Coregonus clupeaformis*) and white sucker (*Catostomus commersonii*)) and predatory fish (including northern pike and lake trout).

In Saskatchewan, the federal *Species at Risk Act* (SARA) [49] applies to species at risk. To comply with the legislation, and as part of the 2019 ERA [7], Orano identified wildlife species at risk that may potentially be found at or near the site. For the aquatic environment, a precautionary approach was taken and, although its presence is not confirmed, the northern leopard frog (*Lithobates pipiens*) was selected from the list to be carried forward into the assessment.

Exposure to radiological substances

The ERA assessed radiological exposures to the aquatic receptors over the long-term model time frame (that is, up to calendar year 7000) and compared their modelled exposures to the aquatic radiological benchmark of 9.6 milligray per day (mGy/d) [30]. All model results showed that doses to aquatic receptors were well below the benchmark throughout both the Island Creek and Cluff Creek watersheds. No impacts from radiological exposures to aquatic biota are expected [7]**.**

Exposure to hazardous substances

The ERA conducted a more in-depth assessment of aquatic biota exposed to COPCs that exceeded WQGs, as described earlier. As part of the assessment, predicted surface water quality concentrations were compared to species sensitivity distribution (SSD) curves, which are statistical representations of all available toxicity data that exists for a specific COPC for all species that have been tested. This assessment allows a more detailed and site-specific approach to be taken, whereby the predicted concentrations in surface water can be compared to the effect levels of more representative species (or surrogate species) that exist in the Cluff Lake Project area.

With respect to species at risk, the northern leopard frog was identified as a species at risk that is potentially in the area. To address potential risk to this receptor, amphibian toxicity data, where available, were included in the development of COPC SSDs. The model results showed that risks to amphibians were not expected at the modelled surface water concentrations for any COPCs in either the Cluff Creek or Island Creek watersheds.

Cluff Creek watershed

In the Cluff Creek watershed, concentrations of arsenic, molybdenum, and chloride are expected to remain below the WQGs over the assessment timeframe (that is, up to calendar year 7000), as discussed in earlier. No effects are expected from exposure to these COPCs.

For other contaminants assessed, including cadmium, cobalt, copper, nickel, uranium, and selenium, peak predicted concentrations in Claude Lake and Claude Creek are expected to temporarily exceed effects levels of some aquatic invertebrates and aquatic plants in the future, depending on the COPC. However, the majority of aquatic species are demonstrated to be protected. For example, the assessment of cadmium showed a 90% protection level for the aquatic community in Claude Lake and Claude Creek. This provides evidence that most aquatic species would remain unaffected by these exposures.

With respect to potential effects on benthic communities, as there were no operational releases to the Cluff Creek watershed, no impacts are expected. The most recent monitoring program results have shown that benthic communities in the exposed lakes are similar to those in corresponding reference lakes, which suggests that the benthic invertebrate community is relatively stable and unimpacted.

Island Creek watershed

In the Island Creek watershed, concentrations of cadmium, cobalt, copper, molybdenum, and nickel are expected to remain below the applicable WQGs over the assessment timeframe (that is, up to calendar year 7000), as discussed above. No effects are expected from exposure to these COPCs.

For other contaminants assessed, including chloride, iron, uranium and selenium, peak predicted concentrations in Snake Lake, Island Lake, and Island Lake fen are expected to temporarily exceed effects levels of some aquatic invertebrates and aquatic plants in the future, depending on the COPC. However, the majority of aquatic species are demonstrated to be protected.

With respect to selenium, which is known to bioaccumulate through aquatic food webs, Orano conducted a more detailed assessment by comparing selenium exposures in the Island Creek watershed to a protective fish tissue concentration of 11.3 µg/g dry weight (dw). In Island Lake, selenium is currently elevated due to the previous operational release of treated effluent to this waterbody. The assessment results showed that the concentrations are expected to fall steadily towards and then below the benchmark in the future in Island Lake. As future concentrations in Island Lake are expected to be lower than current conditions, the concentrations from the recent monitoring were used in a weight-of-evidence assessment. Monitoring has indicated that average selenium concentrations in the ovaries of fish taken from Island Lake in 2020, of 10.1 µg/g (dw), was below the U.S. EPA selenium benchmark of 15.1 µg/g (dw). In addition, the abundance of white sucker in Island Lake has been generally increasing in recent years, with a higher catch per unit effort in both 2009 and 2014 as compared to previous years [9]. In light of the evidence, impacts to fish from selenium exposure is expected to be low.

With respect to potential effects on benthic communities, Island Lake watershed was influenced by operational releases. The 2014 EMP provides evidence of sediment quality improvement in the exposure lakes in 2014 relative to previous years, and spatial and temporal evaluations of the benthic invertebrate communities in the shallow lakes within the Island Lake drainage suggest recovery is occurring. Taxa composition in Island Lake and Snake Lake was more similar to reference communities than in previous monitoring years. Furthermore, density, biomass, and

richness in Island Lake continued to increase in 2014 and were thus more similar to levels in the reference lakes than in previous years. As a result, potential effects on the benthic community are localized and variable by COPC; widespread negative effects on the benthic community in the Island Creek Watershed are not expected.

Findings

Based on CNSC staff's review of Orano's ERA and supporting documentation for the Cluff Lake Project, CNSC staff found that although there is potential for effects to some species in the aquatic environment, the majority of aquatic species will remain protected. In addition, for those species that may be affected, potential impacts are expected to be localized and temporary. It is important to note that the model results and the benchmarks used have an inherent level of conservatism applied, sometimes as high as several orders of magnitude, providing a large margin of safety. In light of this, and considering any potential impacts are expected to be localized, temporary, and influence a small number of aquatic species, the risk is anticipated to be low.

3.2.4 Terrestrial environment

An assessment of potential effects on terrestrial biota at the Cluff Lake Project and the surrounding area consists of characterizing the local habitat and species (including considering federal species at risk) and assessing the possibility of their exposure to radiological and hazardous substances, as well as physical stressors that may be disruptive to ecological receptors.

The list of relevant VCs for the terrestrial environment that were considered in the assessment included terrestrial birds, such as the nighthawk and bald eagle, as well as terrestrial-based mammals, such as hare and moose, which are an important aspect of a traditional land use diet. The full list included moose, eagle, mink, beaver, muskrat, otter, mallard, merganser, scaup, yellowlegs, nighthawk, and hare.

In Saskatchewan, the federal SARA [49] legislation applies to species at risk. To comply with the legislation, and as part of the 2019 ERA [7], Orano identified wildlife species at risk, which may potentially be found at or near the site. A list of these species is provided in table 3.3.

Table 3.3: Species at Risk assessed in the ERA [7]

Common name	Scientific name	SARA designation	Detected at site	Considered in assessment
Common nighthawk	*Chordeiles minor*	Threatened	Yes	Yes
Horned grebe	*Podiceps auritus*	Special concern	Yes	Scaup and mallard used as surrogate
Olive-sided flycatcher	*Contopus cooperi*	Threatened	Yes	Nighthawk used as surrogate
Peregrine falcon	*Falco peregrinus*	Special concern	No	Eagle used as surrogate
Rusty blackbird	*Euphagus carolinus*	Special concern	Yes	Nighthawk used as surrogate

Due to similarities between diets, the scaup and mallard were also selected to serve as surrogate species for the horned grebe, while the eagle served as a surrogate species for the peregrine falcon. The common nighthawk, an insectivore, served as a surrogate for 2 other listed avian insect-eating species that may be in the area, namely the olive-sided flycatcher and the rusty blackbird.

Exposure to radiological substances

The ERA assessed radiological exposures to the terrestrial receptors over the assessment time frame (that is, up to calendar year 7000), and compared their modelled exposures to the terrestrial radiological benchmark of 2.4 mGy/d [7]. All results showed doses to terrestrial receptors were well below the benchmark throughout both the Island Creek and Cluff Creek watersheds. The highest dose in the Island Creek watershed was 0.62 mGy/d to yellowlegs at Island Lake fen, and in the Cluff Creek watershed was 0.53 mGy/d to yellowlegs at Claude Lake [7].

For species at risk, a dose threshold value of 1 mGy/d was applied and is internationally accepted to represent a dose rate with no observable effects to biota. All terrestrial receptors were well below this dose. No impacts from radiological exposures to terrestrial biota are expected [7].

Exposure to hazardous substances

The ERA assessed the potential for effects to terrestrial biota from exposure to hazardous substances in the area over the assessment timeframe (that is, up to calendar year 7000). A probabilistic approach was taken to account for variability in a number of model parameters, where both mean and upper bound predictions were calculated. As per CSA N288.6, the daily intake rates of hazardous substances were compared to the lowest observable adverse effect levels (LOAELs), which are protective at the population level. For species at risk, the no observable adverse effect levels (NOAELs) were applied, as they provide an extra margin of safety where potential risk to individuals is of concern.

Cluff Creek watershed

The long-term model results showed no exceedances of the LOAELs at the mean predicted concentrations for the base case scenario to any of the terrestrial receptors in the Cluff Creek watershed. There were a few instances where the upper-bound results of the assessment did exceed the LOAELs for several receptors in Claude Lake. These included uranium and cobalt exposures to muskrat in Claude Lake, which are attributed in part to high variability between stations. There was also a slight exceedance of uranium and selenium in yellowlegs; however, given the inherent conservativeness in the assessment, this risk is considered to be low.

For species at risk, the nighthawk's (representing nighthawk, olive-sided flycatcher, and rusty blackbird) mean arsenic exposures in Cluff Lake exceeded the NOAEL benchmark in 2018, with levels currently decreasing and expected to be below the NOAEL after several hundred years. This exceedance is driven by naturally high arsenic concentrations in Cluff Lake sediment, which are conservatively assumed to transfer to insects. These receptors consume insects, and it was assumed that all insects can be represented by benthic invertebrate concentrations. It is unlikely that the nighthawk would only consume emergent aquatic insects, and their diet would be more varied to include terrestrial insects such as bees and beetles, with rusty blackbirds similarly consuming terrestrial insects and plant materials. Olive-sided flycatcher primarily

consumes bees. Therefore, the assessment is quite conservative, and impacts to terrestrial birds are not expected.

For the horned grebe (represented by the scaup and mallard) and peregrine falcon (represented by the eagle), exposures remained below the NOAELs, and no impacts are expected for individuals that may be present in the Cluff Creek watershed either currently or in the future.

Island Creek watershed

The long-term model results showed no exceedances of the LOAELs to moose or hare in the Island Creek watershed.

The mean predicted intakes of several other terrestrial receptors did exceed their respective LOAELs. This included selenium exposures in mink, which is associated with the large number of fish that mink consume. In Snake Lake, the upper-bound predictions showed slight exceedances of the LOAEL and were attributed to future selenium loading in groundwater. In Island Lake, exceedances of the LOAEL were attributed to current conditions associated with the past release of treated effluent during operation, and risks are predicted to decrease in the future. It should be noted that this is a conservative assessment as mink are assessed on a waterbody basis but have a home range between 0.06 and 16.3 km^2 and thus are not expected to be associated with a single waterbody. As a result, potential adverse effects are considered localized to Snake Lake and temporary, as recovery is expected.

In addition, the model results indicated that current levels of molybdenum, selenium, and uranium are above the benchmark in muskrat at Island Lake; however, this is attributed to the effluent released to Island Lake during operations. Levels are expected to decline over time as the system recovers from operational releases. Similarly, exposure to selenium exceeded the benchmark in yellowlegs in Island Lake at current conditions, and exposures are expected to decline as the system recovers.

With respect to the nighthawk, exceedances of the selenium benchmark were observed for current exposures in Island Lake and the Island Lake fen as a result of past operations and are predicted to decrease in the future with recovery.

With respect to species protected under SARA, the results show that under conservative exposure assumptions, there are limited predicted effects on individuals from the Island Creek watershed from exposure to arsenic (nighthawk, olive-sided flycatcher, rusty blackbird, and horned grebe) and selenium (nighthawk, olive-sided flycatcher, rusty blackbird, and horned grebe). The assessment of SAR was completed under a number of additional conservative assumptions, including characterizing insectivore bird diets exclusively with emergent aquatic insects at specific receptor locations and characterizing the peregrine falcon diet to be predominantly fish rather than small birds. These highly conservative assumptions, and the demonstration by the model results that the exposures are localized and temporary, provide confidence that the risk is low.

Findings

The results from Orano's 2019 ERA show that there is currently some potential for effects to terrestrial animals that may use Island Lake and the fen exclusively as a result of past operations. However, CNSC staff consider the risk to be low and exposures are expected to continue to decrease as recovery continues.

There is a very low likelihood, but some possibility, for effects to mink, muskrat, yellowlegs, and nighthawk that may use the Snake Lake or Claude Lake area during the time of peak concentrations in the future; however, these exposures are expected to be localized and temporary.

Based on the review of the 2019 ERA and supporting documentation, and given the conservativeness applied in the assessment approach, CNSC staff have found that the potential for impacts to the terrestrial environment is low and terrestrial biota are expected to remain protected.

3.2.5 Human environment

An assessment of the human environment at the Cluff Lake Project consists of identifying representative persons located within, or in proximity, to the site, and determining whether radiological or hazardous COPCs could impact their health by breathing the air, being on the land, drinking and swimming in surface water, and eating plants, fish and wildlife around the Cluff Lake Project area. In general, human receptors may be exposed to contaminants through 4 primary routes: dermal (skin), inhalation, incidental ingestion (soil) and ingestion of food and water. Representative persons are those individuals who, because of their location and habits, are likely to receive the highest exposures to radiological or hazardous substances from a particular source.

Orano's 2019 ERA [7] included a HHRA to assess the risk to humans from both radioactive and hazardous substances released from activities at the Cluff Lake Project. The base case scenario considered an adult, a child, and a toddler visiting the Cluff Lake Project and accessing 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, gathering berries, and camping in the immediate project area. In addition to ingestion of local foods, the receptors also drink water in the area. These assumptions are based on a 2005 workshop held on the decommissioning of the Cluff Lake Project with members of local indigenous communities to gain insights into the historic, current, and expected future traditional use of the land [7].

The assessment assumes that the traditional food obtained around the Cluff Lake Project during those 23 days is consumed for 6 months of the year, with the exception of moose, which is assumed to be consumed over the whole year. Consumption rates of traditional food are based on the Uranium City Country Foods Study, which is represenatative of a western northern Saskatchewan diet, and includes a high fish consumption diet [50]. These receptors were considered to be the most exposed individuals for potential radiological and hazardous contaminant exposures from the site. The human exposure assessment was considered for calendar year 2018 to calendar year 7000. The HHRA did not consider expsosure in air since the Cluff Lake Project has been decommissioned and there are no remaining COPC pathways from the project to air.

Exposure to radiological substances

The CNSC's *Radiation Protection Regulations* [32] prescribe radiation dose limits to protect workers and the public from exposure to radiation from licensed activities. Doses are either monitored by direct measurement or by estimation of the quantities and concentrations of any

nuclear substance released as a result of the licensed activities. The annual effective dose limit for a member of the public is 1 mSv per year.

With respect to radiological exposures, the highest predicted annual mean incremental (that is, not including background) total effective radiological dose was to the toddler receptor, of 0.305 mSv/year in the year 4000. This value is well below the CNSC regulatory public dose limit of 1 mSv/yr. Maximum doses to the adult receptor peaked around 0.1 mSv/yr and around 0.2 mSv/yr to the child receptor over the model timeframe. For all three receptors, the primary dose contributers are from the consumption of fish, mallard, and exposure to groundshine, with other exposure pathways being considered negligible. The reason why the toddler recieves a higher dose than the child or adult is primarily due to its age and size. Although a toddler is assumed to consume roughly half the amount of fish than the adult does, the toddler is considerably smaller, resulting in a higher dose.

As a bounding scenario, Orano conducted an assessment of a family living at the site full-time. In this assessment, conservative assumptions were used, whereby it was assumed that the resident obtains 70% of their drinking water from Cluff Lake and 30% from a background lake, such as Carswell Lake, which is a well known fishing lake about 15km north of the Cluff Lake Project site. In this scenario, which assumes the family also eats locally hunted and gathered foods, the predicted annual mean incremental total effective radiological dose was also to the toddler receptor, which reached 0.306 mSv/year at year 4000, and is comparable to the base case scenario.

The reason the peak mean dose in the bounding scenario is comparable to the base case scenario is due to several factors. As discussed above, consumption of fish, mallard, and exposure to groundshine are the primary factors contributing to dose. All other exposure pathways considered continue to result in a neglibile dose contribution in comparison, including from the increase in the consumption of local water. In addition, the consumption rates of the full-time resident remained the same as that of the base case receptor (that is, consumption of local moose all year, and other local traditional food 6 months of the year, taking into account seasonal changes in availability of traditional foods). The 0.001 mSv/year difference is primarily attributed to the additional dose from groundshine, as a result of increased exposure to the project area.

Exposure to hazardous substances

With respect to chronic exposures to hazardous substances, the HHRA calculated daily intakes of arsenic, cadmium, cobalt, coppper, molybdenum, nickel, selenium, and uranium, assuming a diet of traditional food obtained at and near the Cluff Lake Project for 6 months of the year. These mean daily intakes were compared to appropriate Health Canada Toxicity Reference Values (TRVs) [51].

For the base case scenario, daily intake rates for the adult, child, and toddler receptors remained well below their applicable TRVs for cadmium, cobalt, copper, molybdenum, and nickel. Arsenic and selenium had marginal TRV exceedances. However, arsenic and selenium total intakes are dominated by the intake from supermarket foods in a general Canadian diet, and the contribution from the Cluff Lake Project was marginal. Uranium intakes from the Cluff Lake Project in the near term contribute more to the total intakes than supermarket food; however,

total intakes remain below the TRV with the exception of the upper-bound intake for the toddler currently and the toddler and child in year 2400.

Considering that it is a conservative assessment, the results of the assessment do not indicate that changes to the health outcomes of people using the site and consuming country foods are expected, and it is safe to occasionally drink water from areas around the Cluff Lake Project, including Island Lake.

Similarily to the radiological HHRA, a bounding scenario was applied considering a family living at the site full-time. For non-radiological COPCs, the results were similar to the base case scenario (casual visitor), with the exception of uranium. Uranium daily intakes increased due to the increase in on-site drinking water. However, the mean daily intake rates remained below the TRV for all receptors and time periods. It should be noted that uranium concentrations are predicted to remain below the drinking water quality guideline in Cluff Lake throughout post-decommissioning.

Findings

The primary goal of decommissioning the Cluff Lake Project is to ensure that the site will be stable and safe for traditional land use both in the short term and the long term.

The results of the HHRA 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 (considering availability during different seasons), will not experience adverse effects from exposure to radionuclides or non-radionuclides.

The results of the risk assessment indicate that the site is safe for people who may hunt, fish, drink water, and gather (such as tea, berries) from the site. CNSC staff conducted detailed technical evaluations of Orano's 2019 ERA and confirmed that human health around the Cluff Lake Project will be protected in both the short term and the long term.

3.2.6 Cumulative effects

A formal cumulative effects assessment is not a requirement within CNSC staff's assessments for EPRs as it is not a requirement under the NSCA and other regulatory documents. However, CNSC staff's assessments do consider the accumulation of COPCs within the environment because of the facility or activity through the cyclical nature of ERAs, the monitoring data in annual reports, data from the IEMP, and results from any regional monitoring programs and health studies.

Licensees are required to meet onsite and near-field monitoring requirements associated with their provincial approvals and the federal regulations, including full life-cycle requirements. These programs focus on single operations with scheduled reports on performance submitted to the regulators. These activities are further supplemented by the CNSC's IEMP activities (see section 4.0), which focuses on local areas where Indigenous Nations and communities and members of the public could reasonably be expected to conduct recreational or traditional activities (that is, off-site accessible areas).

4.0 CNSC Independent Environmental Monitoring Program

The CNSC has implemented its IEMP as an additional verification that Indigenous Nations and communities, the public, and the environment around licensed nuclear facilities are protected. It is separate from, but complementary to, the CNSC's ongoing compliance verification program. CNSC staff's findings are supported by IEMP sampling and by the licensee's EP data and ERA predictions. The IEMP involves taking samples from publicly accessible areas around the facilities and analyzing the amount of radiological and hazardous contaminant substances in those samples. For the uranium mines and mills in northern Saskatchewan, CNSC staff, with the assistance of a qualified contractor, collect the samples and send them to an accredited laboratory for testing and analysis.

4.1 IEMP at the Cluff Lake Project

CNSC staff conducted IEMP sampling around the Cluff Lake Project in 2017. The sampling plan focused on radiological and hazardous contaminants with the consideration of Orano's EMP and the CNSC's regulatory knowledge of the site.

In 2017, CNSC staff collected the following samples in publicly accessible areas outside the perimeter of the Cluff Lake Project:

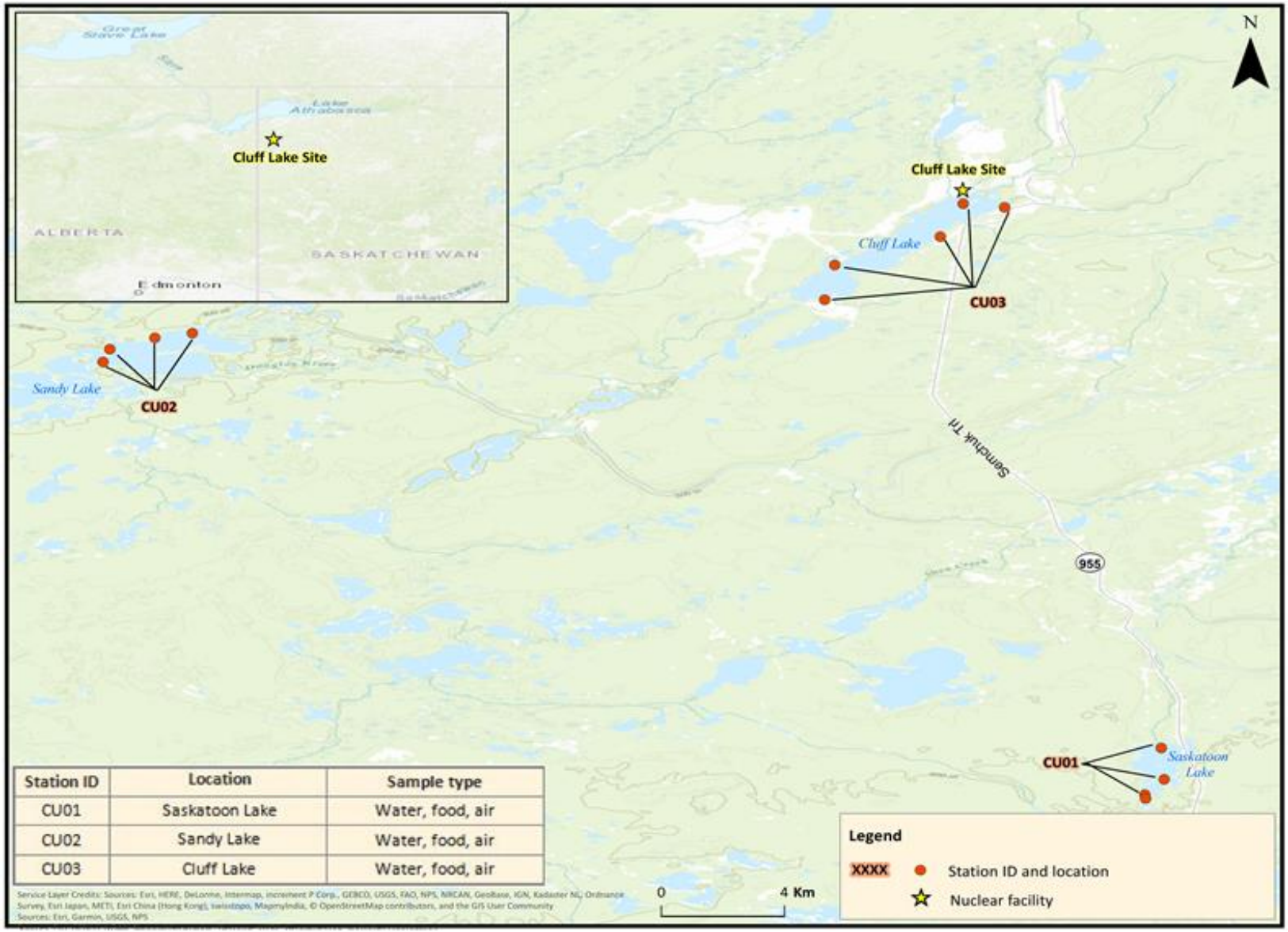
- radon in ambient air (3 locations, 3 samples per location)
- water (3 locations, 1 sample per location)
- fish (3 locations, 5 samples of a benthic fish (lake whitefish) and 5 samples of a pelagic fish (northern pike) per location)
- Labrador tea (3 locations, 5 samples per location)
- blueberries (3 locations, 5 samples per location)

Samples collected were analyzed by qualified laboratory specialists in an accredited laboratory, using appropriate protocols. As requested by CNSC staff, the laboratory specialists measured radionuclides (radium-226, thorium-230, polonium-210, and lead-210) and hazardous substances (arsenic, copper, lead, molybdenum, nickel, selenium, uranium, and zinc) in the collected samples. Water samples were also analyzed for ammonia, hardness, pH, and total suspended solids (TSS). Labrador tea and blueberry samples were also analyzed for moisture content to allow CNSC staff to convert the results from dry weight into wet weight to compare against the screening levels.

The radon samples were submitted to Radonova Inc. for analysis. Radonova Inc. is a company that is fully accredited with numerous global organizations to conduct radon measurements.

Figure 4.1 provides an overview of the sampling locations for the 2017 IEMP sampling campaign around the Cluff Lake Project. The IEMP results are published on the CNSC's IEMP web page for the Cluff Lake Project [52].

Figure 4.1: Overview of the 2017 IEMP sampling locations [52]



Station ID	Location	Sample type
CU01	Saskatoon Lake	Water, food, air
CU02	Sandy Lake	Water, food, air
CU03	Cluff Lake	Water, food, air

4.2 Indigenous participation in the IEMP

It is a priority for the CNSC that IEMP sampling reflect Indigenous traditional land use, values, and knowledge, where possible. In July 2017, in advance of the IEMP sampling campaigns at the Cluff Lake Project, notification emails were sent to the following Indigenous Nations and communities near the Cluff Lake Project: Athabasca Chipewyan First Nation, Clearwater River Dene Nation, Métis Nation of Saskatchewan Northern Region 2, Birch Narrows Dene Nation, and Buffalo River Dene Nation. Notification emails were also sent to certain individuals who had previously expressed interest in the Cluff Lake Project. CNSC staff invited the communities and individuals to send suggestions for species of interest, VCs, or potential sampling locations where traditional practices and activities may take place. CNSC staff did not receive any responses from the Indigenous Nations and communities or the individuals.

4.3 Summary of results

Most of the parameters in the samples measured during the 2017 IEMP sampling campaign at the Cluff Lake Project were below available guidelines and/or screening levels. There were some exceedances of the CNSC's conservative screening levels in polonium-210 and selenium in fish tissue, at both the reference (far from site) and exposure (close to site) locations. All these exceedances were within the natural background of the region. CNSC staff performed a detailed assessment of the screening level exceedances and found that the environment is protected and that there are no anticipated health impacts. Results for all campaigns and CNSC staff's assessment of the screening level exceedances are published on the CNSC's IEMP web page for the Cluff Lake Project [52].

The 2017 IEMP technical report for the Cluff Lake Project included CNSC staff's assessment of the chemistry results of a moose that was gathered near the Cluff Lake Project by an intervenor for the Commission meeting on the 2015 ROR for uranium mines and mills in Canada [53]. Samples of the moose were analyzed by a third-party laboratory, independent of the CNSC. CNSC staff's assessment of the chemistry results of the moose samples is provided in appendix A. CNSC staff found that the sampled moose was safe for consumption.

The CNSC's IEMP results from 2017 are consistent with the results submitted by Orano, supporting the CNSC's assessment that the licensee's EP program at the Cluff Lake Project is, and has been, effective. The results add to the body of evidence that the health and safety of persons and the environment in the vicinity of the Cluff Lake Project are protected.

5.0 Health studies

This section draws from the results of regional health studies, reports, and other studies to provide further independent verification on whether the health of people living near or working at the Cluff Lake Project, in northern Saskatchewan, is protected. Various organizations, such as the Saskatchewan Health Authority and the Northern Inter-Tribal Health Authority (NITHA), monitor the health of people living near the Cluff Lake Project. Disease rates of communities living near the Cluff Lake Project are compared to similar populations to detect any potential health outcomes that may be of concern.

Cancer is the main health concern for occupational and environmental radiation exposures, and is thus the focus of health studies of workers and people living near nuclear facilities such as the Cluff Lake Project; however, all health outcomes were reviewed. The following subsections discuss several health studies and reports that have assessed the health of people living near the Cluff Lake Project, including studies conducted by the CNSC to assess the health effects of workplace radiation exposure among Saskatchewan uranium workers.

CNSC staff continue to review health studies and reports conducted by the community health authorities and conduct CNSC-based health studies to assess the protection of human health. CNSC staff review any new publications and data related to the health of populations living near nuclear facilities. For additional information on health studies related to nuclear facilities, visit the CNSC's web page on health studies [54].

5.1 Population and community health studies and reports

5.1.1 Northern Saskatchewan Population Health Unit reports (latest to 2019)

The Northern Saskatchewan Population Health Unit (PHU) monitors the health and living circumstances of the people of northern Saskatchewan. This includes changes in population and community characteristics, determinants of health, health service use, and the health status and well-being of northern Saskatchewan residents.

The Northern Saskatchewan Health Indicators reports, developed by the PHU, provide an overview of the population of northern Saskatchewan. These reports include important community characteristics, determinants of health (that is, personal, social, economic, and environmental factors that influence health status), and health status and well-being indicators. This information is important to put the communities' health into perspective.

The PHU has published 2 Northern Saskatchewan Health Indicators reports, one in 2004 [55] and another one in 2011 [56], and updates and publishes health monitoring chapters on its Population Health Unit - Northern Saskatchewan web page [57]. In addition, older reports (from 1998) are available on the website for the Athabasca Health Authority, Keewatin Yatthé Regional Health Authority, and Mamawetan Churchill River Health Region.

Northern Saskatchewan Health Indicators report (August 2016) [58]

Community characteristics

Northern Saskatchewan is made up of the Keewatin Yatthé Health Region (KYHR), Mamawetan Churchill River Health Region, and Athabasca Health Authority. These are, by geographical size, the 3 largest health regions/authorities in Saskatchewan, together covering approximately 47% of the provincial surface area with over 70 communities and close to 40,000 individuals. The characteristics of the population of northern Saskatchewan are compared to the rest of the province (unless stated otherwise) to put people's health into perspective. The northern Saskatchewan geographical area encompasses all the uranium mine and mill facilities in Saskatchewan.

As of 2015, northern Saskatchewan has a much larger proportion of young people. Between 28% and 32% of its population is under 15 years of age, while only between 5% and 7% of residents are 65 years of age or older. Most people (85%) in northern Saskatchewan identify as Indigenous (approximately 68% as First Nation and 19% as Métis). Between 44% and 84% of the population in northern Saskatchewan reported having an Indigenous language as their mother tongue, and between 28% and 71% reported that an Indigenous language was the language they spoke most often at home.

Social determinants of health

Smoking rates in northern Saskatchewan have remained high over the last number of years. The overall smoking rate in northern Saskatchewan for 2013–2014 was 41%, which was elevated in comparison to many other northern regions in Canada. In addition, non-smoking individuals in northern Saskatchewan are more likely to be exposed to second-hand smoke in vehicles, public places, or at home compared to their provincial counterparts. Northern Saskatchewan has similar rates of heavy drinking, active physical activity levels, fruit and vegetable consumption, breast feeding initiation, sense of community belonging, and life satisfaction compared to other northern regions in Canada.

Note that the social determinants of health (SDOH) vary greatly among communities in northern Saskatchewan. Some communities score as good as, or better, than the province, while other communities struggle with rates that are up to 25 times worse than the province.

Health status

Significantly fewer people in northern Saskatchewan off-reserve communities report perceiving their own health status and mental health status as very good or excellent compared to the province. However, the northern Saskatchewan off-reserve population indicate similar rates of life stress compared to the province. The percentage of northern Saskatchewan off-reserve population reporting good to full functional health has remained relatively stable from 2009-2010 to 2013-2014, decreasing slightly from 78% to 76%. Similar rates are seen in the province and other northern regions in Canada.

Yearly total mortality rates in northern Saskatchewan have remained relatively stable over the past 10 years. Northern Saskatchewan rates have also consistently remained statistically greater than the province [59].

From 2005 to 2014, the leading causes of death in northern Saskatchewan were, in order; injuries, cancer, circulatory diseases, and respiratory diseases. However, in the KYHR, cancers were ahead of injuries as the leading cause of death. Some of the main specific causes of death in northern Saskatchewan include ischemic heart disease, intentional self-harm, lung cancer, motor vehicle collisions, cerebrovascular disease, and chronic obstructive pulmonary disease (COPD).

Injuries are the leading cause of death in most age groups in the north, with intentional self-harm, motor vehicle traffic accidents, assault, and accidental poisonings being most common. In the older age groups, chronic disease becomes the leading cause of death, with ischemic heart disease, lung cancer, and diabetes being most common. Of all deaths in northern Saskatchewan, 57% were deemed avoidable.

Cancer rates for all cancers combined in northern Saskatchewan are lower for males and similar for females when compared to southern Saskatchewan. From 2010 to 2014, the leading causes of cancer incidence (that is, new cancer cases) were breast, lung, and colorectal cancer in females, and prostate, lung, and colorectal cancer in males. However, lung cancer was by far the leading cause of cancer deaths for both sexes, followed by breast and colorectal cancer for females and colorectal and prostate cancer for males (2010 to 2014). Importantly, lung cancer rates (both cases and deaths) are greater in northern Saskatchewan compared to the province.

Cigarette smoking is the leading cause of lung cancer in northern Saskatchewan. The number of daily cigarette smokers is significantly higher in northern Saskatchewan compared to the provincial average. According to the First Nation Food Nutrition and Environment Study [60], the smoking rate in some northern Saskatchewan Indigenous Nations and communities is estimated to be approximately 4 times the provincial rate, at 79%. Therefore, the impact of tobacco use on cancer in northern Saskatchewan may be even greater than in the province as a whole due to a substantially higher smoking rate [61].

The total number of children (aged 0 to 14 years) diagnosed with cancer in Saskatchewan from 1990 to 2016 was 833. This included 23 children from northern Saskatchewan (about 1 child or fewer a year), meaning that childhood cancer rates are low [62].

Northern Inter-Tribal Health Authority health reports (latest 2010 to 2015)

The NITHA is an Indigenous partnership organization between the Prince Albert Grand Council, Meadow Lake Tribal Council, Peter Ballantyne Cree Nation, and Lac La Ronge Indian Band. The NITHA provides and maintains health services and public health programs in 33 Indigenous Nations and communities in northern Saskatchewan. The NITHA's Public Health Unit provides advice and expertise for various public health programs, including population health assessment, disease surveillance, health promotion, health protection, and disease and injury prevention. The NITHA's Public Health Unit also develops health-related resources, including health status reports, for its partner community members. These resources are available on the NITHA website [63]. According to the latest health status report from 2017, the leading causes of death for the NITHA's partner communities from 2010 to 2015 were cancer (32%), heart diseases (16%), accidental deaths (15%), and diabetes (8%) [63]. Lung cancer was the most common cause of death from cancer, representing approximately 32% of all cancer deaths [64].

5.1.2 Saskatchewan health status reports (latest 2016)

The Province of Saskatchewan produces health status reports that describe the health of the population and offer regional and, where possible, national comparisons. The health status reports draw from a variety of sources of information, including the Saskatchewan Ministry of Health's administrative health services databases, vital statistics, census data, and survey data (such as from the Canadian Community Health Survey). According to the latest Saskatchewan Health Status Report [65], the leading causes of mortality in Saskatchewan in 2009 were circulatory diseases, cancer, injuries, and respiratory disease. While the Province of Saskatchewan's website does not indicate when the latest report was published, the data used is older than 2011 (with most data ranging from 1995 to 2009).

A fact sheet on the prevalence of asthma, COPD, diabetes, ischemic heart disease (IHD), and heart failure in Saskatchewan from 2012 and 2013 [66] noted the prevalence of asthma was lowest in northern Saskatchewan compared to the province as a whole. However, the prevalence of COPD, diabetes, IHD, and heart failure was much higher in northern Saskatchewan compared to the provincial rates.

5.1.3 Saskatchewan Cancer Agency (latest by health region 2017)

From 2014 to 2017, the Saskatchewan Cancer Agency (SCA) collaborated with the Federation of Sovereign Indigenous Nations and with Métis communities on a 3-year cancer surveillance program to gain insight into how to serve First Nation and Métis Nations and communities better [67]. In partnership with 5 Indigenous communities across the province, the SCA collected information within these communities to ensure that they had access to appropriate cancer care programs and services. Working closely with communities was essential to this project, particularly in northern Saskatchewan, where engaging community members is important for proper communication on cancer prevention; for early detection; for cancer awareness, education, and surveillance; and for finding ways to support cancer patients and their families [68]. Youth engagement was also an important focus of this work.

The SCA also conducts cancer control reports, which profile cancer for regional health authorities. The most recent Saskatchewan Cancer Control Report from 2017 [69] combines the 3 northernmost health authorities (namely Mamawetan Churchill River, Keewatin Yatthé, and Athabasca) into 1 region called "the North". This region of the province is unique because its population is small and much younger than in the rest of the province. The northern Saskatchewan Health Indicators reports use the data in the Cancer Control reports. Cancer is most common in people over age 50. In 2014, 90% of new cancer cases diagnosed were in people aged 50 and over, with 96% of cancer deaths occuring among those aged 50 and over. This age group is growing in Saskatchewan and continues to comprise an increasing proportion of Saskatchewan's population. Thus, as the northern Saskatchewan population ages, one can expect to see more cancer cases and deaths. This has important implications for planning cancer screening, diagnostic, and treatment services.

5.1.4 Saskatchewan First Nations 2018 Health Status Report [70]

Overall, many Saskatchewan Indigenous Nations and communities continue to experience health disparities related to the SDOH [70]. These SDOH affect a community's health and wellness,

and contribute to the majority of health challenges faced by Saskatchewan Indigenous Nations and communities. Specifically, poverty, inadequate and overcrowded housing conditions, and food insecurity have contributed to the persistent burden of communicable and chronic diseases. Some of the highlights of this report are as follows:

Demographics: Overall, the registered Saskatchewan Indigenous population living in Indigenous Nations and communities has increased from 61,564 to 75,165 from 2006 to 2016. The northern Saskatchewan Indigenous population had an average growth rate of about 23.3% per year between 2006 to 2016, with an increase in population from 28,884 to 35,611.

About half of the Saskatchewan Indigenous population living in Indigenous Nations and communities is younger than 25 years of age, accounting for 51.2% of the Indigenous communities' population in 2016. This is projected to grow by 34%, from 75,165 in 2016 to 100,577 in 2034.

SDOH: These are the economic and social factors that influence the health of individuals and communities.

- Approximately 41% of the people living in Saskatchewan Indigenous Nations and communities speak an Indigenous language; Cree (26%) and Dene (10%) were the most common languages spoken at home. Culture and language are an SDOH for Indigenous peoples in Canada, and revitalization of Indigenous peoples' culture and language is considered a significant aspect to improve their health status.
- In 2015, 37% of Indigenous households in Saskatchewan Indigenous Nations and communities were classified as food insecure; 27% of the households were moderately insecure and 10% were severely insecure.
- The percentage of severely overcrowded households in Saskatchewan Indigenous Nations and communities remained relatively high but unchanged between 2006 and 2016 (16.2% and 16.6%, respectively). This compares to approximately 1% for people with non-Indigenous identities. In addition, households in Saskatchewan Indigenous Nations and communities in 2016 were 7.6 times more likely to need major repairs compared to households in non-Indigenous communities (51.1% and 6.7%, respectively).
- Saskatchewan Indigenous peoples ages 25 to 54 years attained higher levels of education in 2016 compared to 2006. About 56% of people in Indigenous Nations and communities had a high school diploma or equivalency certificate or greater in 2016.
- Between 2006 and 2016, the median income for Indigenous peoples ages 25 to 54 years old in Saskatchewan Indigenous Nations and communities increased by 40.2% from $11,312 to $15,861, respectively. However, there is a large income gap between Indigenous Nations and communities and non-Indigenous populations (median income $50,253 in 2016) in Saskatchewan.
- In Saskatchewan Indigenous Nations and communities, the employment rates among Indigenous peoples ages 25 to 54 decreased between 2006 and 2016 from 45.2% to 37.7%. This compares to the decrease from 86.8% to 85.0% for non-Indigenous identity people for the same time period.

5.2 Health studies of uranium mine workers

The Saskatchewan Uranium Miners' Cohort Study (SUMC Study) is a 2-part project conducted by the CNSC, the Government of Saskatchewan, and industry stakeholders in the early 2000s.

The CNSC, Government of Saskatchewan, University of Saskatchewan, and industry stakeholders are currently working in partnership to conduct the new Canadian Uranium Workers Study (CANUWS) [71], which will follow up on the health of about 80,000 past and present uranium workers, including miners, millers, and processing workers. This new study will consider workers from previous Canadian uranium worker studies, as well as present-day workers from northern Saskatchewan and Ontario.

The following subsections provide more information on the SUMC Study and the CANUWS.

5.2.1 Saskatchewan Uranium Miners' Cohort Study

Part 1 of the SUMC Study [72] [73] looked at the relationship between lung cancer (deaths and new cancer cases) and exposure to radon and its decay products in a group of Eldorado uranium workers who worked at the Beaverlodge and Port Radium uranium mine sites and Port Hope radium and uranium facility from 1932 to 1980. Workers' mortality and cancer incidence were followed until 1999. This study represents an update of the original Eldorado study group (or cohort) that looked at mortality at the Beaverlodge [74] and Port Radium [75] mine sites from 1950–1980.

Part 1 of the SUMC Study makes the following conclusions:

- Most past uranium workers were male and, overall, uranium mining, milling, and processing workers were as healthy as the general Canadian male population.
- Lung cancer was the only disease that consistently showed significantly higher death and cancer incidence rates among uranium workers.
- Overall, the excess risk of lung cancer death and cancer incidence increased linearly with increasing radon exposure.
- There was no relationship between radon exposure and any disease, other than lung cancer.

Part 2 of the SUMC Study [76] determined whether it was scientifically possible to assess the number of excess lung cancers from the relatively low radon exposure in modern miners from 1975 onward. The type of risk assessed was the increased risk of lung cancer resulting from radon exposure. The study considered factors such as smoking and residential radon exposure as potential confounding factors of the relationship between lung cancer and radon.

Part 2 of the SUMC Study made the following conclusions:

- Present-day Saskatchewan uranium miners have radon exposures that are significantly lower than those of past miners because of dose limits, improved mining techniques, and other radiation protection practices.
- By the year 2030, about 24,000 workers will have spent time working at a uranium mine. During the period under study, 141 miners are expected to develop lung cancer, primarily from tobacco smoking. Only 1 additional miner could expect to get lung cancer from exposure to radon in the workplace.

- It is not feasible to investigate the risk of excess lung cancer in modern miners because exposures are so low. It is also practically impossible to correct for the effects of smoking and residential radon, factors that could greatly affect the study results.

However, CNSC staff continue to monitor the occupational exposures of uranium miners to ensure they remain as low as reasonably achievable. The National Dose Registry maintains exposure records indefinitely.

5.2.2 The Canadian Uranium Workers Study [71]

The CANUWS is a multi-year project initiated by CNSC staff in 2017 to assess the health effects of occupational radiation exposure among uranium workers [77]. The project involves researchers from the CNSC, Health Canada, and the University of Saskatchewan. This retrospective cohort study will assess the information of over 80,000 Canadian uranium mine, mill, and processing workers with occupational radiation exposures from 1932 to 2017. The study will follow up on workers' mortality (1950 to 2017) and cancer incidence (1969 to 2017).

The main objective of the CANUWS is to study the relationship between radon and lung cancer, especially the potential health effects of low cumulative radon exposures and exposure rates. This is possible due to high-quality exposure measurements and the long-term follow-up of workers' health outcomes, with the consideration of workers employed after radiation protection measures were in place. The findings of the study will help to assess the adequacy of occupational radiation safety standards and support future licensing recommendations.

The CANUWS was planned to be completed by 2022–2023; however this timeline may be extended because of delays in data linkage and data access as a result of the COVID-19 pandemic. In June 2022, CNSC staff presented an update of the study's progress to the Northern Saskatchewan Environmental Quality Committee. In addition, annual study progress reports are communicated to interested parties, such as impacted workers and Indigenous Nations and communities.

5.3 Summary of health studies

Ongoing review and conduct of health studies and reports is an important component of ensuring that the health of people living near or working in nuclear facilities is protected. Overall, many Saskatchewan Indigenous Nations and communities continue to experience health disparities related to the SDOH [92] that affect a community's health and wellness, and that contribute to the majority of health challenges faced by Saskatchewan Indigenous Nations and communities.

The population and community health studies and reports indicate that the most common causes of death among the northern Saskatchewan population are cancer and heart disease, alongside injuries, respiratory diseases, and diabetes. This is similar to the rest of Canada, where heart disease and cancer are the 2 leading causes of death. The exception is Nunavut, where heart and respiratory diseases are the leading causes of death [77].

In northern Saskatchewan, cancer is predominantly seen in people aged 50 years and older, which is not atypical given that cancer rates tend to increase as a population ages. Overall, cancer rates for all cancers combined in northern Saskatchewan are lower for males and similar for females when compared to southern Saskatchewan. However, lung cancer rates are greater in

northern Saskatchewan compared to the provincial average, and lung cancer is the most common cause of cancer death in Indigenous Nations and communities in northern Saskatchewan. To put this into perspective, lung cancer is projected to continue to be the most commonly diagnosed cancer and the leading cause of cancer death in Canada in 2020, accounting for 1 in 4 of all cancer deaths [78]. Colorectal, breast, and prostate cancer are also leading causes of cancer incidence and mortality.

According to the Canadian Cancer Society, about 72% of lung cancer cases in Canada are due to smoking tobacco [78] [79]. Other factors include second-hand smoke, radon, asbestos, occupational exposure to certain chemicals, outdoor air pollution, family history, and radiation. The number of daily smokers in northern Saskatchewan is significantly higher than the provincial average [58] [60]. Furthermore, the proportion of Saskatchewan residents who reported daily or occasional smoking was significantly higher than that of Canadian residents [80]. In Canada, exposure to indoor radon is the second leading cause of lung cancer [81]. Research from the Saskatchewan Cancer Agency has demonstrated that community work is essential to cancer control, particularly in northern Saskatchewan, where the focus should be on cancer prevention and education, and ways to support cancer patients and their families [69].

Studies of uranium workers help us assess workers' health and understand the relationship between workplace radiation and health. Part 1 of the SUMC showed that the overall health of workers employed at mines between 1932 and 1980 was similar to the general male population, except for lung cancer incidence and mortality, which were significantly greater in workers compared to the general male population. The risk of lung cancer increased linearly with increasing radon exposure. Part 2 of the SUMC demonstrated that assessing the risk of excess lung cancer resulting from radon exposure in modern miners from 1975 onward is not feasible because exposure is too low and correcting for the effects of smoking and residential radon would be practically impossible. However, strict radiation protection measures exist, including the ongoing monitoring of occupational exposure, to ensure the protection of uranium workers' health. Most recently, CNSC staff and other stakeholders started a new study of all past and present Canadian uranium workers. This large study will add to the understanding of the relationship between radon and lung cancer, especially at the low cumulative exposure and exposure rates of today's workers.

The Cluff Lake Project is not likely to cause any radiation-related illness because radiation exposures are so low. However, there are a number of contributing factors in northern Saskatchewan Indigenous Nations and communities that affect the community's health and wellness, and contribute to their health challenges. CNSC staff know the importance of the environment on Indigenous health and wellness and the social/mental/spiritual effects that the Cluff Lake Project may have. CNSC staff will continue to work with Northern Saskatchewan Indigenous Nations and communities to address these concerns.

6.0 Other environmental monitoring programs

In instances where monitoring programs are carried out by other levels or bodies of government, CNSC staff will review their findings as additional confirmation that the environment and the health and safety of persons around the facility in question are protected. A summary of these programs and their findings is provided below.

6.1 Eastern Athabasca Regional Monitoring Program

Due to community concerns related to cumulative impacts from multiple operations, the Eastern Athabasca Regional Monitoring Program (EARMP) was launched in 2011 with funding by the Government of Saskatchewan and industry (Cameco and Orano). The CNSC became a funding partner in 2017-2018. The following year, the EARMP was extended with the signing of a 5-year funding agreement (from 2018-2019 to 2022-2023) between the CNSC, the Government of Saskatchewan, and the uranium mine and mill industry. It should be noted that the EARMP does not include the Cluff Lake Project, as it falls outside of the EARMP's study area.

The EARMP is an environmental monitoring program designed to gather data on potential cumulative impacts downstream of uranium mine and mill operations. The EARMP is made up of 2 programs: the community program and the technical program. The community program monitors the safety of traditionally harvested country foods. The technical program monitors the aquatic environment at reference and far-field stations to determine if there are any cumulative impacts to aquatic communities. Both components involve a high level of community involvement and communication and have been implemented by a local Indigenous-owned environmental consulting firm.

The technical program was established to monitor potential long-term changes in the aquatic environment downstream of uranium mining and milling operations, where drainages from multiple discharges combined. Four cumulative assessment areas (one at each outlet of Wollaston Lake, Waterbury Lake, and Crackingstone Inlet on Lake Athabasca) and three reference areas (Cree Lake, Pasfield Lake and Ellis Bay on Lake Athabasca) were established. The complete suite of media and analyses were completed at these sites with additional supplemental data identified from Bobby's Lake (2009 and 2012) and Wollaston Lake Ivison Bay (at reference station #4 in 2008 and 2012). Sampling involved water, sediment, and fish tissue for chemical analyses along with collections to characterize the benthic macroinvertebrate community composition. All of these remote locations are realistically only accessible via aircraft. Sampling campaigns were completed in 2011 and 2012 to establish a current baseline with an asssessment campaign completed in 2015. The assessment concluded there was little evidence of change from the baseline monitoring period and the assessment period [82].

The community program monitors the safety of traditionally harvested country foods through analysis of water, fish, berries, and wild meat (namely grouse, rabbit, caribou, and moose) from northern Saskatchewan communities. Samples are collected from areas identified by community members, who either assist in sample collection or provide samples from their own harvesting activities. The community based prgram has involved consistent annual sampling of water and fish with the additional media sampled on a cyclical basis since the establishment of the initial current baseline (2011-2012).

6.1.1 Findings

Although the Cluff Lake Project is not included in the EARMP study area, CNSC staff chose to include a summary of the EARMP in this EPR report given its importance to northern Saskatchewan and for informational purposes as comparison to operational mines and mills. The results of the program showed that concentrations of COPCs have been relatively consistent over time and generally within the regional reference range. This indicates that there is no evidence of long-range transport of contaminants associated with uranium mining and milling, that fall within the EARMP study area. Thus, the EARMP concludes that water and country foods are safe for consumption. CNSC staff reviewed the EARMP technical reports and data and agree with the EARMP's conclusions.

The EARMP technical reports and data are available on the EARMP website [83].

6.1.2 Future of EARMP

With the 2022/23 fiscal year being the last year of the current EARMP funding agreement, the EARMP partners have been considering its future. Uranium mining and milling activities, regional and community monitoring programs, and resident and Indigenous expectations and capabailities regarding active participation and engagement in environmetal stewardship have all substantially changed since EARMP's inception in 2011. One of the current proposals is for the 2023/24 fiscal year to serve as a year of engagement with government (provincial and federal), industry, and Indigenous representatives to discuss regional monitoring within the Athabasca Basin as a whole and the future of EARMP specifically. The goal is to optimize environmetal monitoring and engagement activities to the benefit of those who work and live in the Athabasca Basin. CNSC staff are actively involved in discussions regarding the future of EARMP.

7.0 Findings

This EPR report focused on items of Indigenous, public, and regulatory interest, including physical stressors and future predictions at the Cluff Lake Project. Based on CNSC staff's assessment and evaluation of Orano's documentation, including the 2019 ERA and supporting documentation, CNSC staff have found the following:

- The potential for impacts to human health and the environment from radiological exposures is considered negligible.
- The potential for impacts to human health and the majority of environmental receptors from non-radiological exposures is considered negligible.
- There is potential for some impacts in the current environment to selected aquatic and terrestrial species from exposure to certain metals. However, given that the impacts are localized and temporary, and given the conservativeness applied in the model and assessment approach, the likelihood of these impacts is low.

Orano has developed a robust LTMMP that will be followed by the Province of Saskatchewan to confirm the predictions in the 2019 ERA and ensure that the engineered covers are performing as expected. CNSC staff are satisfied that the implementation of the LTMMP will ensure the protection 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.

As part of CNSC staff's review, a number of technical recommendations were made, including on the LTMMP. Orano has addressed all of the CNSC's comments and recommendations, and has included the following recommendations in an update to the LTMMP:

- Include 4 additional surface water quality monitoring stations, 2 located at Claude Lake and 2 located in Cluff Lake, near the points of groundwater discharge.
- Geotechnical inspections of the TMA cover could inform the need to monitor radon using a tiered approach.
- Should ponding water continue to be observed as part of geotechnical inspections, localized depressions on the TMA should be filled and remedial grading completed.

Orano has committed to including these as a recommendation in the LTMMP for the Province of Saskatchewan to consider and has allocated funds in the revised LTMMP to conduct these monitoring and maintenance activities.

CNSC staff's findings from this EPR report inform and support staff recommendations to the Commission in future licensing and regulatory decision making that pertain to the Cluff Lake Project. These findings are based on CNSC staff's reviews of documents associated with Orano's Cluff Lake Project, such as the submitted ERA documentation, and the conduct of compliance verification activities, including the review of annual and quarterly reports and onsite inspections. CNSC staff also reviewed the results from various relevant or comparable health studies to substantiate their findings. CNSC staff also conducted IEMP sampling around the Cluff Lake Project in 2017.

Abbreviations

Units

Bq	becquerel
kg	kilogram
km	kilometer
L	litre
mg	milligram
mGy	milligray
mSv	millisievert
µg	microgram

Acronyms

AECB	Atomic Energy Control Board
Amok	Amok Ltd.
CANUWS	Canadian Uranium Workers Study
CCME	Canadian Council of Ministers of the Environment
CEAA 1992	*Canadian Environmental Assessment Act* (1992)
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CMD	Commission member document
CNSC	Canadian Nuclear Safety Commission
COGEMA	COGEMA Resources Inc.
COPC	contaminant of potential concern
COPD	chronic obstructive pulmonary disease
CSA	Canadian Standards Association
CSD	comprehensive study for decommissioning
CSR	comprehensive study report
CWRP	Claude Waste Rock Pile
DDP	detailed decommissioning plan
DJ	Dominique-Janine
DP	Dominique-Peter
DSQO	Decommissioning Sediment Quality Objectives

DSWQO	Decommissioning Surface Water Quality Objectives
DW	dry weight
EA	environmental assessment
EAP	Environmental Assessment Policy
EARMP	Eastern Athabasca Regional Monitoring Program
EARP	Environmental Assessment Review Process
EASR	environmental assessment and safety report
EcoRA	ecological risk assessment
EMP	environmental monitoring program
EMS	environmental management system
EP	environmental protection
EPP	environmental protection program
EPR	environmental protection review
ERA	environmental risk assessment
HHRA	human health risk assessment
IAA	*Impact Assessment Act of Canada*
ICP	Institutional Control Program
IEMP	Independent Environmental Monitoring Program
IMS	integrated management system
KYHR	Keewatin Yatthé Health Region
LCH	licence conditions handbook
LEL	lowest effect level
LOAEL	lowest observable adverse effect levels
LTMMP	long-term monitoring and maintenance plan
mSv	Millisievert
NITHA	Northern Inter-Tribal Health Authority Health
NOAEL	no observable adverse effect levels
NSCA	*Nuclear Safety and Control Act*
Orano	Orano Canada Inc.
PHU	Population Health Unit
ROR	regulatory oversight report
SARA	*Species at Risk Act*
SCA	Saskatchewan Cancer Agency

SEL	severe effects level
SSD	species sensitivity distribution
SUMC Study	Saskatchewan Uranium Miners' Cohort Study
SQG	sediment quality guidelines
TMA	tailings management area
TRV	toxicity reference values
TSS	total suspended solids
UML	uranium mill licence
VC	valued component
WQG	water quality guidelines

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[81] Chen J., Moir D., & Whyte J., "Canadian Population Risk of Radon Induced Lung Cancer: A Re-Assessment Based on the Recent Cross-Canada Radon Survey," *Radiation Protection Dosimetry,* vol. 152(1-3), pp. 9-13, 2012.

[82] Canada North Environmental Services, "Eastern Athabasca Regional Monitoring Program 2015 - Technical Report Project No. 1916," 2016.

[83] Eastern Athabaska Regional Monitoring Program, "Reports," https://www.earmp.ca/reports

[84] Irvine J., & Lyster J., "Radionuclides and Trace Metals in Canadian Moose near Uranium Mines: Comparison of Radiation Doses and Food Chain Transfer with Cattle and Caribou," *Health Physics*, vol. 88(5), pp. 423-438, 2005.

Appendix A: CNSC staff's assessment of the moose gathered near the Cluff Lake Project

In December 2016, as an intervention for the CNSC's Regulatory Oversight Report for Uranium Mines and Mills and Historic and Decommissioned Sites in Canada: 2015, an intervenor presented the chemistry results of a moose that he shot near the Cluff Lake decommissioned site. The chemistry results were provided by SRC Analytical Laboratories. The following 2 paragraphs show CNSC staff's assessment of the chemistry results of the moose.

CNSC staff conclude that concentrations of contaminants in this specific moose, shown in table A.1, are typical of other moose sampled to date from various areas in the boreal forest in Saskatchewan and elsewhere in Saskatchewan. Relevant detailed information for interpretation of risks are found in a sampling program and risk assessment by Patricia Thomas et al. in a technical journal article in the May 2005 edition of Health Physics. This study analyzed tissues from 2 moose from Cluff Lake, 12 from other uranium mining sites in northern Saskatchewan, 20 moose and 4 cattle from southern Saskatchewan as a control. This study also made some comparisons from a previous study to a group of barren ground caribou that temporarily resided in the Wollaston Lake area.

As a relevant example of the consequences of a traditional diet consisting of considerable moose, the dose to a person consuming 100 grams per day of meat plus one liver and one kidney per year was found to be no higher than 0.31 mSv/year for the uranium mining area moose, versus 0.089 mSv/year for moose from southern Saskatchewan. For comparison, the dose from similar consumption rates for Wollaston caribou meat was 1.66 mSv/year because of polonium-210 and its association with lichens. As a result, CNSC staff conclude that the moose is safe to eat. It should be noted that as with any consumption of big game species in most parts of Canada, consideration should be given to limit the intake of kidney and liver due to the presence of some toxic metals such as cadmium, which highly accumulates in kidneys of large ungulates [84].

Table A.1: Results of the moose tissue analysis provided by SRC Analytical Laboratories

Parameter	Units	Moose tissue type			
		Kidney	Liver	Muscle	Bone
Lead-210	Bq/g	<0.004	0.003	<0.004	0.032
Polonium-210	Bq/g	0.025	0.015	0.001	0.014
Radium-226	Bq/g	<0.0003	<0.0002	<0.0002	0.0126
Thorium-230	Bq/g	<0.0004	<0.0003	<0.0004	<0.0051
Aluminum	µg/g	<2.2	2.2	2.8	1.5
Antimony	µg/g	<0.09	<0.05	<0.08	<0.06
Arsenic	µg/g	0.09	0.03	<0.04	<0.03
Barium	µg/g	1.3	0.44	0.12	260
Beryllium	µg/g	<0.009	<0.005	<0.008	<0.013
Boron	µg/g	<0.9	<0.5	<0.8	1.4
Cadmium	µg/g	36.2	1.5	0.03	<0.01
Chromium	µg/g	<0.4	<0.3	<0.4	<0.3
Cobalt	µg/g	0.241	0.122	0.012	0.430
Copper	µg/g	11.2	115	4.3	0.21
Iron	µg/g	170	188	114	11
Lead	µg/g	<0.009	0.011	<0.008	0.051
Manganese	µg/g	3.5	3.0	0.47	0.92
Molybdenum	µg/g	0.45	1.14	<0.08	<0.06
Nickel	µg/g	0.13	<0.03	0.08	0.05
Selenium	µg/g	1.61	1.52	0.43	0.04
Silver	µg/g	<0.009	0.098	<0.008	<0.01
Strontium	µg/g	0.45	0.14	0.08	140
Thallium	µg/g	<0.04	<0.03	<0.04	<0.03
Tin	µg/g	<0.04	<0.03	<0.04	<0.03
Titanium	µg/g	<0.04	<0.03	<0.04	0.11
Uranium	µg/g	<0.004	<0.003	<0.004	<0.01
Vanadium	µg/g	<0.09	<0.05	<0.08	<0.06
Zinc	µg/g	94	95	189	72

Results are reported on a dry weight basis.

Document availability

This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046, Station B
Ottawa, ON K1P 5S9
CANADA

Tel.: 613-995-5894 or 1-800-668-5284 (in Canada only)
Fax: 613-995-5086

Email: cnsc.info.ccsn@cnsc-ccsn.gc.ca

Website: nuclearsafety.gc.ca
Facebook: facebook.com/CanadianNuclearSafetyCommission
YouTube: youtube.com/cnsc-ccsn
Twitter: @CNSC_CCSN
LinkedIn: linkedin.com/company/cnsc-ccsn

PART TWO

Part Two provides all relevant information pertaining directly to the licence, including:

1. current licence UML-MINEMILL-CLUFF.00.2024
2. current licence conditions handbook UML-MINEMILL-CLUFF.00/2024
3. Cluff Lake End State Report
4. Notice from the Government of Saskatchewan on the Acceptability of the CLP to the ICP

CURRENT LICENCE

URANIUM MINE LICENCE
ORANO CANADA INC.
CLUFF LAKE PROJECT

I) LICENCE NUMBER: UML-MINEMILL-CLUFF.00/2024

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

Orano Canada Inc.
817 – 45th Street West
Saskatoon, Saskatchewan S7L 5X2

III) LICENCE PERIOD: This licence is valid from August 1, 2019 to July 31, 2024, unless otherwise suspended, amended, revoked, replaced or transferred.

IV) LICENSED ACTIVITIES:

This licence authorizes the licensee to:

a) possess, manage, and store nuclear substances that are associated with the Cluff Lake Project (hereinafter, "the facility") in the province of Saskatchewan, as shown on the drawing referenced in Appendix A to this licence.

V) EXPLANATORY NOTES:

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

b) The Cluff Lake Project Licence Conditions Handbook (LCH) identifies the criteria used to meet the conditions of this licence. The LCH also provides information regarding delegation of authority and document version control.

VI) CONDITIONS:

G. *GENERAL*

G.1 Licensing Basis for Licensed Activities

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

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

(ii) the conditions and safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence

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

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

G.2 Notification of Changes

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

G.3 Financial Guarantee

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

G.4 Public Information and Disclosure

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

1. *MANAGEMENT SYSTEM*

1.1 Management System

The licensee shall implement and maintain a management system.

2. *RADIATION PROTECTION*

2.1 Radiation Protection Program

The licensee shall implement and maintain a radiation protection program.

3. *CONVENTIONAL HEALTH AND SAFETY*

3.1 Conventional Health and Safety Program

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

4. *ENVIRONMENTAL PROTECTION*

4.1 Environmental Protection Program

The licensee shall implement and maintain an environmental protection program.

SIGNED at OTTAWA, this 25 day of July, 2019.

Rumina Velshi, President
on behalf of the Canadian Nuclear Safety Commission

e-Doc 5215940 (Word)
e-Doc 5795558 (PDF)

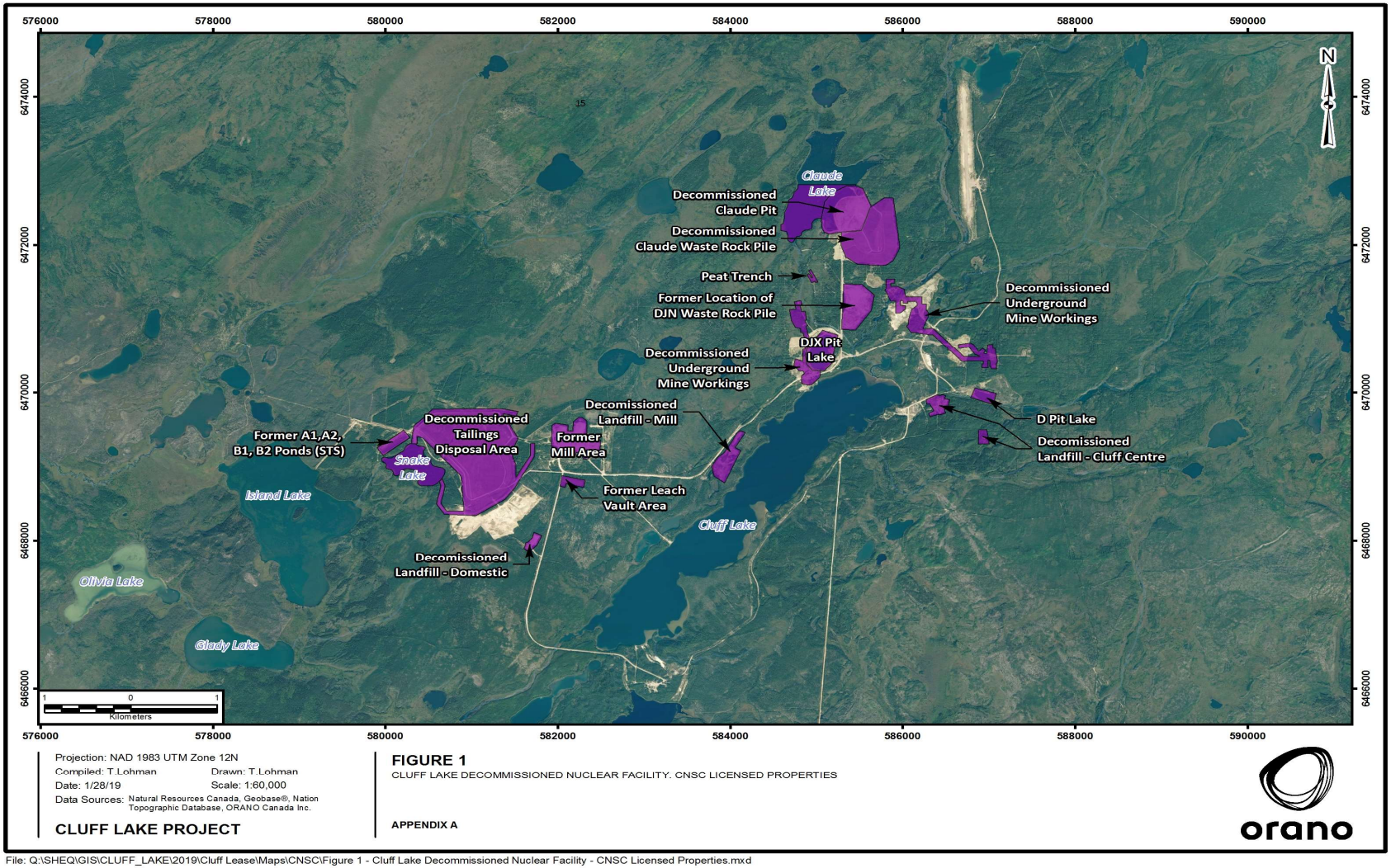
APPENDIX A

LOCATION AND SURFACE LEASE AREA OF THE CLUFF LAKE PROJECT

Figure 1 shows the properties (shaded in purple) that will be covered by this licence. For familiarity they are labelled to reflect their pre-decommissioning function during mining and milling operations.

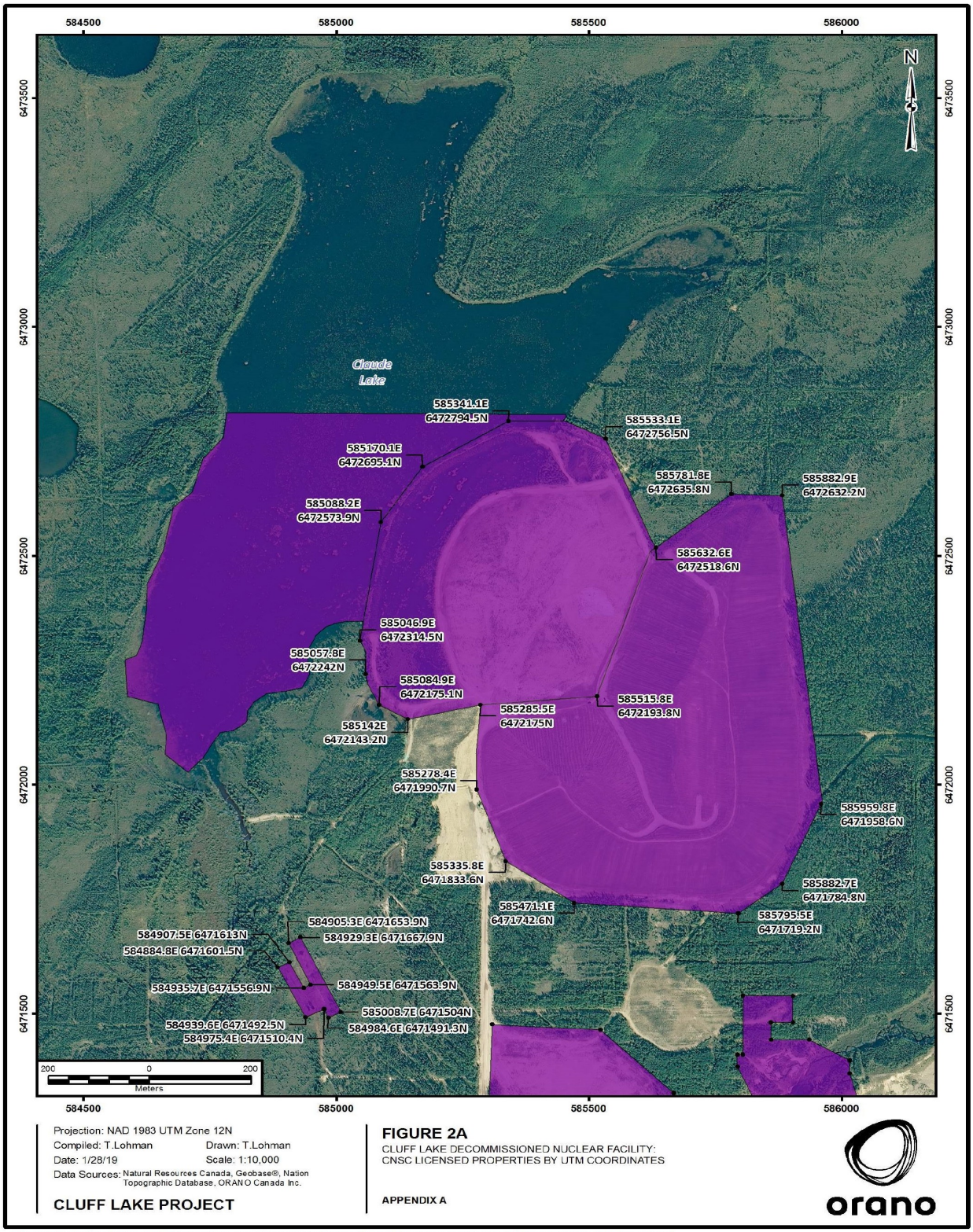
Figures 2.A to 2.F includes a series of detailed larger scale maps which label the actual Provincial lease numbers for all of the properties covered by this licence.

Figure 1 – Cluff Lake - CNSC Licensed Properties



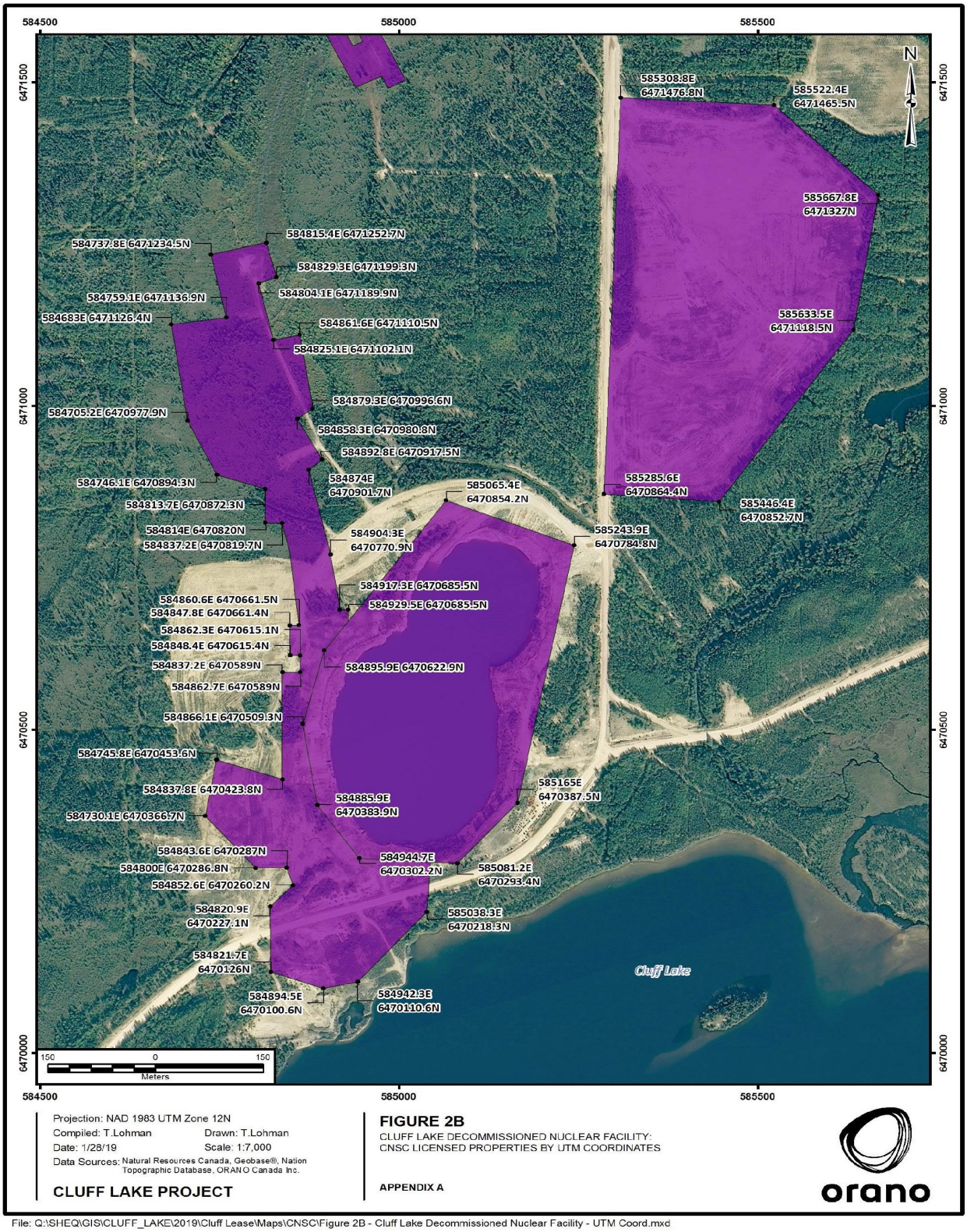
File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 1 - Cluff Lake Decommissioned Nuclear Facility - CNSC Licensed Properties.mxd

Figure 2.A Cluff Lake – CNSC Licensed Properties by UTM Coordinates



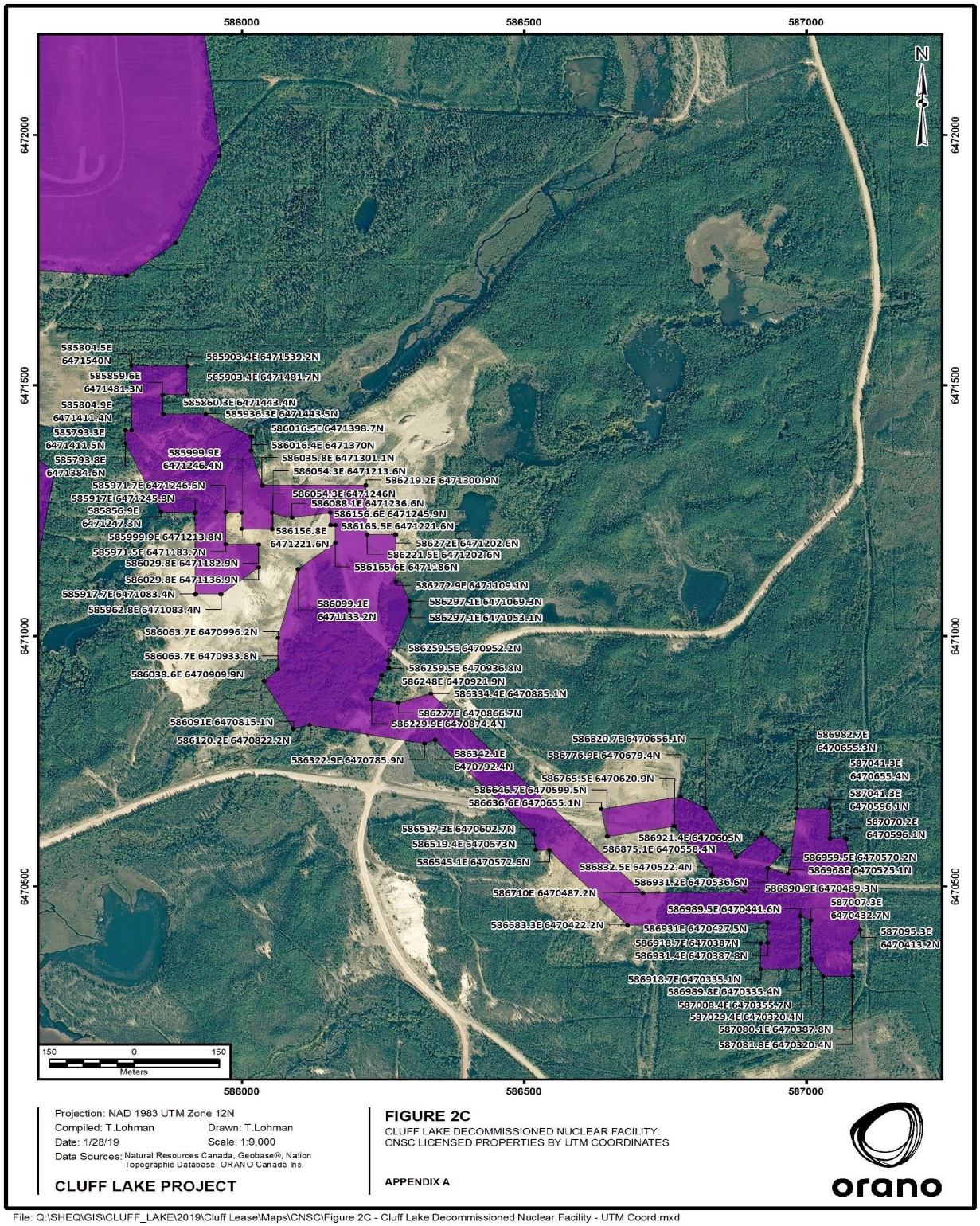
File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 2A - Cluff Lake Decommissioned Nuclear Facility - UTM Coord.mxd

Figure 2.B Cluff Lake – CNSC Licensed Properties by UTM Coordinates



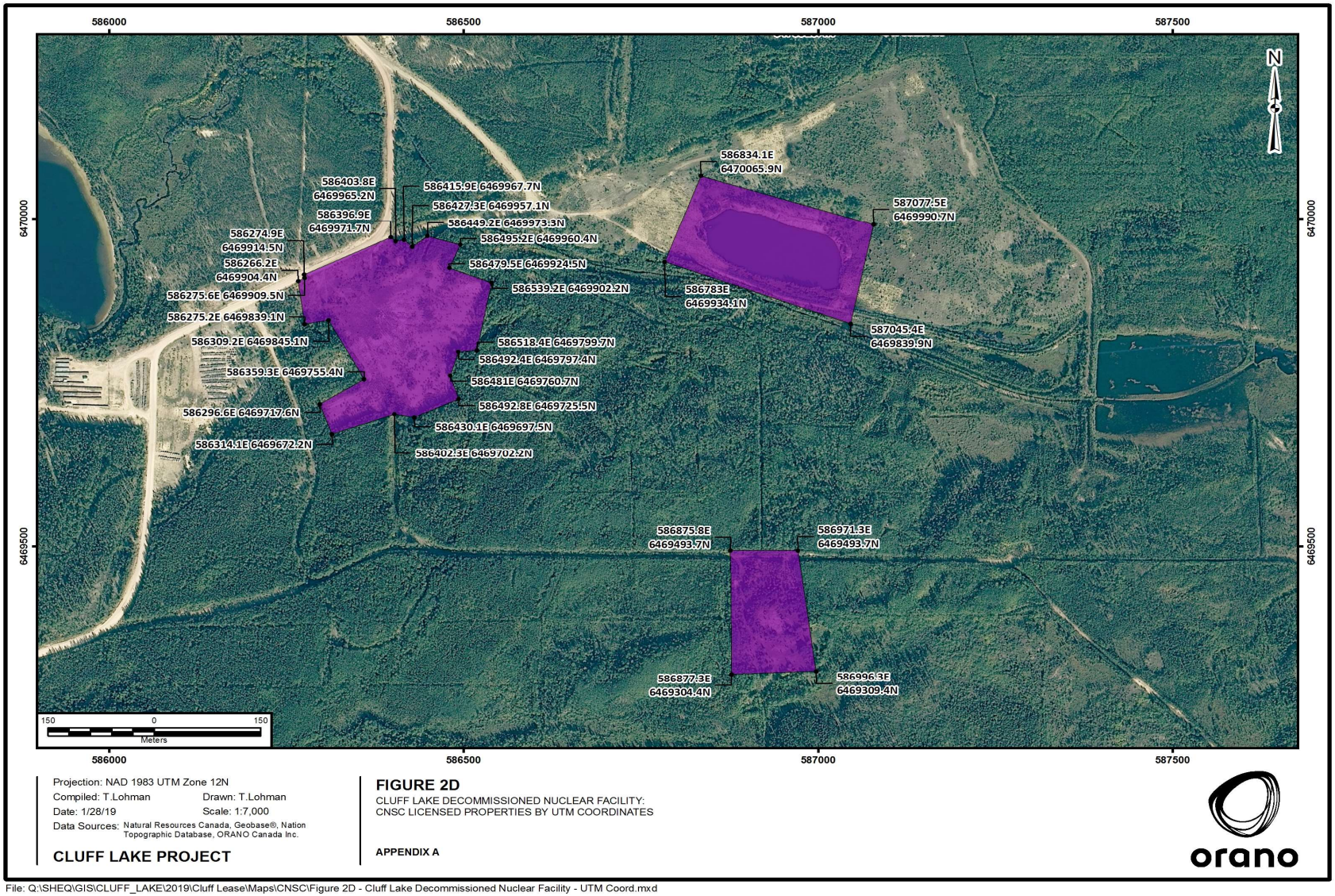
File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 2B - Cluff Lake Decommissioned Nuclear Facility - UTM Coord.mxd

Figure 2.C Cluff Lake – CNSC Licensed Properties by UTM Coordinates



File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 2C - Cluff Lake Decommissioned Nuclear Facility - UTM Coord.mxd

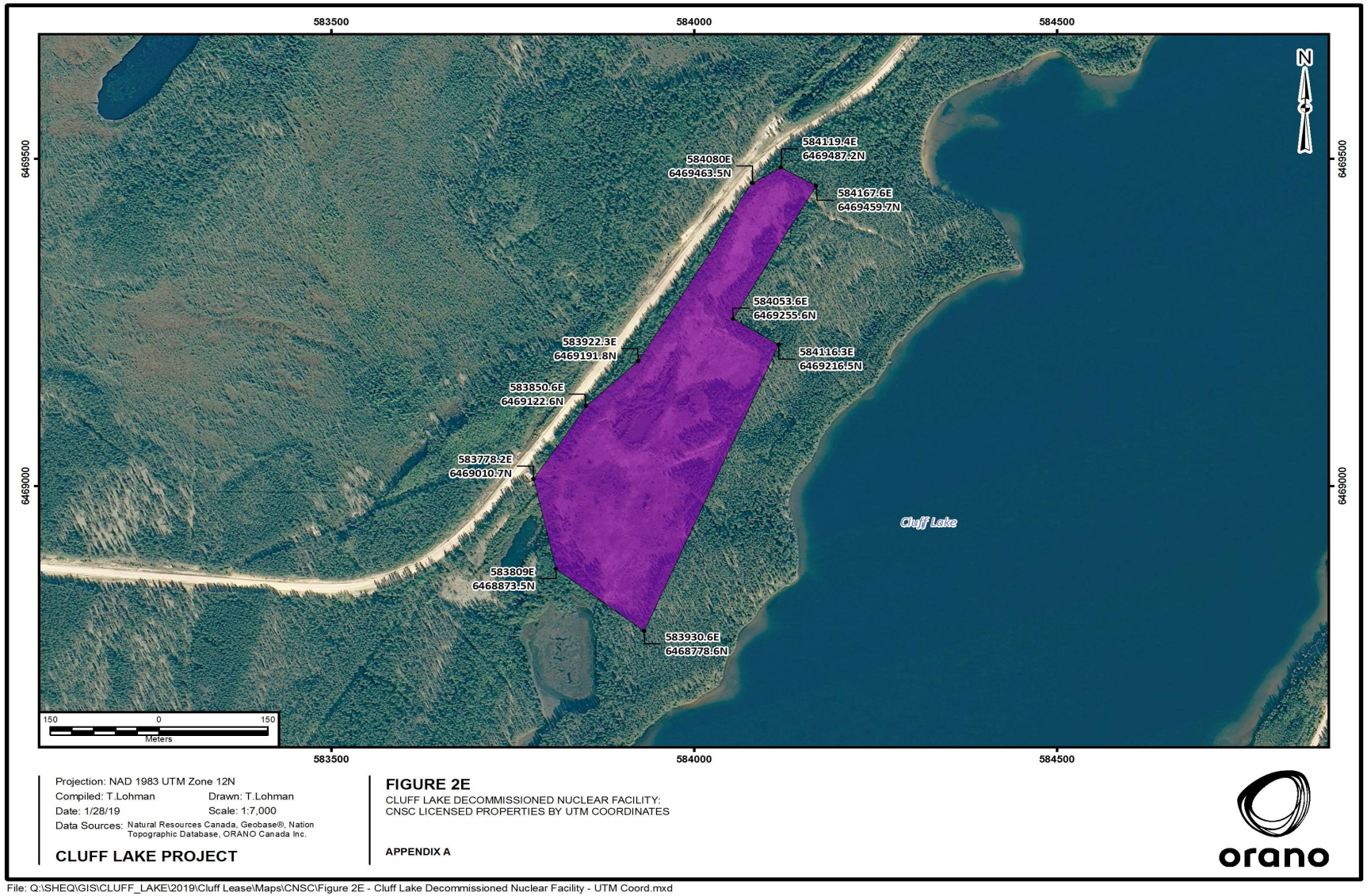
Figure 2.D Cluff Lake – CNSC Licensed Properties by UTM Coordinates



File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 2D - Cluff Lake Decommissioned Nuclear Facility - UTM Coord.mxd

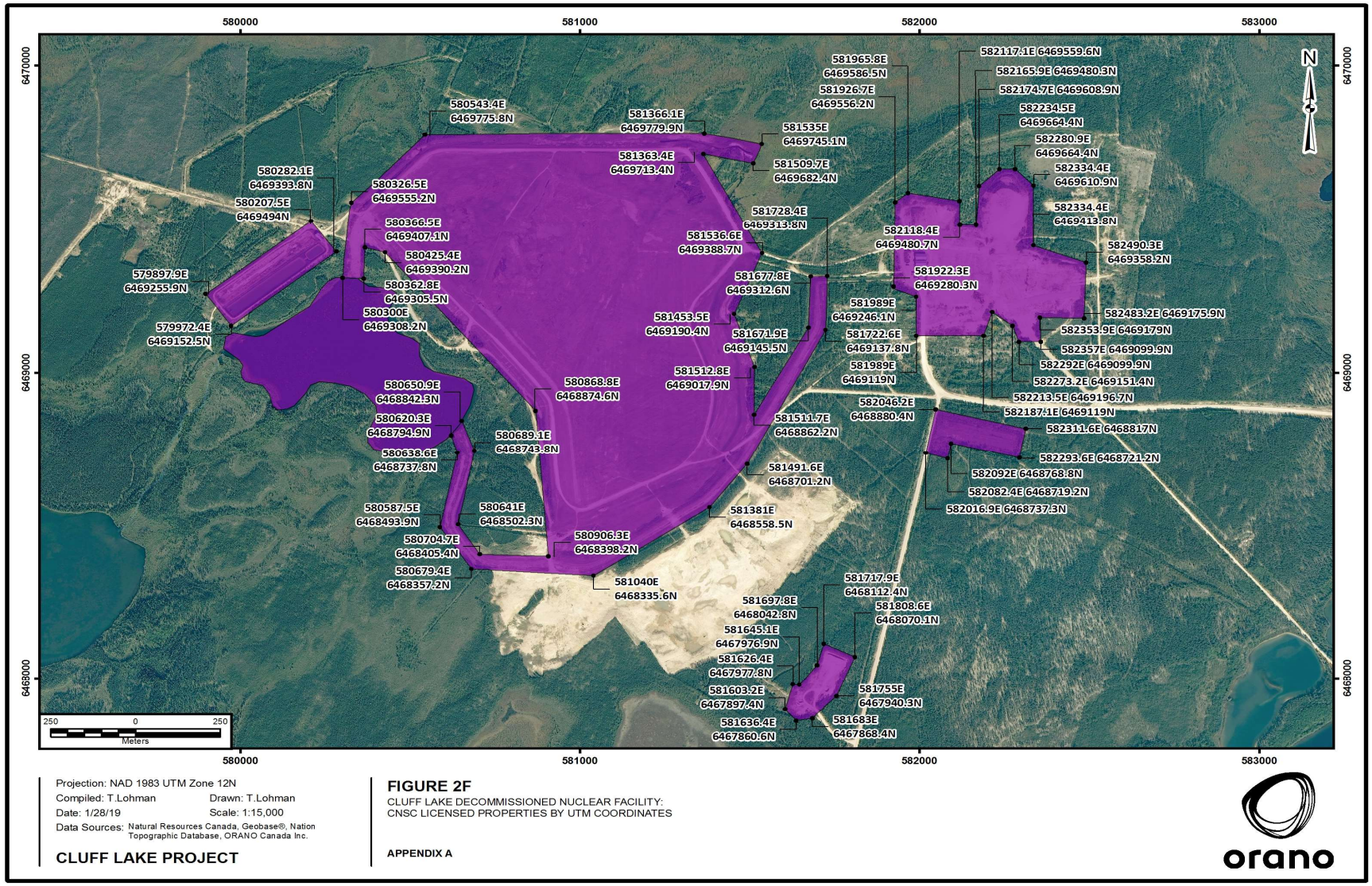
e-Doc 5215940 (Word)
e-Doc 5795558 (PDF)

Figure 2.E Cluff Lake – CNSC Licensed Properties by UTM Coordinates



File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 2E - Cluff Lake Decommissioned Nuclear Facility - UTM Coord.mxd

Figure 2.F Cluff Lake – CNSC Licensed Properties by UTM Coordinates



File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 2F - Cluff Lake Decommissioned Nuclear Facility - UTM Coord.mxd

CURRENT LICENCE CONDITIONS HANDBOOK

Canada's Nuclear Regulator

e-DOC 5725195 (Word)
e-DOC 5795671 (PDF)

LICENCE CONDITIONS HANDBOOK

LCH-MINEMILL-CLUFF.00/2024

CLUFF LAKE PROJECT
URANIUM MINE LICENCE

UML-MINEMILL-CLUFF.00/2024

Revision 0

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

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Licence Conditions Handbook **Effective: May 4, 2022**

LCH-MINEMILL-CLUFF.00/2024

Cluff Lake Project

Uranium Mine Licence

UML-MINEMILL-CLUFF.00/2024

(Effective: July 25, 2019)

SIGNED at OTTAWA this 4th day of May 2022

_____

Patrick Burton, Director
Uranium Mines and Mills Division
Directorate of Nuclear Cycle and Facilities Regulation
CANADIAN NUCLEAR SAFETY COMMISSION

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Revision History:

Effective Date	Revision	Section (s) Changed	Description of the Changes	CNSC Document Number
May 4, 2022	0	N/A	Original document	5725195 (Word) 5795671 (PDF)

TABLE OF CONTENTS

PART I - INTRODUCTION

The purpose of the licence conditions handbook (LCH) is to identify and clarify the relevant parts of the licensing basis for each licence condition (LC). This will help ensure that the licensee will maintain facility operations in accordance with the licence and the intent of the licensing basis. The intent of the licensing basis is to maintain the protection of the health, safety of the public and the protection of the environment. The LCH also provides information regarding delegation of authority, document version control and conflict resolution. The LCH should be read in conjunction with the licence.

The LCH has three parts under each LC: the Preamble, Compliance Verification Criteria (CVC), and Guidance. The Preamble explains the regulatory context, background, and/or history related to the LC. CVC are criteria used by Canadian Nuclear Safety Commission (CNSC) staff to oversee compliance with the LC. Guidance is non-mandatory information, including direction, on how to comply with the LC.

The statement "a person authorized by the Commission" in the LCs or the LCH indicates that the Commission may delegate certain authority to CNSC staff. Unless otherwise specified, the delegation of authority by the Commission to act as a person authorized by the Commission (Delegated Officer) is only applied to incumbents in the following positions[1]:

- Director, Uranium Mines and Mills Division
- Director General, Directorate of Nuclear Cycle and Facilities Regulation
- Executive Vice-President and Chief Regulatory Operations Officer, Regulatory Operations Branch

[1] Record of Decision for Commission Hearing 19-H3, September 17, 2019 (eDoc 5941005).

PART II – FRAMEWORK FOR EACH CONDITION

G. GENERAL

G.1 Licensing Basis for Licensed Activities

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

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

(ii) the conditions and safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence

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

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

Preamble

Licence condition G.1 requires activities (defined in Section IV of the licence) to be conducted in accordance with the licensing basis. Further information on the licensing basis is further discussed in CNSC's regulatory document REGDOC–3.5.3, *Regulatory Fundamentals*.

The licensing basis, established by the Commission at the time the licence is issued, sets the boundary conditions for a regulated activity, and establishes the basis for the CNSC's compliance program for that regulated activity.

Part (i) of licence condition G.1 includes, but is not limited to the following:

- *Nuclear Safety and Control Act*
- *Radiation Protection Regulations*
- *Impact Assessment Act*

The safety and control measures mentioned under Parts (ii) and (iii) of licence condition G.1 have the potential to affect the health and safety of people, the environment, security, or international obligations to which Canada agrees. These measures may be found in high-level programmatic documents but might also be found in lower level supporting documentation. Safety and control measures can also be found in licensing basis publications such as CNSC regulatory documents, CSA Group standards or licensee documentation submitted in support of a licence.

The CNSC licence authorizes Orano Canada Inc. (Orano) to conduct the following undertakings at the decommissioned Cluff Lake site, for which the CNSC provides regulatory oversight:

- maintenance activities associated with the decommissioned site, and
- environmental monitoring.

Compliance Verification Criteria

Licensing Basis Documents

Licensing basis documents are listed in appendix B in addition to tables under the most relevant LC. All "shall" or normative statements in licensing basis publications are considered CVC unless stated otherwise. If any "should" or informative statements in licensing basis publications are also considered CVC, this is explained under the most relevant LC.

In the event of any inconsistency between 2 elements of the licensing basis, the licensee shall consult CNSC staff to determine the approach to resolve the issue.

For operational activities that are not in accordance with the licensing basis, the licensee shall take action as soon as practicable to return to a state that is compliant with the licensing basis, taking into account the risk significance of the situation. Reporting requirements are outlined in CNSC's REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills* and discussed under LC 1.1 of this LCH.

Changes to documentation or activities which are not in accordance with the licensing basis must be approved by the Commission prior to implementation.

Guidance

When the licensee becomes aware that a proposed change or activity might not be in accordance with the licensing basis, it should first seek direction from CNSC staff regarding the potential acceptability of this change or activity. The licensee should take into account that certain types of proposed changes might require significant lead times before CNSC staff can make recommendations and/or the Commission can properly consider them. Guidance for notifications to the CNSC related to licensee changes are discussed under LC G.2.

G.2 Notification of Changes

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

Preamble

During the course of licensed activities, it is expected that the licensee may make changes to implement improvements or to address changes in operational needs. While making these changes it is imperative the licensee remains within the bounds of the licensing basis.

Appendix B provides a list of licensee documents that require notification of change. CNSC staff track the current version of these licensee documents in a document separate from the LCH (e-Doc 6035401).

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Changes to the design, operating conditions, policies, programs and methods that have the potential to be outside of the licensing basis require prior written notification to the CNSC. CNSC staff will confirm the change remains within the licensing basis and notify the licensee prior to implementation of the change by the licensee. The licensee shall allow sufficient time for the CNSC to review the change proportionate to its complexity and the importance of the safety and control measures being affected. Regular communication between the CNSC and the licensee should ensure review timelines are established prior to submission of a notification of change. It remains the responsibility of the licensee to ensure that the decommissioned Cluff Lake Project continues to operate within the bounds of the licensing basis.

Prior written notification shall include:

- a summary description of the change
- the rationale for the change
- expected duration (if not a permanent change)
- a summary explanation from the licensee supporting the conclusion that the change remains in accordance with the licensing basis.

Ongoing regular communication shall be maintained between the CNSC and licensee.

Guidance

A list of criteria to determine if a change would be in accordance with the licensing basis is provided in appendix A.

G.3 Financial Guarantee

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

Preamble

The licensee is responsible for all costs of decommissioning at the site, implementing the proposed decommissioning plan, and providing an appropriate financial guarantee that is acceptable to the Commission.

The licensee's decommissioning cost estimate is provided in the facility's detailed post-decommissioning plan. The facility's current financial guarantee is covered by specific financial instruments.

Compliance Verification Criteria

Orano has completed its planned decommissioning of the Cluff Lake Project operations. Currently, operations are restricted to surveillance and maintenance.

The latest revision of the detailed post-decommissioning plan and the estimation of the cost of managing the project into the foreseeable future were finalized in Orano's *Detailed Post-Decommissioning Plan, Post-Closure Monitoring and Maintenance.*

The Commission accepted Orano's revised financial guarantee for the surveillance and maintenance of the Cluff Lake Project for the amount of C$3.5M, as well as the financial instruments (letters of credit) used for the financial guarantee[2].

The financial guarantee for the decommissioned Cluff Lake Project is provided by the financial instruments.

Licensing Basis Publications

Source	Document Title	Document Number
CSA Group	Decommissioning of facilities containing nuclear substances	N294-09

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Yes
Orano	Surety Bond # BDTO-860042-019 [$3,496,920]	6762472	Yes

[2] *Record of Decision, Application for the Renewal of the Uranium Mine Licence for Cluff Lake Project*, (e-Doc 5941005).

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	G-206

G.4 Public Information and Disclosure

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

Preamble

The public information and disclosure program ensures that information related to the health and safety of persons and the environment and other issues associated with the lifecycle of the nuclear facility is effectively communicated to the public. In addition, the program shall include a commitment to and protocol for ongoing timely communications regarding emissions, effluent releases, unplanned events and other incidents and activities related to the licensed facility that may be of interest to the public.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Public Information and Disclosure	REGDOC-3.2.1

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	Cluff Lake Decommissioning Project Public Information Program Version 5	6782847	Yes
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Yes

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Indigenous Engagement	REGDOC-3.2.2
CNSC	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	G-206

1. MANAGEMENT SYSTEM

Licence Condition 1.1

The licensee shall implement and maintain a management system.

Preamble

The "management system" safety and control area covers the framework which establishes the processes and programs required to ensure an organization achieves its safety objectives, continuously monitors its performance against these objectives and fosters a healthy safety culture.

The management system must satisfy the requirements set out in the *Nuclear Safety and Control Act* (NSCA), regulations made pursuant to the NSCA, the licence and the measures necessary to ensure that safety is of paramount consideration in implementation of the management system. The licensee is required to implement and maintain a process for reporting information to the CNSC. This includes monitoring results, changes to facilities or approved activities, performance assessments and the occurrence of unusual events.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CSA Group	Management system requirements for nuclear facilities	N286-12
CNSC	Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills	REGDOC-3.1.2

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	Integrated Management System Manual	4385365	Yes

The licensee shall submit to the CNSC an annual compliance report by March 31 of each year, covering the operation for the 12-month period from January 1 to December 31 of the previous year.

CNSC staff will verify that Orano submits a written report, by the end of March each calendar year, summarizing Orano's activities including the results of environmental monitoring programs at the Cluff Lake Project. The annual report should include, at a minimum, information on:

- principal licensed activities completed
- results of the monitoring programs described in the documents found in appendix B
- a summary description of events reported to the Commission
- a summary description of any changes in the methods, procedures and equipment used to carry out the licensed activities.

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC/SK	CNSC – Saskatchewan Harmonized Annual Reporting Requirements	3678482

2. RADIATION PROTECTION

Licence Condition 2.1

The licensee shall implement and maintain a radiation protection program.

Preamble

The "radiation protection" safety and control area covers the implementation of a radiation protection program in accordance with the *Radiation Protection Regulations*. This program must ensure that contamination and radiation doses received are monitored, controlled, kept as low as reasonably achievable (ALARA), with social and economic factors taken into account.

There are no full-time workers at the Cluff Lake site and most maintenance and monitoring work is completed by contractors. Estimated radiation doses to workers are well below the regulatory public dose limit of 1 mSv/year; therefore, Orano is not required to ascertain individual worker dose. Workers are not required to wear licensed dosimetry to measure and monitor dose.

The overall radiation risks for workers and the public accessing the decommissioned Cluff Lake mine and mill site are low because of the low levels of radiation.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	Integrated Management System Manual*	4385365	Yes
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Yes

* Pertinent information from the Code of Practice – Radiation Protection incorporated into document

The radiation protection (RP) program will be assessed against the following principles:

2.1.1 Worker's, supervisors and contractors will have the qualifications (knowledge, skills, experience) needed to effectively perform RP practices for any work activity with a project exposure ≥ 0.1 mSv.

2.1.2 Radiological conditions are monitored, and sources of internal and external radiation exposures are controlled commensurate to the ALARA principle.

2.1.3 RP instrumentation and equipment are calibrated, maintained and used so that radiation levels are accurately determined. Uncalibrated equipment is removed from use.

2.1.4 Personal dosimetry will be used by individuals for any activities with a predicted exposure > 0.1 mSv.

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Ascertaining and Recording Radiation Doses to Individuals	G-91
CNSC	Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"	G-129

3. CONVENTIONAL HEALTH AND SAFETY

Licence Condition 3.1

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

Preamble

The "conventional health and safety" safety and control area covers the implementation of a program to manage workplace safety hazards and to protect personnel and equipment.

The regulation of non-radiological health and safety at uranium mines and mills is governed by the *Canada Labour Code Part II*, which is administered by Employment and Social Development Canada. However, the *Saskatchewan Uranium Mines and Mills Exclusion Regulations* (SOR/2001-115) defer the regulation of occupational health and safety in Saskatchewan uranium mines and mills to the province of Saskatchewan in accordance with the requirements of *The Mines Regulations, 2018* Part II *Revised Regulations of Saskatchewan*.

The CNSC also has regulatory responsibilities for the oversight of the protection of the health and safety of workers. The CNSC harmonizes the oversight of conventional health and safety with the Saskatchewan Ministry of Labour Relations and Workplace Safety.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	Integrated Management System Manual	4385365	Yes
Orano	Environmental Monitoring Program Optimization, Environmental Monitoring Locations and Schedules	5616834	Yes
Orano	Technical Information Document Hydrogeology and Groundwater Modelling	6015314	Yes

Orano is responsible for safety at all times. This responsibility cannot be delegated or contracted to another organization or entity. The licensee shall ensure that contractors and other organizations present on site are informed of, and uphold, their roles and responsibilities related to conventional health and safety.

Guidance

There is no guidance provided for this licence condition.

4. ENVIRONMENTAL PROTECTION

Licence Condition 4.1

The licensee shall implement and maintain an environmental protection program.

Preamble

The "environmental protection" safety and control area covers programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities.

The environmental protection program must include an environmental monitoring program that characterizes and monitors the quality of the environment associated with a licensed facility. The overall objective of the environmental monitoring program is to measure the effects of a licensed activity on the receiving environment with respect to the concentrations and quantities of nuclear and hazardous substances in the environment (abiotic and biotic) and/or measurable changes in biological processes.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Environmental Protection: Environmental Principles, Assessments and Protection Measures	REGDOC-2.9.1
CSA Group	Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills	N288.4
CSA Group	Environmental risk assessments at Class I nuclear facilities and uranium mines and mills	N288.6-12

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	Integrated Management System Manual	4385365	Yes
Orano	Environmental Monitoring Program Optimization, Environmental Monitoring Locations and Schedules	5616834	Yes
Orano	Technical Information Document - Environmental Performance, Volume 2 Version 2 – Environmental Risk Assessment	6032669	Yes
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Yes

Guidance

Guidance Publications

Source	Document Title	Document Number
CSA Group	Environmental management systems – Requirements with guidance for use	ISO 14001:2015
CNSC	Assessing the Long-Term Safety of Radioactive Waste Management	REGDOC-2.11.1

5. FACILITY SPECIFIC

There are no facility specific licence conditions.

APPENDIX A CHANGE CONTROL PROCESS

A.1 Change Control Process

A change control process is applied to the LCH to ensure that:

- preparation and use of the LCH are properly controlled
- all referenced documents are correctly identified and maintained
- procedures for modifying the LCH are followed.

A request to change this LCH can be initiated by either CNSC staff or the licensee. The licensee will be consulted on any changes to the LCH that are proposed by CNSC staff.

CNSC staff will take the following steps to update the LCH:

1. the CNSC receives or initiates written notification of proposed change
2. initiate a change request using the Change Request Form
3. complete a technical review of the proposed change, if required
4. consult the licensee and in case of disagreement on the proposed change, the dispute resolution process outlined in section A.3 will apply
5. obtain consent and signature from a Delegated Officer
6. update the LCH in accordance with the Change Request Form and send the updated document to the parties identified on the distribution list (see section A.5).

Change Request Form

1. GENERAL INFORMATION			
File Plan #		**e-Doc #(s) for Change Request Form**	
Licensee	**Licence Number**	**LCH #, Rev/Version**	**Request Date**
Licensing Officer			

2. CHANGE(S) TO THE LCH			
#	**Description and Purpose**	**Proposed Change**	**References**
1	<initiator, nature, reason for change, e.g. administrative, change to a licensee doc, etc.>	<identify modifications, such as by track changes, highlighting, etc.>	<LC, page, section #, etc.>
2			

3. ASSESSMENT (text and/or e-Doc #s)			
#	**Division/Org**	**Comment**	**Disposition**
1	<division>		
	<division>		
	<licensee>		
	<division>		
2	etc.		

4. CONSENT TO MODIFY		
#	**Agreed**	**Comment**
1		
2		

Name	**Title**	**Signature**	**Date**

5. LCH DOCUMENTATION AND DISTRIBUTION			
New LCH Number	**LCH Effective Date**	**e-Doc #** (include version number)	
CNSC Outgoing Notification		**e-Doc #**	**Date Sent**

APPENDIX A

A.2 Review Criteria for Proposed Changes to Licensing Basis Documents

The licensee must provide the CNSC with written notification of a proposed significant change to key licensee documents before the licensee implements the change. The notification must be accompanied by sufficient information to demonstrate that the change is within the intent of the licensing basis. Written notification of minor or administrative changes may be made in batches after the changes have been implemented.

The following criteria will be used by CNSC staff to determine if the proposed change is acceptable:

1. The submission includes the appropriate level and quality of information with regards to:
   a) The description of the proposed change including:
      - a summary of the change, including the purpose or need for the change
      - a preliminary finding of whether this proposal or notification is required under the *Nuclear Safety and Control Act*, a regulation made under the Act or the licence, or has implications under the *Impact Assessment Act*, or whether a licence amendment or other licensing action would likely be required
      - where applicable, the alternatives evaluated and the reasons for selection of the chosen option
      - any changes to the inventories of nuclear substances on site related to the proposed change
      - the construction, commissioning and operating schedule for the proposed change including hold points or progress reports for regulatory review and approval (as appropriate)
      - expected impacts, if any, on the proposed decommissioning or closure plans
      - results of any risk analysis or HAZOPs studies performed, and a summary of the identified hazards and the mitigation measures identified to control potential hazards.
   b) The description of the design control, operating specifications and criteria including:
      - the design basis and criteria, and performance specifications
      - the design drawings such as the general arrangement, process and instrumentation diagrams, and process flow sheets
      - the quality management program for the various key stages of the change (e.g., design, construction, commissioning, etc.).

c) The assessment of both the short- and long-term impacts with the mitigation measures in place on:
   - worker's health and safety, including potential radiological and non-radiological exposures
   - the environment
   - security
   - Canada's international obligations.

d) The planned administrative controls including:
   - changes to the organization, roles and responsibilities
   - changes to applicable programs and procedures
   - a description of the proposed monitoring, inspection and test plans, including locations and frequency proposed to evaluate both positive and negative results.

e) Changes to contingency plans including "full-stop measures".

f) Evidence that the licensee's internal reviews and approvals have been completed, including meeting the requirements of the licensee's change management procedure and consultation with the onsite occupational health and environmental committees, where applicable.

g) Identification of the documents and training programs that may require revision when the proposed change is implemented.

2. The effects of the proposed change or action remain within the licensing basis.
3. Following the implementation of the change, the licensee will remain in compliance with the requirements set out in the applicable Acts, regulations, and LCs.

A.3 Dispute Resolution

In case of a dispute between the licensee and CNSC staff regarding changes to the LCH, both parties will meet to discuss the dispute and reach a decision on the path forward. The decision, including its rationale will be documented. If any party is not satisfied with the decision, the resolution process will proceed up to the Director, Director General or Executive Vice-President and Chief Regulatory Operations Officer level. If any party is still not satisfied with the decision, the issue will be brought to the attention of the Commission at a Commission meeting. The decision made by the Commission will be final.

A.4 Records Management

In order to track changes to the LCH, the document change request and accompanying documentation will be archived in records and referenced in the revision history of the LCH. Electronic communication related to the change, such as comments from reviewers will be stored in the CNSC information management system.

A.5 Distribution

A copy of the updated version of the LCH will be distributed to the following parties:

- Uranium Mines and Mills Division, CNSC
- Orano Canada Inc.

A.6 Reporting to the Commission

CNSC staff will report on the changes made to the LCH during the previous year in their report to the Commission.

APPENDIX B LICENSEE DOCUMENTS THAT REQUIRE NOTIFICATION OF CHANGE

Document Title	CNSC e-Access Document Number
Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086
Integrated Management System Manual	4385365
Cluff Lake Decommissioning Project Public Information Program Version 5	6782847
Environmental Monitoring Program Optimization, Environmental Monitoring Locations and Schedules	5616834
Technical Information Document Hydrogeology and Groundwater Modelling	6015314
Technical Information Document - Environmental Performance, Volume 2 Version 2 – Environmental Risk Assessment	6032669
Orano Surety Bond # BDTO-860042-019 [$3,496,920]	6762472

APPENDIX C LIST OF DOCUMENTS USED AS GUIDANCE OR COMPLIANCE VERIFICATION CRITERIA

Document	Document Title	Document Number
CNSC	Ascertaining and Recording Radiation Doses to Individuals	G-91
CNSC	Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"	G-129
CNSC	Environmental Protection: Environmental Principles, Assessments and Protection Measures	REGDOC-2.9.1
CNSC	Assessing the Long-Term Safety of Radioactive Waste Management	REGDOC-2.11.1
CNSC	Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	REGDOC-3.1.2
CNSC	Public Information and Disclosure	REGDOC-3.2.1
CNSC	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	G-206
CNSC	Indigenous Engagement	REGDOC-3.2.2
CNSC/SK	CNSC – Saskatchewan Harmonized Annual Reporting Requirements	3678482
CSA Group	Management system requirements for nuclear facilities	N286-12
CSA Group	Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills	N288.4
CSA Group	Environmental risk assessments at Class I nuclear facilities and uranium mines and mills	N288.6-12
CSA Group	Decommissioning of facilities containing nuclear substances	N294-09
CSA Group	Environmental Management Systems – Requirements with guidance for use	ISO 14001:2015

Orano Canada Inc.

100-833 45th Street West
Saskatoon SK S7L 5X2
Tel.: +1 (306) 343-4500

September 9, 2022

Dustin Zmetana, Senior Analyst, Metallic Minerals – Mineral Policy
Saskatchewan Ministry of Energy and Resources

Tim Moulding, Manager Uranium & Northern Operations
Saskatchewan Ministry of Environment

Tracey Charabin, Director, Lands – Lands Unit
Saskatchewan Ministry of Environment

Scott Boyes, Director, Northern Engagement
Saskatchewan Ministry of Government Relations

Patrick Burton, Director – Uranium Mines and Mills Division
Canadian Nuclear Safety Commission

Dear Mr. Zmetana, Mr. Moulding, Mr Boyes, Ms. Charabin & Mr. Burton:

Re: Transfer of the Decommissioned Cluff Lake Project site into the Saskatchewan Institutional Control Program and Submission of Cluff Lake End-State Report

On February 28, 2020 Orano Canada Inc. (Orano) requested transfer of the decommissioned Cluff Lake Project site ("the site" or "the property") into the Province of Saskatchewan's Institutional Control (IC) Program (see attached).

The successful transfer into the IC Program requires simultaneous and contingent approvals from the Saskatchewan Ministry of Energy and Resources, Saskatchewan Ministry of Environment (Environmental Protection Division and the Lands Branch of the Resource Management and Compliance Division) and the Canadian Nuclear Safety Commission (CNSC).

On August 9, 2022, the CNSC provided a notice of public hearing for March 1 or 2, 2023 to consider Orano's request to release the site from licensing under the *Nuclear Safety and Control Act*. The action allows for:

- the transfer of the parcels remaining in the Cluff Lake Project lease area (Figure 1.1) into the IC Program managed by the Ministry of Energy and Resources, and

- the exemption of the Province of Saskatchewan for the activity of possess, manage, store radioactive waste according to Section 7 of the *Nuclear Safety and Control Act* and Section 11 of the General Nuclear Safety and Control Regulations.

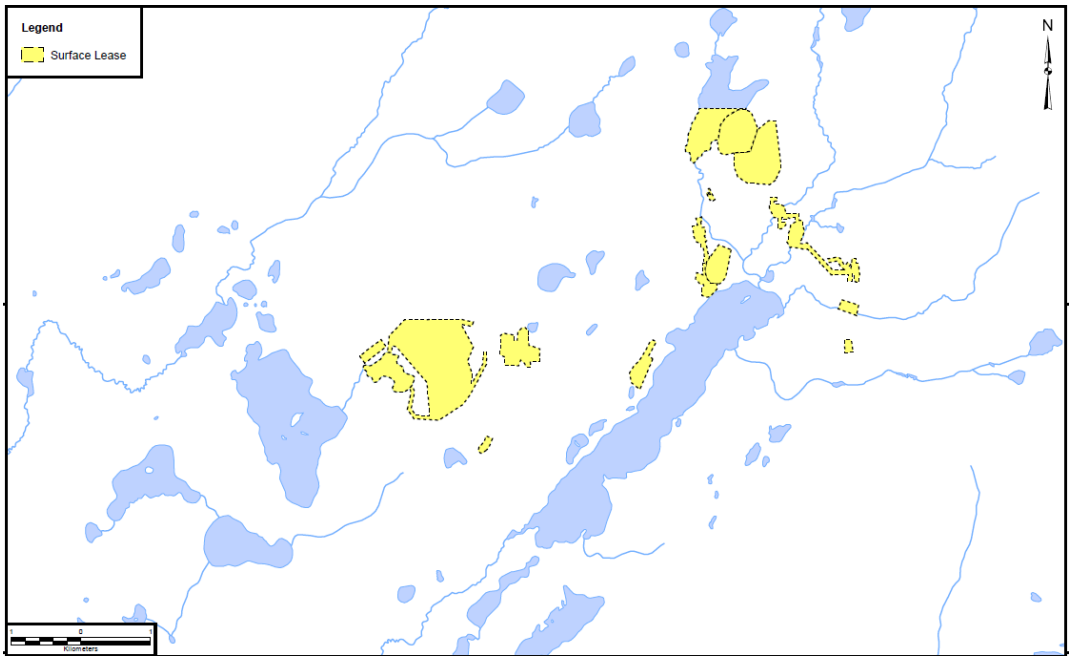


Figure 1-1: Cluff Lake Project lease area to be transferred into the IC program

It is the expectation that all parties will be in the position to make final determinations on their respective decisions at the time of the hearing, recognizing that the determinations will only be effective upon the CNSC acceptance to transfer the property to the Province of Saskatchewan, accompanied by a licence exemption for the Province.

Orano is requesting to resume the process with the respective provincial ministries to secure their decisions in advance of the Commission Member Documents submission date, which are due November 18, 2022.

The required provincial decisions are fulsomely described in the attached February 28, 2020 letter, and include:

- acceptance of the Cluff Lake property into the IC Program by the Ministry of Energy and Resources;

- release of the Cluff Lake property from decommissioning (closing the Approval to Operate) by the Ministry of Environment; and

- termination of the Cluff Lake Surface Lease Agreement by the Ministry of Government Relations and the Lands Branch

As committed to in the February 2020 letter, please find attached the Cluff Lake End-State Report.

To discuss further please contact me or Tina Searcy, Manager Regulatory and Environmental Science at tina.searcy@orano.group.

Regards,

Dale Huffman
Vice President, Operations

Attachments: February 28, 2020 Letter
August 9, 2022, the CNSC provided a notice of public hearing
Cluff Lake End-State Report.

cc: Orano Distribution
Alan Merkowsky
Ron Stenson

/TS

Orano Canada Inc.

817 45th Street West
Saskatoon SK S7L 5X2
Tel.: +1 (306) 343-4500

February 28, 2020

Mr Cory Hughes, Executive Director - Mineral Policy
Saskatchewan Ministry of Energy and Resources

Mr Tim Moulding, Manager - Uranium and Northern Operations
Mr Greg Hayes, Manager – Land Branch
Saskatchewan Ministry of Environment

Mr Scott Boyes, Director – Northern Engagement
Saskatchewan Ministry of Government Relations

Mr Peter Fundarek, Director – Uranium Mines and Mills Division
Canadian Nuclear Safety Commission

Dear Mr Hughes, Mr Moulding, Mr Hayes, Mr Boyes, and Mr Fundarek:

Re: Request to Transfer the Decommissioned Cluff Lake Mine and Mill Site into the Provincial Institutional Control Program

Orano Canada Inc. (Orano) is requesting to transfer the decommissioned Cluff Lake mine and mill site ("the site" or "the property") into the Province of Saskatchewan Institutional Control (IC) Program given that:

I. Post-closure monitoring and risk assessments have demonstrated that the Cluff Lake site a) has sustainably achieved the agreed end-state, b) is expected to remain safe and stable under passive care, and c) residual risk is well understood and appropriate for IC.
II. The provincial IC Program was a) established for land that, in consequence of development and use, requires long-term monitoring and maintenance b) developed to ensure the health, safety, and well-being of future generations and c) designed to meet provincial, national, and international obligations for the storage of radioactive materials.

A successful transfer to the IC Program will require simultaneous and contingent approvals from the Saskatchewan Ministry of Energy and Resources, Saskatchewan Ministry of Environment (Environmental Protection Division and the Lands Branch of the Resource Management and Compliance Division), and the Canadian Nuclear Safety Commission (CNSC). As such, this request to transfer the Cluff Lake property into the IC Program is submitted collectively to responsible organizations. This collective IC transfer request is accompanied by a formal application to the CNSC Secretariat requesting a one-day public hearing date be scheduled for the end of 2020 or early 2021, with the expectation that all parties will be in a position to make final determinations on their respective decisions at that time.

Saskatchewan Ministry of Energy and Resources: Orano requests that the Ministry of Energy and Resources accept the Cluff Lake property in accordance

with Section 5 of the *Reclaimed Industrial Sites Act* and to create a Crown Reserve according to Section 21 of the *Crown Minerals Act* as delineated by the Provincial Surface Lease (Property No. 200085) dated April 10, 2002 and amended effective July 11, 2019.

Orano is of the understanding that the following conditions must be met:

- Orano to demonstrate to the Ministry of Energy and Resources' satisfaction that the closed Cluff Lake site meets the prescribed conditions for IC[1], receipt of deposits into the IC Monitoring and Maintenance Fund and the IC Unforeseen Events Fund[2], provision of a financial assurance[3], IC registry[4], and payment of the IC registration fee (under separate cover); and
- approvals granted by the Saskatchewan Ministry of Environment (Environmental Protection Division and the Lands Branch of the Resource Management and Compliance Division), the Saskatchewan Ministry of Government Relations, and the CNSC as detailed below.

Saskatchewan Ministry of Environment - Environmental Protection Division Uranium & Northern Operations: Orano requests that the Saskatchewan Ministry of Environment issue a release from decommissioning and reclamation pursuant to Section 22 of the *Mineral Industry Environmental Protection Regulations* thereby closing the Cluff Lake Approval to Operate Pollutant Control Facilities - PO18-025 (valid February 28, 2018 to February 28, 2023; issued pursuant to the *Environmental Management and Protection Act*) and accompanying closure of the Cluff Lake Decommissioning Financial Assurance.

Orano is of the understanding that the following conditions must be met:

- Orano to demonstrate to the Ministry of Environment satisfaction that remaining liabilities are sufficiently detailed and that the planned long-term monitoring and maintenance plan is satisfactory; and
- approvals granted by the Saskatchewan Ministry of Energy of Resources, the Saskatchewan Ministry of Government Relations, and the CNSC.

Saskatchewan Ministry of Environment – Lands Branch of the Resource Management and Compliance Division and the Saskatchewan Ministry of Government Relations: Orano requests that, pursuant to Article 23.3 of the Cluff Lake Surface Lease Agreement, the Saskatchewan Ministries of Environment and Government Relations approve the termination of the Cluff Lake Surface Lease Agreement (Property No. 200085) dated April 10, 2002 and amended effective July 11, 2019. The Surface Lease Agreement can be terminated provided successful completion of decommissioning as recognized through a release from decommissioning and reclamation issued from the Ministry of Environment Environmental Protection Division.

[1] *Reclaimed Industrial Sites Regulations* S.3
[2] *Reclaimed Industrial Sites Act* S.11 & 12, *Reclaimed Industrial Sites Regulations* S.4
[3] *Reclaimed Industrial Sites Regulations* S.5
[4] *Reclaimed Industrial Sites Act* S.6, *Reclaimed Industrial Sites Regulations* S.6

Canadian Nuclear Safety Commission: Orano requests that the CNSC approve the transfer and exemption of the sole licensable activity to possess, manage, store radioactive waste (i.e. the activities will no longer be licensed thereby effectively closing CNSC Licence UMDL-MINEMILL-CLUFF.00/2024).

I) transfer of the Cluff Lake Licence (Uranium Mine Licence UMDL-MINEMILL-CLUFF.00/224 (August 1, 2019 – July 31, 2024)) to accompany the transfer of property to the Ministry of Energy and Resources according to Section 24(4) of the *Nuclear Safety and Control Act*, and

II) exempt the Province of Saskatchewan for the activity of possess, manage, store radioactive waste according to Section 7 of the *Nuclear Safety and Control Act* and Section 11 of the *Nuclear Safety and Control Act General Regulations.*

The requested transfer and exemption are possible given that the Province of Saskatchewan is qualified to possess, manage, store radioactive waste and, in doing so, will make adequate provision for the protection of the environment, health and safety of persons, and maintenance of national and international obligations. Further, the provincial IC Program (i.e. registry and monitoring) were designed to be comparable to an active licence issued by the CNSC thereby meeting provincial, national, and international obligations for the oversight of decommissioned radioactive waste. Therefore, the exemption will not I) pose unreasonable risk to the environment or health and safety of persons, II) pose unreasonable risk to national security, or III) result in a failure to achieve conformity with measures of control and international obligations to which Canada was agreed.

Orano is of the understanding that the following conditions must be met:

- Orano to demonstrate to the CNSC satisfaction that the long-term monitoring plan to be funded under IC is commensurate with risk and sufficient to identify issues of concern that would warrant re-engagement of the CNSC under Sections 43 and 45 of the *Nuclear Safety and Control Act*; and
- approvals granted by the Saskatchewan Ministry of Energy of Resources, the Saskatchewan Ministry of Environment, and the Saskatchewan Ministry of Government Relations.

End State Report: For clarity, the Cluff Lake Detailed Post-Decommissioning Plan (Version 04; March 2019) will be revised for submission as the Cluff Lake End State Report (Version 05) in support of this application. The End State Report will include a roadmap to meeting the prescribed conditions for IC under Section 3 of the *Reclaimed Industrial Sites Regulations* including the long-term monitoring and maintenance plan, administrative controls under IC, and a path forward for unforeseen events.

To: Mr Hughes, Mr Moulding, Mr Hayes, Mr Boyes, Mr Fundarek
Re: Request to Transfer the Decommissioned Cluff Lake Mine and Mill Site into the Provincial Institutional Control Program
February 28, 2020

If you have any questions or concerns please do not hesitate to contact Diane Martens at 306-343-4042 or diane.martens@orano.group.

Regards,

Vincent Laniece
Vice President Safety, Environment and Engineering

cc:
Mr Dustin Zmetana, Senior Analyst - Mineral Policy, SK Ministry of Energy and Resources
Mr Alan Merkowsky, Senior Environmental Protection Officer, SK Ministry of Environment
Ms Cathy Yuzek, Land Manager – Lands Unit, SK Ministry of Environment
Mr Ron Stenson, Senior Project Officer, Canadian Nuclear Safety Commission
UMMD Distribution, Canadian Nuclear Safety Commission
Orano Cluff Regulatory Distribution

/DM/TS

From:	Registry / Greffe (CNSC/CCSN)
To:	HUFFMAN Dale (ORN-MN)
Cc:	Registry / Greffe (CNSC/CCSN); Stenson, Ron; Duhaime, Brenda; Burton, Patrick; UMMD / DMUCU (CNSC/CCSN); SEARCY Tina (ORN-MN); OC-CluffRegulatory
Subject:	Notice of Public Hearing and Participant Funding on Orano"s Application to Revoke the Licence for the Cluff Lake Project.
Date:	Tuesday, August 9, 2022 8:01:29 AM
Attachments:	E-DOCS-#6846729-v1-Notice_of_Public_Hearing_and_Participant_Funding_-_Orano_s_Request_to_Revoke_the_Licence_for_the_Cluff_Lake_Project.PDF

Good morning,

Please find attached the Notice of Public Hearing and Participant Funding posted yesterday on the application by Orano Canada Inc. for the revocation of its Cluff Lake uranium mine and mill operating licence.

- Notice of Public Hearing and Participant Funding on the application by Orano for the revocation of its Cluff Lake uranium mine and mill operating licence

This one-part public hearing will be held on March 1 or 2, 2023. The number of interventions will dictate the duration of the hearing. The location of the hearing is not yet determined.

Here are key deadlines to remember:

One-Part Public Hearing on March 1 or 2, 2023	
Deadline for intervenors to apply for participant funding	September 30, 2022
CNSC (CMD 23-H8) and Orano's (CMD 23-H8.1) written submissions	November 18, 2022
Submissions from Intervenors	January 12, 2023
Supplementary written submissions (if required) and presentations from CNSC staff and Orano	February 22, 2023
List of presenters and supporters from Orano and CNSC Staff	February 15, 2023
Final speaker notes for interpreters	February 28, 2023

Do not hesitate to contact me should you have any questions.

Regards,

Louise Levert

Senior Tribunal Officer, Commission Registry / Agente principale du tribunal, Greffe de la Commission
Canadian Nuclear Safety Commission / Commission canadienne de sureté nucléaire
louise.levert@cnsc-ccsn.gc.ca
Tél: 613-858-7651

Orano Canada Inc.

Cluff Lake Project

End State Report
for Provincial Institutional Control

September 2022

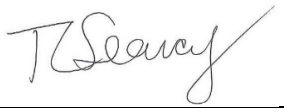
Orano Canada Inc.

orano

Distribution List

Recipient	Copies
Canadian Nuclear Safety Commission	2 + Electronic
Saskatchewan Ministry of Environment	Electronic

Approval for Use

Editor:		
Tina Searcy	Manager, Regulatory & Environmental Science	
Name	Title	Signature

Contributions from:

- Tyler Lohman, Geo-Environmental Technician
- Kebbi Hughes, Senior Geo-Environmental Scientist

Approver:		
Dale Huffman	VP Operations	
Name	Title	Signature

Acronyms and Abbreviations

Term	Definition
AECB	Atomic Energy Control Board
ALARA	As Low As Reasonably Achievable
CCME	Canadian Council of Ministers of the Environment
CEAA	Canadian Environmental Assessment Act
CNSC	Canadian Nuclear Safety Commission
COPCs	Constituents of Potential Concern
CSD	Comprehensive Study for Decommissioning
CSR	Comprehensive Study Report
CWRP	Claude Waste Rock Pile
DDP	Detailed Decommissioning Plan
DPDP	Detailed Post-Decommissioning Plan
CWRP	Claude Waste Rock Pile
DSWQO	Decommissioning Surface Water Quality Objectives
EA	Environmental Assessment
EMLS	Environmental Monitoring Location Schedule
EQC	Environmental Quality Committees
FUP	Follow-up Program
IAEA	International Atomic Energy Association
ICP	Institutional Control Program
IMS	Integrated Management System
LLRD	Long lived radioactive dust
LTMP	Long-Term Monitoring Plan
MHI	Saskatchewan Ministry of Highways and Infrastructure
MMER	Metal Mining Effluent Regulations
NSCA	Nuclear Safety and Control Act
Orano	Orano Canada Inc.
PIP	Public Information Document
SMOE	Saskatchewan Ministry of Environment
SSWQO	Saskatchewan Surface Water Quality Objective
TID	Technical Information Document
TMA	Tailings Management Area
TRU	Traditional Resource User

Table of Contents

Appendices

Tables

Figures

1 Introduction

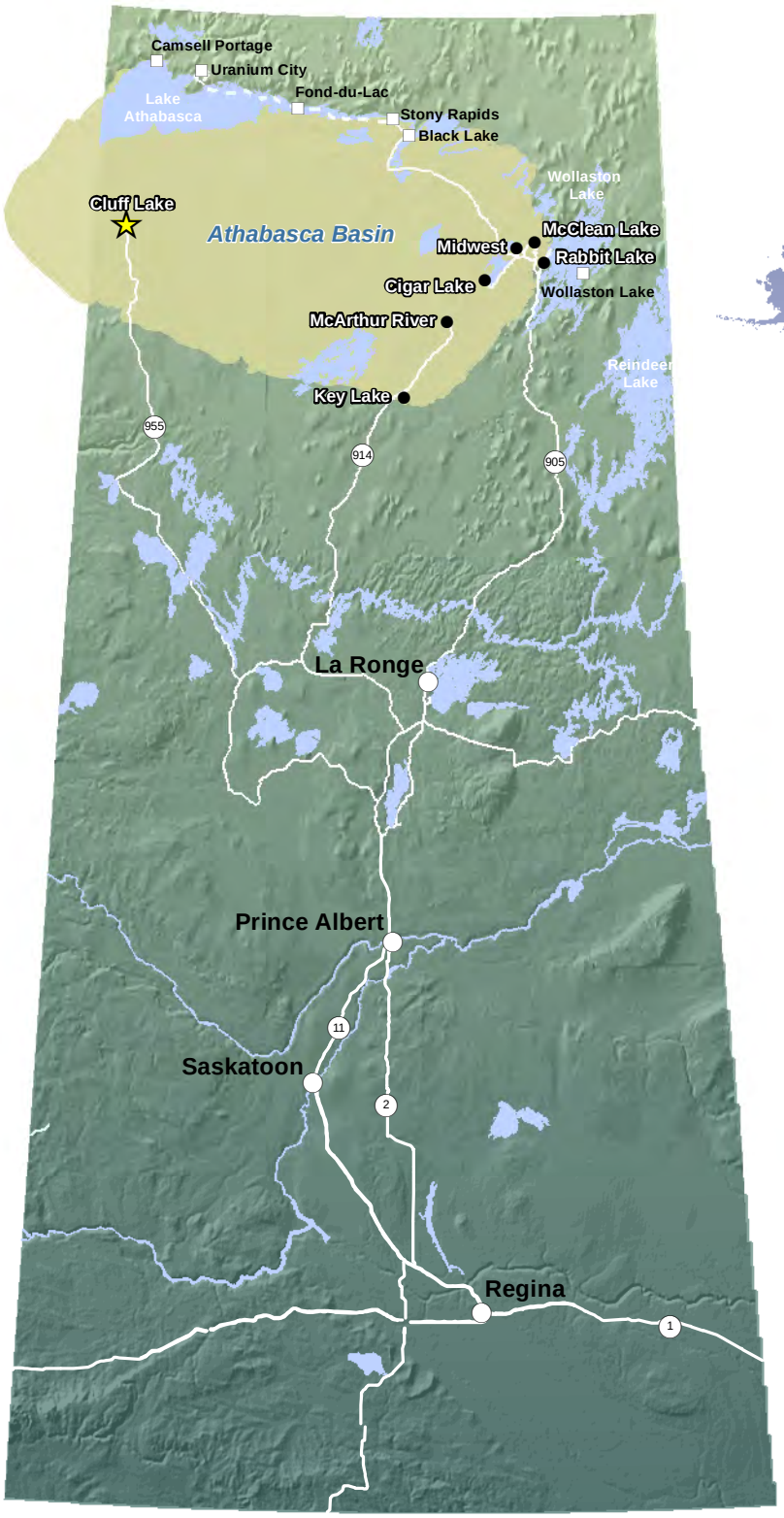
1.1 Purpose

In 2019, Orano demonstrated to the satisfaction of provincial and federal regulators that the Cluff Lake Project decommissioning objectives have been met and will continue to be met in the very long term. The Cluff Lake Project Technical Information Documents (AREVA 2015a, AREVA 2015b, and AREVA 2015c, Orano 2019b, Orano 2019c, Orano 2022) and the Follow-up Program Report (AREVA 2015d) document the successful completion of the decommissioning.

This End-State Report had been prepared to describe the final status of the Cluff Lake Project as responsibility for the site is turned over to the Province of Saskatchewan under their institutional control program. The End-state Report is intended to satisfy the requirements of CNSC REGDOC 2.11.2.

1.2 Project Overview

The Cluff Lake Project is a former uranium mine and mill site located in the Athabasca Basin of northern Saskatchewan. The mine site is located approximately 900 km north of Saskatoon, Saskatchewan, and approximately 75 km south of Lake Athabasca (Figure 1.1).



N

Projection: NAD 1983 UTM Zone 13N
Compiled: T.Lohman Drawn: T.Lohman
Date: 2022-04-21 Scale: 1:6,000,000
Data Sources: Natural Resources Canada, Geobase®, Nation Topographic Database, ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 1.1
LOCATION OF THE CLUFF LAKE PROJECT

orano

File: Q:\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 1.1 Project Location.mxd

The Cluff Lake Project commenced mining and milling operations in 1980. Over the 22-year operating life of the mine, five ore bodies were extracted using either underground or open pit techniques. The Cluff Lake Project produced 28 million kilograms of uranium concentrate (U_3O_8) over its operational period and produced its final barrel of yellowcake in December 2002. Operational facilities at the Cluff Lake Project included open pit and underground mines, a mill, a tailings management area (TMA) with a two-stage liquid effluent treatment system, a residential camp area, and various other support and site infrastructure facilities.

Over its operating life, the Cluff Lake Project was the largest industrial employer on the west side of northern Saskatchewan providing a stable base of employment for over 20 years generating about 4,000 person years of company staff employment. Employees averaged around 200 at a given time and with on-site contractors, indirect, and induced employment this number is estimated to have been as high as 958 individuals employed in 1996. Approximately 52% of company staff were northern and approximately 80% of northerners were from the west side of the province. The company was recognized for advancing residents of northern Saskatchewan into management and supervisory positions. The training and experience gained by individuals throughout the project life provided transferable skills for subsequent employment. As well, nearby lands continued to be used for traditional purposes that included the safe consumption of country food.

Mining operations include decommissioning as a phase in the overall project life. The Cluff Lake Project may be considered the first decommissioned uranium mine site of its era in Saskatchewan. With the end of successful operations in 2002, the decommissioning of the site underwent a decommissioning environmental assessment (Comprehensive Study for Decommissioning (CSD), COGEMA 2000a and Comprehensive Study Report (CSR), CNSC 2003). The general decommissioning objectives and appropriate locations and timeframes for accomplishing the objectives were established in consultation with federal and provincial authorities and through the public engagement process.

Subsequent to receiving federal and provincial environmental assessment and licensing and permitting approvals, decommissioning of the Cluff Lake Project commenced in 2004. The majority of physical decommissioning was completed by 2006 including demolition of the mill complex buildings, covering the TMA and Claude Waste Rock Pile, moving the DJN waste rock to the Claude Pit, complete backfilling of the Claude Pit, flooding the contiguous DJN and DJX pits (referred to collectively as the DJX Pit post-decommissioning), grading, and revegetation. Underground mine raises and declines were decommissioned earlier at the cessation of underground mining. Minor physical undertakings were completed in 2013 to mark the end of an on-site presence, included the demolition of a small residential camp which included potable and sewage treatment plants, two steel outbuildings, and the Secondary Treatment System. The Cluff Lake site has been in post-decommissioning monitoring since 2006 with a transition to campaign monitoring in 2013. With final minor physical works completed in 2017 and 2018, the site was readied for transfer back to the province through the Institutional Control Program (ICP).

With the establishment of the Institutional Control (IC) Program under the Saskatchewan *Reclaimed Industrial Sites Act*, parcels of land that, in consequence of development and use, require long-term monitoring and, in certain circumstances, maintenance, can be transferred to the Government of

Saskatchewan if the site achieves an end state of long-term safety and stability and the proponent provides funds necessary for the government administration of the decommissioned site.

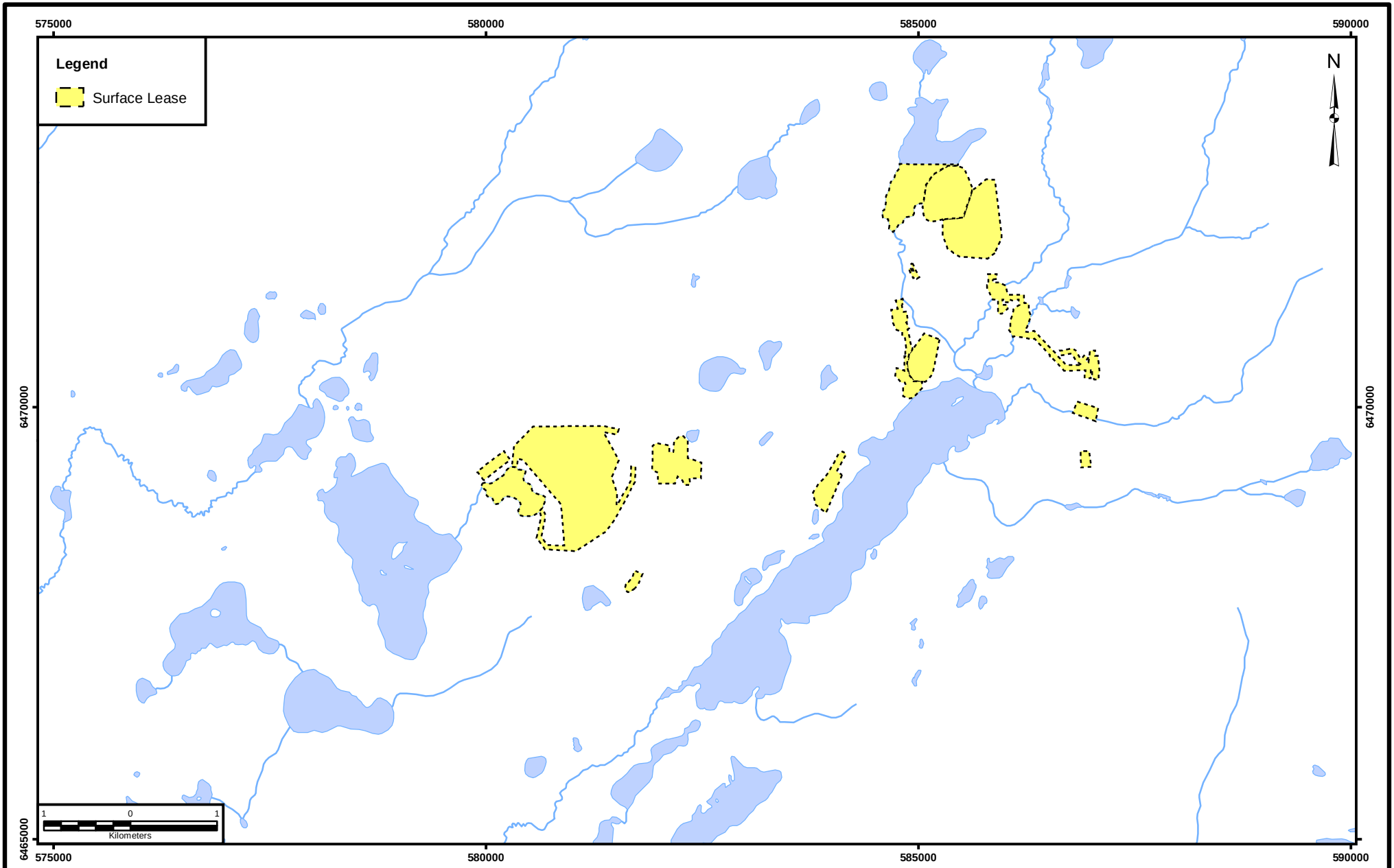
In 2019, regulators acknowledged that decommissioning objectives had been met and a portion of the Cluff Lake surface lease was surrendered, releasing the following parcels that would not require restrictions:

- Undeveloped/undisturbed areas – 508.11 hectares
- Surface water bodies (Cluff Lake and Island Lake as they do not require long-term controls or maintenance) – 527.21 hectares
- Remediated areas of previous surface disturbance – 260.76 hectares

Parcels that require long-term administrative controls, and in certain circumstances, maintenance remained in the Cluff Lake surface lease. The following areas will be transferred to the provincial IC Program :

- D Mining Area: D-pit
- Claude Mining Area: Claude pit, Claude waste rock pile, Claude peat trenches
- DJ Mining Area: DJN/DJX pit, DJ underground mine
- OP-DP Mining Area: OP/DP underground mine
- Mill Complex Area
- Tailings Management Area
- Landfills: domestic, industrial, Secondary Treatment System Ponds, mill landfill and Cluff centre landfill
- Lakes: Snake Lake and the portion of Claude Lake that is within the surface lease boundaries.

With buffers for underground mine workings and pits (25 meters) and other parcels (10 meters), as recommended by the Saskatchewan Ministry of Energy and Resources, the total leased area, to be transferred into the provincial IC Program is 336.39 hectares (Figure 1.2).



Projection: NAD 1983 UTM Zone 12N
Compiled: T.Lohman Drawn: T.Lohman
Date: 1/3/2022 Scale: 1:60,000
Data Sources: Natural Resources Canada, Geobase®, Nation Topographic Database, ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 1.2
CLUFF LAKE - CURRENT SURFACE LEASE

orano

File: Q:\SHEQ\GIS\CLUFF_LAKE\2022\Annual Report\Maps\CLUFF_SL.mxd

1.3 Regulatory

1.3.1 Licensee

Orano Canada Inc., with headquarters in Saskatoon, is the sole owner and operator of the Cluff Lake Project. Orano Canada Inc. is a wholly owned subsidiary of Orano Group, a world leader in nuclear energy and components.

The business address is:

Orano Canada Inc.
100-833 45th Street West
Saskatoon, SK S7L 5X2

1.4 Provincial Institutional Control Program

In 2005, Saskatchewan initiated the formal development of an institutional control framework for the long-term management of decommissioned mine and mill sites on provincial Crown lands. This work resulted in the establishment of the Institutional Control (IC) Program in 2007. The IC Program's purpose is to: support the safe, environmentally sound decommissioning of mining and mill sites; ensure the on-going monitoring and maintenance of reclaimed sites; provide a funding mechanism to cover costs associated with long-term monitoring and maintenance of reclaimed sites; and ensure that records and information on the reclaimed sites are preserved through the establishment of a registry.

The amount deposited into the funds by the former owner of each site accepted into the IC Program is determined by the Ministry of Energy and Resources based on a site-specific risk assessment detailed by a long-term monitoring and maintenance schedule.

The legislated funds are managed by the Government of Saskatchewan and independent from provincial revenue.

Orano's objective is for the Cluff Lake property to successfully transfer into the IC Program.

Orano has demonstrated that the Cluff Lake site is well understood and remaining residual risks can be adequately and confidently addressed under the provincial IC Program. The purposes of the IC Program, as outlined in the Section 3(2) of the Saskatchewan *Reclaimed Industrial Sites Regulations* are:

> "(a) to set out the conditions by which the Government of Saskatchewan will accept responsibility for land that, in consequence of development and use, requires long-term monitoring and, in certain circumstances, maintenance;

(b) to ensure that the required monitoring and maintenance are carried out on that land;

(c) to provide a funding mechanism to cover costs associated with the monitoring and maintenance on that land; and

(d) to ensure that certain records and information are preserved with respect to that land."

Ecological risk assessments provide the basis for the scope and complexity of monitoring programs (CSA N288.4-19 Clause 4.1, CSA 2019). Decommissioning monitoring started with the 2003 Comprehensive Study Report (CSR) where potential project-environment interactions were identified, and potential effects defined.

EP TID Volume 2 (Orano 2019c) and associated GW TID (Orano 2019b) provide the basis for the scope and complexity of the proposed Long-Term Monitoring and Maintenance Plan (LTMMP) to be administered under the IC Program by the Province of Saskatchewan. The LTMMP is proposed to continue for decades, at a sample frequency focused on confirming the site's environmental performance against predicted performance and relative to decommissioning objectives.

2 Project Status

2.1 Decommissioning Environmental Assessment and Objectives

The original environmental assessment for the Cluff Lake Project was completed in 1978 and the environmental assessment for decommissioning was completed in 2003, referred to as the Comprehensive Study Report (CSR) (CNSC 2003). The CSR was accepted in 2004, followed by the subsequent issuance of required federal and provincial authorizations to proceed with decommissioning activities.

As described in the CSR, the effects of decommissioning are largely positive. Decommissioning involves the removal or stabilization of constructed structures and the reclamation of disturbed areas. Orano's key objective was to remove, minimize, or control potential contaminant sources and thereby minimize the potential for adverse environmental effects associated with the decommissioned property. Decommissioning was designed to minimize the need for care and maintenance activities and long-term active institutional controls (i.e., prioritize passive care) taking into consideration socio-economic factors.

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

To evaluate the success of the decommissioning program for the Cluff Lake Project, site-specific objectives (referred to as abandonment criteria in section 5.2 of the CSD and decommissioning objectives in section 7 of the CSR) were established which, when achieved, indicate the site has been successfully decommissioned. The decommissioning objectives, and associated locations and timeframes for accomplishing the objectives, were established in consultation with federal and provincial authorities and with public engagement through the CSR process.

The following criteria are indicators of decommissioning success:

- achieving 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 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.

The CSR outlined decommissioning objectives for surface water quality, radiological clearance, a stable, self-sustaining state with minimal requirements for monitoring, maintenance, or institutional controls, and safe, casual traditional land use. Sediment quality guidelines are noted in both the CSD and CSR as benchmarks, i.e., values are not considered to be formal decommissioning criteria. Sediment quality is considered in the ecological risk assessment (see section 2.1.5) but not as a specific decommissioning endpoint.

Over a decade of post-decommissioning monitoring (2006 to 2021) has provided the environmental data for comparison to water quality, radiological objectives, or key model inputs used to forecast long-term surface water quality (e.g., infiltration rates through soil covers and source terms). The decommissioning groundwater and ecological risk models are validated, and long-term predictions remain within decommissioning objectives (AREVA 2015a, AREVA 2015b, and AREVA 2015c, Orano 2019b, Orano 2019c, Orano 2022).

2.1.1 Post-Decommissioning Surface Water Quality

Objective: Achieving Decommissioning Surface Water Quality Objectives (DSWQO) and other accepted decommissioning objectives at surface water and flooded pit locations.

Decommissioning Surface Water Quality Objectives (DSWQO) were based on the 1997 Saskatchewan Surface Water Quality Objectives (SSWQO) and site-specific surface water quality objectives developed by Orano in the absence of provincial surface water quality objectives (i.e., uranium, molybdenum, and cobalt) or specific natural conditions prevailing in the area (i.e., iron). These decommissioning objectives were described in the original Comprehensive Study Report for Decommissioning (COGEMA 2000a).

Locations chosen to meet the DSWQOs for key surface waterbodies were identified by consideration of the locations and the distances of potential constituents of potential concern (COPC) sources in relation to potentially impacted natural surface waterbodies, and in consultation with federal and provincial authorities. As presented in the CSR (CNSC 2003), selected locations and DSWQOs are listed in Table 2.1.

Table 2.1: Summary of Post-Decommissioning Surface Water Quality Objectives

Parameter	Unit	Snake Lake	Island Lake	Claude Lake	Claude Creek	Peter River	Earl Creek	Cluff Lake	Flooded Pits (1)
As	μg/L	50	50	50	50	50	50	50	50
Ba	mg/L	1	1	1	1	1	1	1	1
Cd	μg/L	1	1	1	1	1	1	1	1
Cr	μg/L	20	20	20	20	20	20	20	20
Cu	μg/L	10	10	10	10	10	10	10	10
Fe (2)	mg/L	3.2	1	7.3	7.3	1	5.2	1	7.3
Pb	μg/L	20	20	20	20	20	20	20	20
Hg	μg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ni (3)	μg/L	-	-	-	-	-	-	-	-
Se	μg/L	10	10	10	10	10	10	10	10
Ag	μg/L	10	10	10	10	10	10	10	10
Zn	μg/L	50	50	50	50	50	50	50	50
Ra^{226}	Bq/L	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
U (4)	mg/L	-	-	-	-	-	-	-	-
Mo (2)	μg/L	73	500	73	73	73	73	73	500
Co (5)	μg/L	20	20	20	20	20	20	20	20

(1) Flooded Pits – Objectives apply to upper 50% of the water column only

(2) Fe and Mo are waterbody specific objectives

(3) Nickel values are hardness related; values range from 25 μg/L when [Hardness] <100 mg/L and 100 μg/L when [Hardness] >100 mg/L at the site in question

(4) Uranium DSWQO was calculated as 0.002 [Hardness in mg/L] at the site in question. The current CCME surface water quality guideline for uranium is 0.015 mg/L. The CCME guideline is used as a screening tool for the environmental risk assessment.

(5) Cobalt objective was set as a site specific decommissioning objective

Status: Surface water quality objectives have been achieved and are predicted to be achieved in the long-term. Surface water quality at key waterbodies will continue to be monitored by Orano and following successful transfer of the property into Provincial Institutional Control the long-term monitoring of surface water quality will be administered by the Province of Saskatchewan.

Orano has used the CCME surface water quality guideline for uranium of 0.015 mg/L, as a screening tool in environmental risk assessments (AREVA 2015c, Orano 2019c). The uranium guideline was exceeded at Island Lake, D-Pit and DJX-Pit and site-specific risk assessment characterized localized risks from uranium (AREVA 2015c, Orano 2019c). The conservative assessment concluded that uranium exposure should not result in unacceptable risk to individual species or populations.

Key reference(s) that provide evidence or document achievement of objective:

- Annual Reports, e.g., Cluff Lake Project 2017 Annual Report Section 5.4 (Orano, March 2018b)
- Environmental Performance Technical Information Documents Volume 1 Section 4.2 (AREVA, 2015b)
- Environmental Performance Technical Information Documents Volume 2 Section 6 (AREVA 2015c, Orano 2019c)
    - Site-specific risk assessments for pit lakes, i.e., D-Pit, and DJX-Pit, are presented in Appendix K (AREVA 2015c)

2.1.2 Post-Decommissioning Radiological Objectives

Objective: Levels of gamma, radon (RnP), and long-lived radioactive dust (LLRD) which pose no unacceptable risk to traditional land use, and which are consistent with application of the ALARA principle.

The decommissioning radiological objectives are based on a need to keep radiation doses to the general public below the regulatory limits and "as low as reasonably achievable" (ALARA; social and economic factors considered) through the final decommissioning and post-decommissioning phases.

The limit on annual effective dose to a member of the public under the CNSC's Radiation Protection Regulations (RPR) is 1 mSv per year above natural background levels. The regulations specify that the proposed limit includes contributions from external sources, inhalation of radon progeny, and ingestion and inhalation of radioactivity according to the sum rule provided [subsection 13(2) of the RPR].

RnP and LLRD levels were reduced through removal of source material or by covering with clean soil material. Sufficient cover materials were applied to eliminate LLRD, and to reduce radon progeny levels to near background conditions, where source terms existed. Post-decommissioning LLRD and RnP levels are near background and did not require specific decommissioning objectives. The potential exposure to gamma radiation is the primary exposure pathway and this potential pathway was addressed through surface gamma clearance surveys and associated remediation as necessary. Exposure to ambient gamma radiation is included in a comprehensive human health risk assessment (AREVA 2015c, Orano 2019c).

Status: Levels of gamma, radon, and long-lived radioactive dust pose no unacceptable risk to traditional land use and are consistent with application of the ALARA principle. Radiological levels achieved protect public health by maintaining doses to future users that are well within regulatory limits for members of the public. Having confidently achieved this decommissioning objective, radon monitoring was removed from the environmental monitoring program in late 2017 with regulatory approval. **Radiological objectives have been achieved.**

Key reference(s) that provide evidence or document achievement of objective:

- Annual Reports, e.g., Cluff Lake Project 2017 Annual Report Section 4 (Orano, March 2018b)
- Environmental Performance Technical Information Documents Volume 1 Section 3.2.3.1 (AREVA, 2015b)
- Environmental Performance Technical Information Documents Volume 2 Section 8.1 (AREVA, 2015c, Orano 2019c)
- Environmental Monitoring Locations and Schedule Optimization Report Section 5 (AREVA, 2017)
- Gamma Radiation Clearance Reports:
    - Submission for Gamma Radiation Clearance – Cluff Lake Project, November 2007 (AREVA 2007a)
    - Review of Surface Gamma Radiation Survey of Disturbed Areas at Cluff Lake Site and validated by a third-party survey (SENES 2009)
    - Addendum to Submission for Gamma Radiation Clearance – Cluff Lake Project, titled Submission for Gamma Clearance of the Germaine Camp Area, December 2009 (AREVA 2009)
    - 2014 Surface Gamma Clearance Report - Cluff Lake Project, October 2014 (AREVA 2014a)
    - Cluff Lake Project – Surface Gamma Clearance Report, October 2018 (Orano, 2018e)

2.1.3 Post-Decommissioning Landscape

Objective: a stable, self-sustaining reclaimed landscape

Decommissioning of the site included works to stabilize the landscape and minimize public safety hazards, e.g., backfilling or flooding mined out pits. Of particular note is the decommissioning of underground mine workings and the TMA dam rehabilitation, as summarized below. A detailed progression of physical works is documented in the evolution and closure of the Cluff Lake Project DDP.

- DJ Underground: mined using undercut and fill mining method; DJU raises entirely backfilled from bottom of the raise to the raise collar elevation in 2002; DJU decline backfilled from about 181m down the ramp to the portal opening; reinforced concrete caps placed over all backfilled raises and a concrete plug poured over the former DJU portal opening; single instance of surface subsidence related to mining activities at the DJ underground mine – the only area of the DJ mine that sub-outcropped to surface and was vulnerable to crown pillar failure – was stabilized and the area eliminated from further ground fall considerations.
- OP/DP Underground: mined using undercut and fill mining method; raises partially backfilled in 2000 with final backfilling completed in 2002; OP/DP decline was backfilled from about 176m down the ramp to the portal opening; reinforced concrete caps placed above backfilled raises and a concrete plug was poured over the former OP/DP portal opening; no instance of surface subsidence associated with the OP/DP mining activities and works are not vulnerable to crown pillar failure.
- TMA dam rehabilitation: construction of storm water management structures and design including engineered cover, spillway established to passively release water, grading for positive drainage

towards spillway, installation of toe drain in 1999, construction of the south division ditch and north diversion ditches in 1999 and 2000, respectively; buttressing the main dam with a downstream slope of 4H:1V; potentially erodible slopes vegetated; achievement of a passive state that does not require regular surveillance; considered physically, chemically, ecologically, and socially stable (i.e. a landform).

The revegetation approach for the Cluff Lake Project included two different strategies: seeding soil covers with grasses and forbs (addressed in following section on waste covers); and planting trees in other disturbed areas. Tree seedlings were propagated from local seed and cutting sources including a mixture of six native woody species: green alder, balsam poplar, white birch, trembling aspen, willow, and jack pine. Over 600,000 seedlings were planted across 129 ha from 2005 to 2007. In general, 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.

The Cluff Lake Project is located in the northern boreal ecosystem where natural revegetation commonly begins with early successional species including various types of forbs (e.g., fireweed) and a selection of native grasses (e.g., northern reedgrass). Deciduous shrubs and trees (e.g., alder, willow, balsam poplar, trembling aspen, and birch) tend to establish next as soil conditions improve. Climax species in the Cluff Lake Project area are generally conifers, such as black spruce and jack pine, which take advantage of early life cover and enriched soil conditions largely attributable to the earlier deciduous successional stage.

Status: the former mine site is stable, self-sustaining, and largely reclaimed; further minor works are appropriately captured under long-term maintenance. **Decommissioning works are complete**.

Key reference(s) that provide evidence or document achievement of objective:

- Cluff Lake Detailed Decommissioning Plan (COGEMA 2003, COGEMA 2004, AREVA 2009, AREVA 2014, this document)
- Environmental Performance Technical Information Documents Volume 1 Section 5.2.3 and 5.3.1 (AREVA 2015b)
- Status of Vegetation Recovery in the Cluff Lake Project Reclaimed Areas 2008-2014 (HAB-TECH Environmental, 2014)
- TMA Water Management and 2013 Remedial Works Closure Report (SRK 2018)
- Third-Party Geotechnical Inspection Reports, e.g., 2016 Biennial Geotechnical Inspection Final Report – Cluff Lake Saskatchewan (SRK 2017)
- Vegetation Recovery at the Cluff Lake Mine Site 2008 to 2020. December 2020.
- Third-Party Geotechnical Inspection Reports, e.g., 2020 Biennial Geotechnical Inspection Final Report – Cluff Lake Saskatchewan (SRK 2021)

2.1.4 Engineered Soil Covers

Objective: Reduction of infiltration rates around the TMA and the Claude Waste Rock Pile to levels that adequately restrict contaminant movement to groundwater and are suitably protective of downstream surface water receptors

The purpose of soil covers for the Claude Waste Rock Pile (CWRP) and the Tailings Management Area (TMA) are to promote surface runoff, minimize infiltration, and thus minimize the release of contaminants to groundwater. Between 2001 and 2006, a minimum 1 m thick glacial till cover was placed on the TMA. The CWRP was overlain with a 1 m thick till cover in 2005/06. A soil cover monitoring program was implemented following final grading of these areas in 2006. Monitoring stations were installed at select locations to monitor soil and weather conditions to gauge the success of the cover systems and results are presented in the Cluff Lake Project Annual Reports and more comprehensively in the Follow-up Program Report (AREVA 2015d).

Transformations of the TMA and CWRP covers into evaporative covers were initiated in 2006 by hydroseeding the areas with shallow-rooting grasses and forbs. 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. As native vegetation progressively invades, the soil binding capabilities of the grass/forb understory persists and is supplemented by the rooting systems of the native varieties. The vegetation community has shifted over time with both the TMA and CWRP on a natural revegetation trajectory (Hab-tech, 2014; CanNorth 2020).

Status: The cover systems have been performing for a number of years and are on a stable trajectory; they are expected to continue to be stable. The covers are self-sustaining and effective in controlling erosion. Long-term monitoring for erosion and potential minor repair to covers is appropriate under the institutional control program. **Engineered soil cover objectives have been achieved.**

Key reference(s) that provide evidence or document achievement of objective:

- Follow-up Program Version 03 Sections 3.1.2 and 3.2.1 and Appendix B (AREVA, 2015d)
- Hydrogeology and Groundwater Modelling Technical Information Document Section 2.1.2.3 and 2.2.2.6 (AREVA, 2015a)
- Environmental Performance Technical Information Document Volume 2 Section 6 (AREVA, 2015c)
- Status of Vegetation Recovery in the Cluff Lake Project Reclaimed Areas 2008-2014 (HAB-TECH Environmental, 2014)
- Risk Assessment of the Presence of Ponded Water on the Decommissioned TMA (Orano 2018f)
- Hydrogeology and Groundwater Modelling Technical Information Document, Version 02. October 2019. (Orano 2019b)

- Environmental Performance Technical Information Document, Volume 2, Version 02. October 2019. (Orano 2019c)
- Vegetation Recovery at Cluff Lake (CanNorth 2020)

2.1.5 Post-Decommissioning Aesthetics and Absence of Unreasonable Risk

Objective: 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

Re-vegetation efforts (as summarized in section 2.1.3 above) focused on the re-establishment of native species of grasses, forbs, and woody species to accelerate the process of natural ecological succession and result in a forested environment similar to that which existed prior to mining. With forest establishment comparable to pre-mining and sound decommissioning, wildlife species can reclaim the mine footprint. The site is safe, reclaimed, and allows for hunting and trapping land uses that existed prior to site development.

A comprehensive ecological and human health risk assessment for the Island Creek and Cluff Creek watersheds was submitted in 2015 and again in 2019 (AREVA 2015c, Orano 2019c). The assessments were completed to comply with applicable components of the N288.6 Standard for Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills. Potential risk was characterized both temporally and spatially within an integrated probabilistic framework to address uncertainties in the assessment of effects.

A weight-of-evidence approach was used combining the results of the predictions and risk evaluations with biological monitoring carried out at the Cluff Lake Project. The weight-of-evidence suggests that I) there are elevated levels of some COPCs in the Island Creek Watershed but the aquatic system is recovering and will continue to improve in the future and there is some potential risk to local populations including mink, muskrat, otter, yellowlegs, and the nighthawk with no further terrestrial species concern downstream at Island Creek at the Dolomites II) conditions in the Cluff Creek Watershed will not significantly affect the health of the aquatic communities present and there are no predicted effects on terrestrial species. The results are comparable to those predicted in the CSR (CNSC, 2003) stating recovery of the Island Creek watershed over time and potential effects on biota considered not significant as effects are restricted locally with full recovery expected.

The results of the human health assessment indicated that a casual visitor to the site who hunts, fishes, and traps over a lifetime as well as his/her family who would consume the food over a six-month period at the Cluff Lake Project will not experience adverse effects from exposure to radionuclides or non-radionuclides.

Status: There is an absence of unreasonable risk. The site has unrestricted access and public health and safety does not rely on controlling human behaviours (e.g. fences, signs, fish advisories). Ecological integrity is maintained. Aquatic and terrestrial systems are recovering, and they are expected to continue to do so in the future. **Aesthetic and risk objectives have been achieved**.

Key reference(s) that provide evidence or document achievement of objective:

- Environmental Performance Technical Information Document Volume 2 (AREVA 2015c; Orano 2019c)

2.2 Decommissioning

The majority of physical decommissioning of mine and mill facilities was completed by 2006. Certain infrastructure remained from 2006 until 2013 in order to support the post-closure monitoring phase and to control site access during the initial monitoring period. In 2013, remaining structures and facilities were decommissioned. Final minor decommissioning works took place in 2017, 2018 and 2021. A history of decommissioning is provided as Appendix C3.

Within this report section, key decommissioning documents detailing decommissioning activities are listed and completion of final works from the approved 2014 DDP, the 2018 DPDP to the final closure state described in this end-state report.

2.3 Decommissioning Reports

Detailed information on the decommissioning work completed can be found in the following reports:

- Decommissioning of the D Pit Area, November 1995 (COGEMA 1995)
- Cluff Lake Interim Construction As-Built Report, February 1998 (COGEMA 1998a)
- TMA Interim Construction Activities, February 1998 (COGEMA 1998b)
- Cessation of Mining at Dominique-Peter Mine, September 1999 (COGEMA 1999d)
- Site Cleanup and Reclamation Activities for 1999 (COGEMA 1999b), 2000 (COGEMA 2000c), 2001 (COGEMA 2001), and 2002 (COGEMA 2002e)
- Construction of the TMA Surface Diversion Works – South Ditch. April 20, 1999. (COGEMA 1999a)
- Construction of the TMA Surface Diversion Works – North Ditch. April 20, 2000. (COGEMA 2000b)
- Cessation of Mining in DJ Mine and Additional Reclamation Activities at DP Mine. April 5, 2002 (COGEMA 2002a)
- Cessation of Mining Activities at the Cluff Lake Project. May 22, 2002. (COGEMA 2002b)
- Interim As-Builts for Closure of Underground Mines. July 1, 2002. (COGEMA 2002c)
- Sealing of Underground Mine Openings. July 24, 2002. (COGEMA 2002d)
- TMA Lower Solids Levelling Course. October 1, 2002. (COGEMA 2002f)
- As-Built Report – Permeable Reactive Barrier (Peat Trench) Adjacent to Claude Creek (AREVA 2006)

- Germaine Camp – 2006 Demolition Report, September 2006 (Denison 2006)
- Submission for Gamma Radiation Clearance (AREVA 2007a)
- As-Built - Claude Mining Area Decommissioning (AREVA 2007b)
- As-Built - Dominique Janine Area Decommissioning (AREVA 2007c)
- As-Built - Mill Demolition (AREVA 2007d)
- As-Built - Tailings Management Area Decommissioning (AREVA 2007e)
- As Built Report – Second Permeable Reactive Barrier (Peat Trench) Adjacent to Claude Creek (AREVA 2007f)
- Submission for Gamma Clearance of the Germaine Camp Area (AREVA 2009a)
- Construction Completion Report – 2013 Miscellaneous Earthworks and Site Cleanup (Denison 2013)
- 2014 Submission for Gamma Radiation Clearance (AREVA 2014a)
- 2017 Minor Earthworks and Activity Report (AREVA 2018)
- TMA Water Management and 2013 Remedial Works Closure Report, Final Report – Cluff Lake Saskatchewan (SRK 2018)
- Cluff Lake Project – Claude Pit Horizontal Drain Closure Report (Orano 2018d)
- Cluff Lake Project – Surface Gamma Clearance Report, October 2018 (Orano 2018e)
- Claude Pit Horizontal Drain Closure Report (Orano 2018g)
- 2018 Minor Earthworks and Activity Report (Orano 2019a)
- 2020 Minor Earthworks and Groundwater Well Decommissioning Report (Orano 2021)

2.4 Planning Envelopes

The 2004 DDP (AREVA 2004) included decommissioning plans for key areas described as planning envelopes. The following table and section provide the status and summary of each of these parcels.

The majority of physical decommissioning of site facilities was completed between 2004 and 2006, from 2006 to 2021 reclamation activities focused on revegetation efforts, environmental monitoring, and landform maintenance.

In 2019, provincial and federal regulators acknowledged that decommissioning objectives had been met, the site entered post-decommissioning phase, parcels of the surface lease that would not require future oversight were released without restrictions, maintaining parcels that would be transferred into the provincial IC program.

Planning Envelope	Parcel	Current Status
D-Mining Area	D-Pit	Decommissioning complete To Transfer to IC Program
	D-Waste Rock Pile	Decommissioning complete
Claude Mining Area	Claude Pit	Decommissioning complete To Transfer to IC Program
	Claude Waste Rock Pile	Decommissioning complete To Transfer to IC Program
DJ Mining Area	DJN/DJX Pit	Decommissioning complete To Transfer to IC Program
	DJN Waste Rock Pile Area	Decommissioning complete Released
	DJ Underground	Decommissioning complete To Transfer to IC Program
	DJX Overburden Pile	Decommissioning complete Released
OP/DP Mining Area	OP/DP Underground	Decommissioning complete To Transfer to IC Program
Mill Complex Area	Mill Complex Area	Decommissioning complete To Transfer to IC Program
Tailings Management Area	Cover and Main Dam	Decommissioning is complete To Transfer to IC Program
Landfills	domestic, industrial, Secondary Treatment System Ponds, mill landfill and Cluff centre landfill	Decommissioning is complete To Transfer to IC Program
Ancillary Buildings and Services	Germaine Camp	Decommissioning complete Released
	Cluff Center	Decommissioning complete Released
	Southgate Entrance	Decommissioning complete Released
	Airstrip	Decommissioning is complete Released
	Site Roads	Decommissioning is complete Released
	Highway 955	Decommissioning is complete. Released. Responsibility of three crossing locations on the portion of road between the end of highway 955 and the airstrip are currently held by Orano under a provincial land use permit. These areas will be transferred to the Province or local lodge owner (permit pending)

2.4.1 D Mining Area

2.4.1.1 D Pit

D Pit was the first ore body mined at the Cluff Lake Project, beginning in 1979 and completed in 1981. The pit, with a maximum depth of 28 m, became flooded in 1983 when ice formation during the spring thaw caused Boulder Creek to overflow its banks. The pit has remained flooded since that time. There is no surficial outflow from the pit; water either discharges as groundwater or is lost to evaporation.

Routine monitoring on 5 m intervals throughout the water column has been conducted since 1987. The water column is stable, has an established chemocline with very little seasonal depth fluctuation. All decommissioning surface water quality objectives for flooded pits are met in the upper 50% of the water column (Orano 2022b). The shoreline has naturally revegetated with native emergent and submergent aquatic macrophytes

Decommissioning complete.
Transfer to IC Program

2.4.1.1 D-Waste Rock Pile

The D waste rock pile is small (2.3 ha) with a volume of less than 150,000 m^3. The pile is entirely D Pit waste and is located immediately adjacent to the pit. The pile was resloped and revegetated shortly after pit flooding. A self-sustaining vegetative cover has been established, initially from seeding of agronomic species, and more recently by native colonization. Infiltration from the waste rock pile reports to the flooded D Pit.

Extensive cleanup, grading, and revegetation have been undertaken at the D Mining Area. A final radiological survey was conducted on the D Waste Rock Pile as part of the Surface Gamma Radiation Clearance. Initial radiological surveys identified areas of elevated gamma radiation primarily on the D waste rock cover that required further remediation. Remediation was carried out in strategic areas to reduce individual readings to below 2.5 µSv/hr and to meet ALARA objectives, although the large area average ALARA objective is not met. To remediate the D Mining Area to meet the large area average objective would require an extra layer of till which would destroy a substantial amount of vegetation in an advanced stage of growth that had already occurred. The affected area is small in comparison to the entire Cluff Lake Project site and is unlikely to contribute significantly to the annual effective dose for traditional land users. The area was determined to be ALARA, social and economic factors considered.

Decommissioning complete.
Released in 2019.

2.4.2 Claude Mining Area

2.4.2.1 Claude Pit

Claude open pit is the largest pit at the Cluff Lake Project and was mined from 1982 through to 1989. The pit has been used as a repository for waste rock, scrap steel, contaminated materials and demolition wastes.

To facilitate the backfilling of Claude Pit, dewatering of the Claude Pit started in 2003 and was completed by September 2005. Backfilling involved the placement of waste rock from DJX Pit and the DJN Waste Rock Pile into Claude Pit, disposal of demolition waste from the Mill complex and other site buildings and the application of a final cover. After final capping and grading, the remaining till cover was revegetated with tree seedlings.

In the fall of 2009, some surface seepage was observed on the Claude Pit till cover and investigation revealed the water was elevated in dissolved metals and had a low pH. Mitigative measures were implemented to prevent the surface seepage from directly entering Claude Lake. In 2010, piezometers were installed at varying depths in Claude Pit and hydraulic head and water chemistry data was collected from 2010 to 2013. In 2013, regulatory approval was received to install three horizontal finger drains across the ring-dyke road west of Claude Pit. The purpose of the drains is to breech the barrier to groundwater movement created by the ring-dyke, thereby reducing the groundwater elevation in the area and the possibility of groundwater expression to surface during periods of high precipitation. The drains were installed in 2013 and semi-annual inspections of the area are conducted during monitoring campaigns.

Summarized below is the Cluff Lake Project – Claude Pit Horizontal Drain Closure Report provided to regulators in August 2018.

Three horizontal drains were installed in 2013 to reduce the frequency, duration, and extent of groundwater expression to surface on the Claude Pit cover. Five years of monitoring and two targeted field studies in the fall of 2017 and the spring of 2018 support that the 2013 performance optimization was achieved: I) localized groundwater levels at the edge of the former Claude Pit have been lowered by about 0.5 m and II) the incremental contaminant loading remains bounded by the flow through the drains, i.e., <10% of total flow/contaminant loading from the Claude Pit flowpath. No further mitigation is recommended.

Decommissioning complete.
Transfer to IC Program

2.4.2.1 Claude Waste Rock Pile

The CWRP was constructed between 1982 and 1989 and contains all waste rock from Claude pit. The pile contains roughly 5.2 million cubic meters of waste, is approximately 30 m high and covers an area of approximately 29.5 hectares to the south of Claude pit. The pile was developed by end dumping and contains well-developed traffic surfaces between the lifts of dumped material. The pile was recontoured in 1993 to reduce side slopes to 2H:1V or less. In 2001 and 2002, resloping and compaction tests were conducted on the CWRP to evaluate constructability and performance issues in support of the final cover design.

In 2005 and 2006, the CWRP was recontoured, compacted, covered with 1 m thick glacial till cover and revegetated with grasses and forbes.

Decommissioning complete.
Transfer to IC Program

2.4.2.2 Buildings and Infrastructure

Claude Shop, formerly used for heavy equipment storage and maintenance was removed in 2006. The surrounding area was covered with clean glacial till and graded for aesthetic reasons. Subsequently, the Claude Shop yard area was cleared for surface gamma radiation and revegetated with tree seedlings.

Decommissioning is complete.
Released in 2019

2.4.3 DJ Mining Area

Decommissioning the DJ mining area involved:

- the entire DJN Waste Rock Pile and part of the DJX waste rock moved to Claude pit
- decommissioning of remaining DJ area buildings and surface infrastructure

2.4.3.1 DJN/DJX Pit

The DJX and DJN open pits are located south of the Claude deposit and adjacent to the north end of Cluff Lake. The DJN pit came into production in 1989 and continued through to 1991. Mining of the DJX pit occurred from 1994 through to 1997.

The DJN pit was allowed to fill with water prior to mining of the DJX ore body. The DJN pit was drained and later filled with clean waste rock from the DJX pit.

Decommissioning the DJN/DJX Pit complex involved relocating a portion of the existing waste rock in DJN Pit, flooding of the pits, regrading the area, stormwater management, and revegetation.

Decommissioning complete.
Transfer to IC Program

2.4.3.2 DJN Waste Rock Pile

The DJN waste rock pile was constructed between 1989 and 1991 during the development of the DJN open pit. The pile contained approximately 1.4 million cubic meters of waste rock, was up to 16 m high and covered an area of approximately 14 ha. The entire pile was relocated to Claude Pit in 2004 and 2005 and the area regraded and revegetated.

Decommissioning is complete.
Released in 2019

2.4.3.3 DJ Underground

The DJ underground (DJU) mine was developed in 1994 and operated until mine closure in 2002.

During site cleanup operations in 2002, DJU raises and the DJU decline were backfilled with till material. DJU raises were entirely backfilled from the bottom of the raise to the raise collar elevation. The DJU decline was backfilled from approximately 181 m down the ramp to the portal opening. Reinforced concrete caps were placed above all backfilled raises and a concrete plug was poured at the DJU portal opening. The mine was partially flooded in 2002 using minewater from the adjacent DJX pit. The mine continues to flood under natural water flow conditions.

Decommissioning complete.
Transfer to IC Program

2.4.3.1 DJX Overburden Pile

The DJX Overburden Pile consists of till material removed from the DJX Pit prior to mining. This material was used as cover material in the cover construction of the CWRP. Once the till haulage was completed, the area was graded and revegetated with tree seedlings.

Decommissioning is complete.
Released in 2019

2.4.4 OP/DP Mining Area

Decommissioning the OP/DP mining area involved:

- Decommissioning of the OP/DP underground mine
- Decommissioning of DP area buildings and surface infrastructure

2.4.4.1 OP/DP Underground

Stripping and construction of ramps for the OP/DP mine began in 1983 and production commenced in 1985. Mining was discontinued in 1999, and the OP/DP mine was allowed to flood under natural conditions. Complete flooding of the workings was achieved in August 2002.

The OP/DP raises were partially backfilled in 2000 with final backfilling completed during site cleanup operations in 2002. The OP/DP decline was backfilled from approximately 176 m down the ramp to the portal opening. Reinforced concrete caps were placed above all backfilled raises and a concrete plug was poured at the OP/DP portal opening. Site grading and radiological clearance was completed in 2004.

Decommissioning complete.
Transfer to IC Program

2.4.4.2 Buildings and Infrastructure

All buildings and surface infrastructure in this area have been decommissioned, the area has been regraded and revegetated with seedlings.

Decommissioning is complete.

2.4.5 Mill Complex and Supporting Facilities

Decommissioning the mill area was completed in two phases. Phase 1 was carried out from August to November 2004. Phase 2 was carried out from August to December 2005. Demolition material was disposed of in the Claude Pit during backfilling. Following demolition, the former Mill area was covered with clean glacial till, graded, cleared for surface gamma radiation, and then revegetated with tree seedlings.

To provide adequate facilities to support post-decommissioning environmental monitoring, the mill warehouse and services fuel farm were maintained until 2013. In August 2013, demolition occurred, and non-salvageable material was disposed of in the landfill.

Decommissioning complete.
Transfer to IC Program

2.4.6 Tailings Management Area

The TMA was the disposal location for all tailings produced during the operating life of the Cluff Lake Project. The TMA is an aboveground facility located in a topographic low with tailings solids (and liquids previously) retained behind a clay-core dam. The TMA has also been used as a receptor for contaminated mine water and site runoff requiring treatment.

The South Diversion Ditch and North Diversion Ditch were constructed in 1999 and 2000, respectively, to divert uncontaminated water (from the drainage basin surrounding the TMA) to Snake Lake. These ditches minimize run-on of clean water into the TMA and ensure that area runoff from a major precipitation event, including a Probable Maximum Precipitation event, can be safely diverted around the TMA.

Decommissioning the TMA area involved the following primary work items:

- Covering all tailings materials with a minimum 1m glacial till cover
- Backfilling the Liquids Pond
- Buttressing the main dam
- Construction of stormwater management structures
- Removal of buildings and surface infrastructure, and
- Revegetation

2.4.6.1 TMA Cover and Main Dam

Two reports were submitted to regulators in August 2018 in support of closing the 2014 DDP: TMA Water Management Report and 2013 Remedial Works Closure Report, Final Report – Cluff Lake Saskatchewan (SRK 2018) and Risk Assessment of the Presence of Ponded Water on the Decommissioned Tailings Management Area (CanNorth 2018).

The TMA engineered cover was designed to minimize surface ponding but not necessarily eliminate the presence of ephemeral ponds. Ephemeral ponds are observed primarily on the former liquids pond where the thickest amount of till was placed during decommissioning (up to 5 m) and adjacent to the internal TMA berm at the boundary of the lower solids areas where about 2 m of till was placed. The presence of ponded

water does not undermine design. Positive drainage is maintained across the TMA towards the spillway contributing to the overall capacity to route higher precipitation events, including a PMP.

No further mitigation is recommended.

A risk assessment of TMA ponded water was completed to evaluate potential impacts and to alleviate community concern. Ponded water, sediment, and vegetation samples were collected on the TMA and the associated ecological risk was evaluated using a consistent approach and assumptions as presented in Environmental Performance Technical Information Document Volume 2 (AREVA 2015c, Orano 2019c). From an ecological perspective, should ephemeral ponds on the TMA persist, I) no adverse effects are expected for terrestrial wildlife or species-at-risk that may use the TMA and II) other than a small potential for nickel concentrations to be an issue for individual toads, no adverse effects are expected from an aquatic perspective.

Decommissioning complete.
Transfer to IC Program

2.4.7 Ancillary Buildings and Services

2.4.7.1 Germaine Camp Area

A permanent camp for the Cluff Lake operations is located adjacent to Germaine Lake near the southwest end of Cluff Lake. With reduced site personnel following decommissioning of the major mining areas, a portion of the camp was decommissioned in 2006. The remaining camp facilities supported both the staff providing monitoring and minor maintenance for the Cluff Lake Project and exploration staff working at the Shea Creek site located to the south of the Cluff Lake site and were decommissioned in August 2013, along with the sewage treatment plant and freshwater supply plant.

The area underwent gamma surveys and was regraded and revegetated.

Decommissioning is complete.
Released in 2019

2.4.7.1 Cluff Center

A portion of the Cluff Centre area is used for core storage. The fenced core storage area provides a specific storage area for mineralized core and other sections for non-mineralized core pursuant to The Mineral Disposition Regulations. The core storage area continues to be used by Orano's Exploration Department.

The unfenced portions of area referred to as Cluff Centre have been regraded and revegetated. The area was cleared for surface gamma radiation.

Decommissioning is complete.
Release in 2019

2.4.7.1 Southgate Entrance

The Southgate Entrance was a security gate located at the south end of the site on the main access road at the end of Highway 955 and was the primary location for controlling site access until 2013. In August 2013, upon completion of decommissioning and cleanup activities, the south gate was removed, and the site remains open for unrestricted access to the general public.

Decommissioning is complete.
Released in 2019

2.4.7.2 Batch Plant

The batch plant was sold and removed in 2003. Decommissioning activities were completed with final regarding and revegetation.

Decommissioning is complete.
Release in 2019

2.4.7.3 Cluff Lake Pumphouse

The Cluff Lake pumphouse, and associated pipeline to the mill, were demolished with the Mill complex. Demolition materials that were not salvageable were disposed of in the Claude Pit during backfilling and the area has been regraded and revegetated.

Decommissioning is complete.
Released in 2019

2.4.8 Airstrip

The airstrip was closed in 2013 and is listed as abandoned on air navigation charts and in the Canada Flight Supplement. As detailed in the 2017 Minor Earthworks and Activity Report (AREVA 2018) and the 2018 Notification of Activities (Huffman to Merkowsky and Glover dated August 10, 2018), the airstrip will be left in its current condition and will remain listed as abandoned. Abandoned airstrips serve as important, potential landing strips for aircraft and the west side of Saskatchewan has limited alternate landing locations.

The Cluff Lake airstrip is well positioned as an emergency landing strip - the closest active aerodrome is Fort Chipewyan, 100 km to the northwest. There is another abandoned aerodrome, Keane Tower, about 45 km west of Cluff Lake and located in Alberta. The closest active aerodromes in Saskatchewan are the

private strip with no winter maintenance at Axe Lake, 126 km to the south and Camsel Portage and Uranium City at 137 and 139 km to the north. There are other examples of abandoned airstrips in Saskatchewan and across Canada located on active mineral claims including Hidden Bay and Otter Lake abandoned airstrips.

Decommissioning is complete.
Released in 2019

2.4.9 Site Roads

These include several on-site roads used during the mining and milling operations.

Since cessation of a full-time site presence, cleanup activities in 2013 included removing culverts at 7 locations and replacing them with drive-through cross ditches:

- Boulder Creek (1)
- Earl Creek (3)
- Peter River (1)
- Claude Creek (1)
- Lost Knife Creek (1)

Streambank restoration at these sites involved recontouring and flattening of approach slopes, riprap armouring of the streambed and partial slope and erosion control matting installed at the Claude Creek location.

As detailed in correspondence titled Cluff Lake Project 2018 Notification of Activities (August 10, 2018 from Huffman to Merkowsky and Glover), the Cluff Creek culverts and Germaine Camp culverts were removed in the fall of 2018 (2018 Final Earthworks Report to be submitted).

On-site roads are determined to be sufficiently de-activated and decommissioned and obligations under the previous DDP are closed.

The Cluff Lake site has about 28 km of onsite roads and an additional 22 km of trails. Traffic on roadways at Cluff Lake reduced considerably in 2002 at the end of operations, again in 2006 following the end of the main decommissioning and reduced further when continuous on-site presence ended in 2013. Current traffic on Cluff Lake roads includes a small crew of about four workers travelling the site for about two weeks at a time for annual campaign monitoring, exploration, and occasional travel by traditional land users - mainly by members of the Flett family to visit their cabin on Cluff Lake.

Scarification of roads would unnecessarily delay final, natural reclamation of the site. The roadways at the Cluff Lake site are in various stages of natural revegetation that began when grading and regular use of the

roads stopped. Berms have been placed across the entrances to the mill landfill and half berms placed before stream crossings to slow potential traffic. Beaver dam activity to the north of Cluff Lake is resulting in some water flowing over that site road. Overtime, the improved access resulting from mining activity will fade into wilderness travel.

Decommissioning is complete.
Released in 2019

2.4.10 Highway 955

Prior to mining at the Cluff Lake Project, highway 955 transitioned into an ice road servicing Uranium City. Over time with the increased traffic due to mining activities, the road was upgraded including installation of culverts. Highway 955 largely bypasses the decommissioned mine site and provides continued public access north to Carswell Lake where there is an established business. Culverts are located at the Beaver, Boulder, and Earl Creek crossings on the portion of Highway 955 overlapping with the current Cluff Lake Project provincial surface lease.

The Earl Creek culverts were removed in 2013 and the streambed rehabilitated. In 2016, members of the public improperly installed a single undersized culvert at the Earl Creek crossing potentially impeding fish passage. The crossing was partially washed out in the spring of 2017 and again in 2018 with attempted repairs both years, again by members of the public, with placed cobble and gravel. The final state of the Beaver, Boulder, and Earl Creek crossings was re-evaluated given:

I. the known and documented public use of this route prior to, during, and post mining operations,
II. the demonstrated public interest in maintaining the road,
III. stated concerns from the Carswell Lake business owner that culvert crossings are required for reliable truck and trailer access to the business,
IV. with the understanding that removal of the Beaver and Boulder Creek crossings would materially affect public access north to Carswell Lake and also to established Traditional Resource User (TRU) parcels (including cabins) on Cluff and Sandy lakes,
V. the high potential for improper installation of culverts in the future where adequate culverts are currently in place, and
VI. interest in decommissioning that minimizes adverse effects and also considers benefits.

Orano will maintain responsibility for the three culvert crossings until they are successfully transferred to the Ministry of Highways (public) or potentially to the TRU holders and/or Carswell Lake business owner (private). Should the culverts be successfully transferred to a private owner, the infrastructure will be permitted under a provincial Miscellaneous Use Permit.

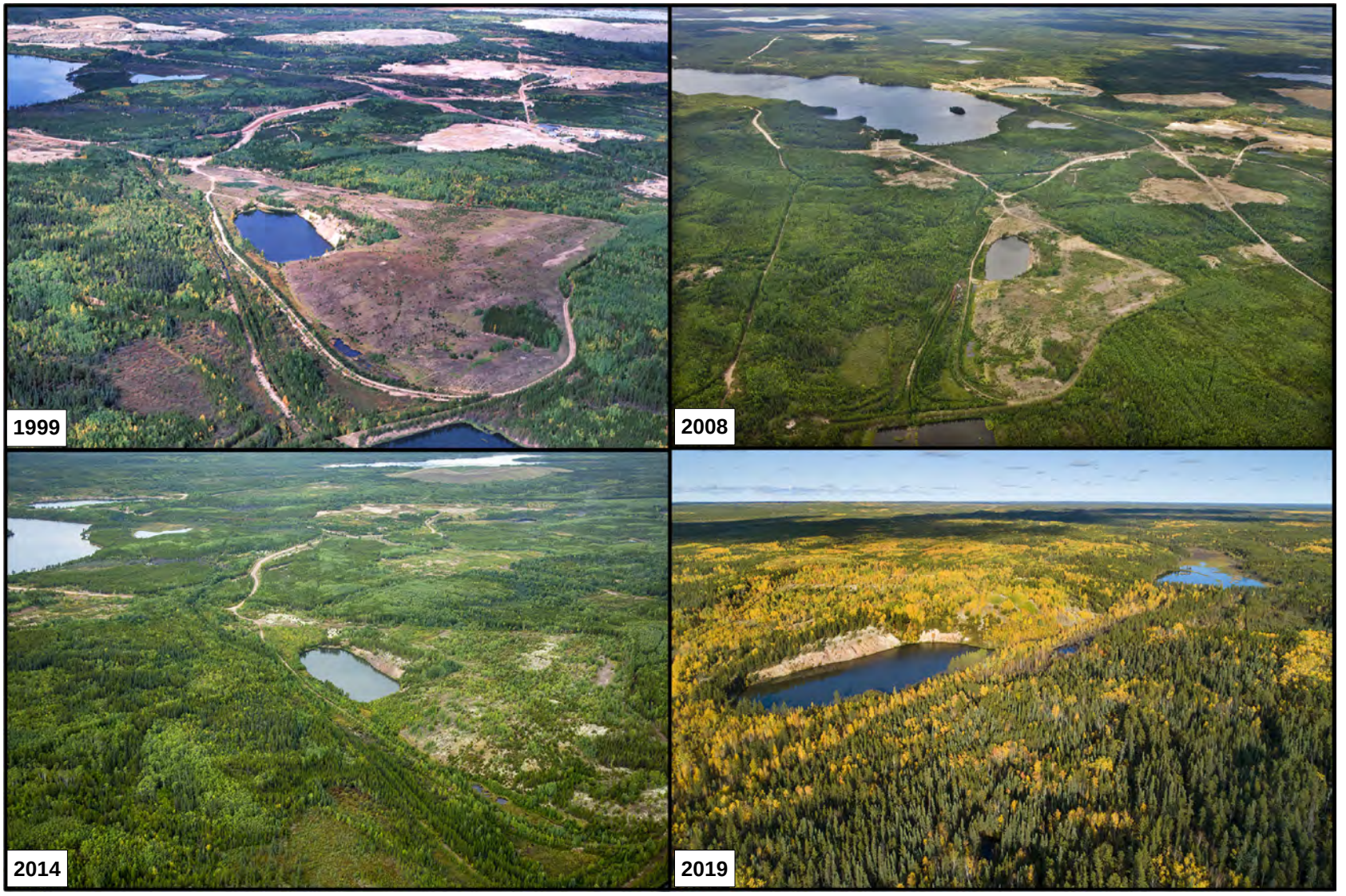
The Cluff Lake site can remain recognized as decommissioned with a provincially or privately maintained road bypassing the site.

Decommissioning is complete.

2.4.11 Fuel Storage Facilities

Decommissioning of the fuel storage farm in 2013 was carried out in accordance with the Saskatchewan Hazardous Substances and Waste Dangerous Goods Regulations. The diesel tanks were drained of their contents and ventilated prior to crushing and disposal of the tanks in the landfill. Approximately 0.5 m of underlying substrate soil beneath the fuel farm was excavated and transported to the hydrocarbon landfarm.

Aerial photographs of key areas which show operational, decommissioned, and recent conditions are presented in Figures 2.1 to 2.6.



Projection:
Compiled: T.Lohman
Drawn: T.Lohman
Date: 2022-04-28
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Data Sources: ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 2.1
AERIAL PHOTOGRAPHS OF D MINING AREA

orano

File: \\ocskfile\teamdata\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 2.1 Aerial Photographs of D Mining Area.mxd

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Data Sources: ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 2.2
AERIAL PHOTOGRAPHS OF CLAUDE MINING AREA

orano

File: \\ocskfile\teamdata\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 2.2 Aerial Photographs of Claude Mining Area.mxd

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CLUFF LAKE PROJECT

FIGURE 2.3
AERIAL PHOTOGRAPHS OF DJ MINING AREA

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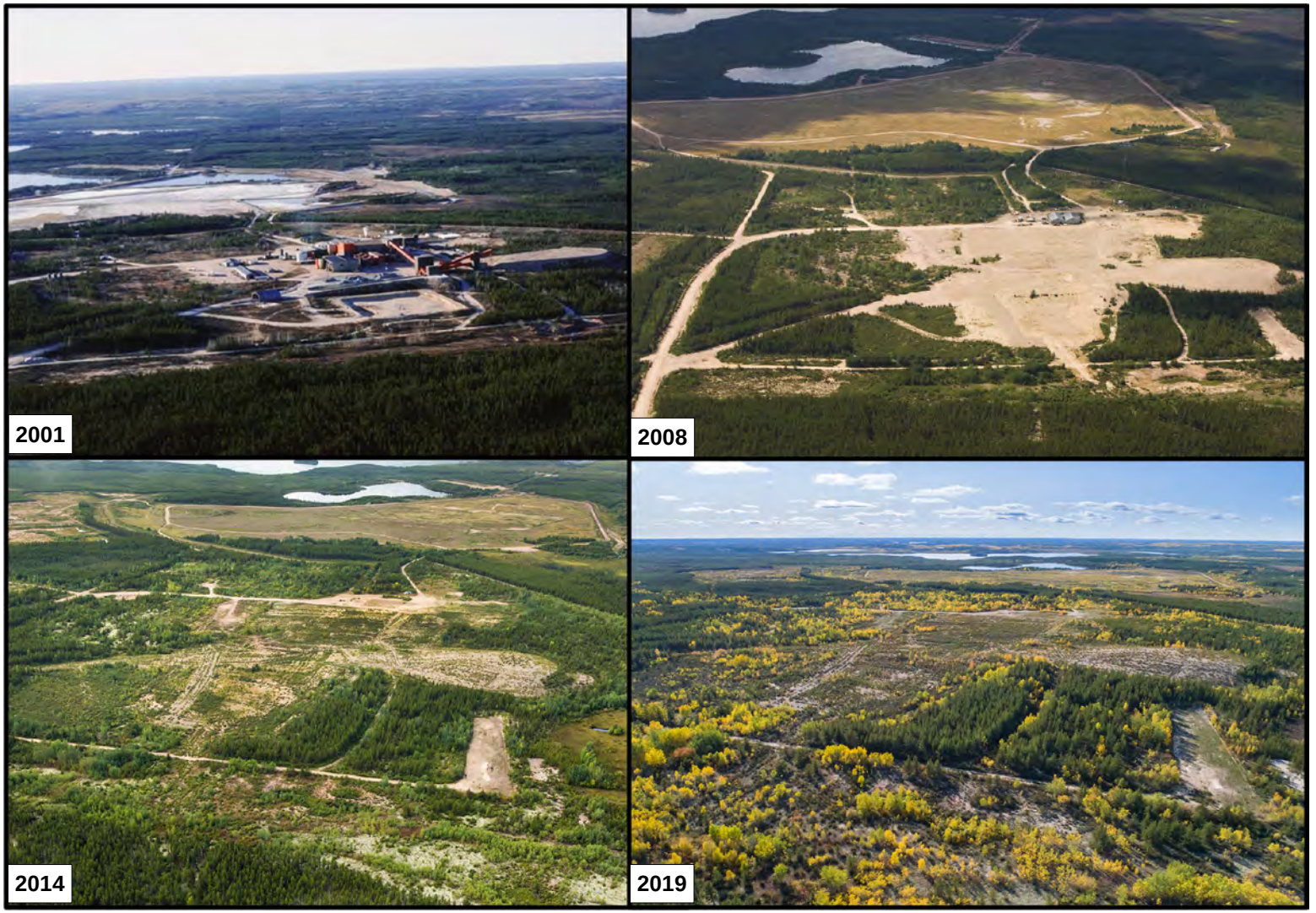
File: \\ocskfile\teamdata\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 2.3 Aerial Photographs of DJ Mining Area.mxd



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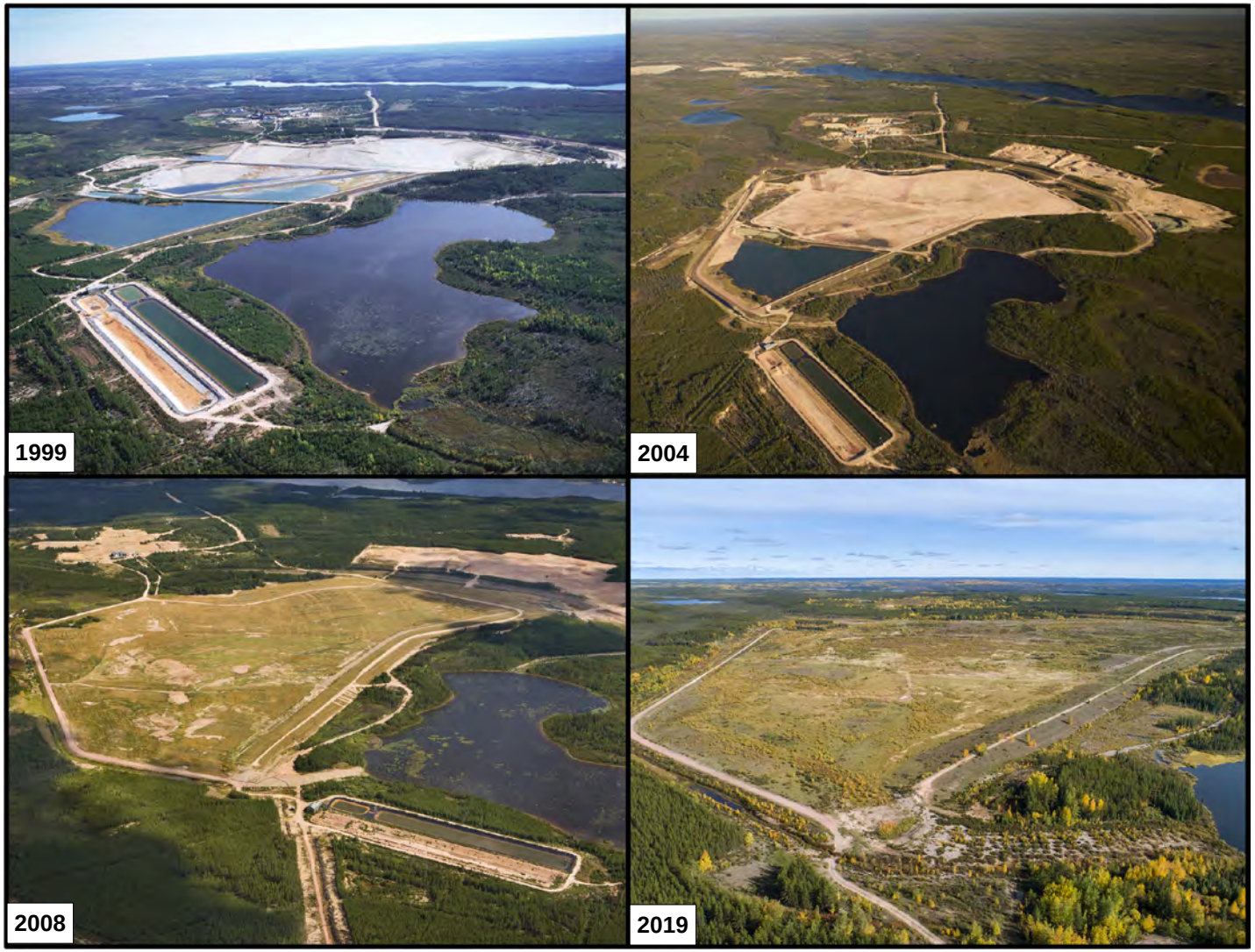
Data Sources: ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 2.4
AERIAL PHOTOGRAPHS OF MILL COMPLEX AREA

orano

File: \\ocskfile\teamdata\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 2.4 Aerial Photographs of Mill Complex Area.mxd



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CLUFF LAKE PROJECT

FIGURE 2.5
AERIAL PHOTOGRAPHS OF TAILINGS MANAGEMENT AREA (TMA)

orano

File: \\ocskfile\teamdata\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 2.5 Aerial Photographs of TMA.mxd

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Date: 2022-04-21
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Data Sources: ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 2.6
AERIAL PHOTOGRAPHS OF GERMAINE CAMP AREA

orano

File: Q:\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 2.6 Aerial Photographs of Germaine Camp.mxd

3 Waste Quantities and Disposition

3.1 Remaining Nuclear Waste

In 2019, the Surface Lease was amended to reflect the parcels that will have land-use controls under the IC Program.

These parcels include subsets of land parcels that may be defined as decommissioned nuclear facilities containing mine and mill wastes (i.e., disposed nuclear substances; decommissioned waste rock and tailings) with a radioactive inventory of 10^{15} Bq or more (*NSCA* S.2 and *NSCR* S.19(a)). In 2019, the Cluff Lake Licence was reduced to include parcels of land to be included for future transfer into the provincial IC Program, the parcels identified included land where the licenced activity of 'possess, manage, store' a nuclear substance is conducted, or parcels of land with a radioactivity inventory of 10^{15} Bq or more (identified above and in Figure 4-1). These parcels are listed below, and the status described in Section 2.4.

- Claude Waste Rock Pile
- Claude Pit
- DJX Pit
- Tailings Management Area

As activities licensed under the Cluff Lake licence, these land parcels which 'possess, manage, store' a nuclear substance will be included in the return of property to the Government of Saskatchewan. The transfer will occur in accordance with Subsection 24(4) of the *NSCA* and Section 13 of the *GNSCR* given the acceptance of the Cluff Lake Property by the Saskatchewan Ministry of Energy and Resources according to Section 5 of the *Reclaimed Industrial Sites Act*. The Province of Saskatchewan is qualified to possess, manage, store radioactive waste and, in doing so, will make adequate provision for the protection of the environment, health and safety of persons, maintenance of national and international obligations.

Following the transfer, a licence exemption should be granted to the Province for the activity of possess, manage, store radioactive waste on the Cluff Lake property according to Section 7 of the *NSCA* and Section 11 of the *GNSCR*. The radioactive waste will not be abandoned; the responsibility is being transferred from one responsible authority to another.

3.2 Waste Management

The Cluff Lake Project was subject to a robust waste management plan, directing waste generated during operation and decommissioning to designated areas (i.e., landfills, TMA, Claude Pit), hazardous waste was shipped off site for recycling/disposal. Volumes were diligently inventoried for reporting in annual reports and post minor work reports provided to the regulators.

4 Abnormal Incidents or Occurrences

4.1 Island Lake Fish Kill

In the spring of 2002 and 2003 increased fish mortality was observed in the lower reaches of Snake Creek and the inlet of Island Lake, attributed to a reversion to the natural astate that existed prior to operations. Over 20 years of effluent release through the winters provided enough dissolved oxygen in the lake waters under the ice cover to support artificial enlargements of the White Sucker population.

With the shutdown of the effluent treatment system and the lack of effluent releases, the Island Lake system reverted to its predevelopment condition, of limited dissolved oxygen content in the winters.

Island Lake is an isolated system and ecological effects assessments indicated that fish populations are recovering.

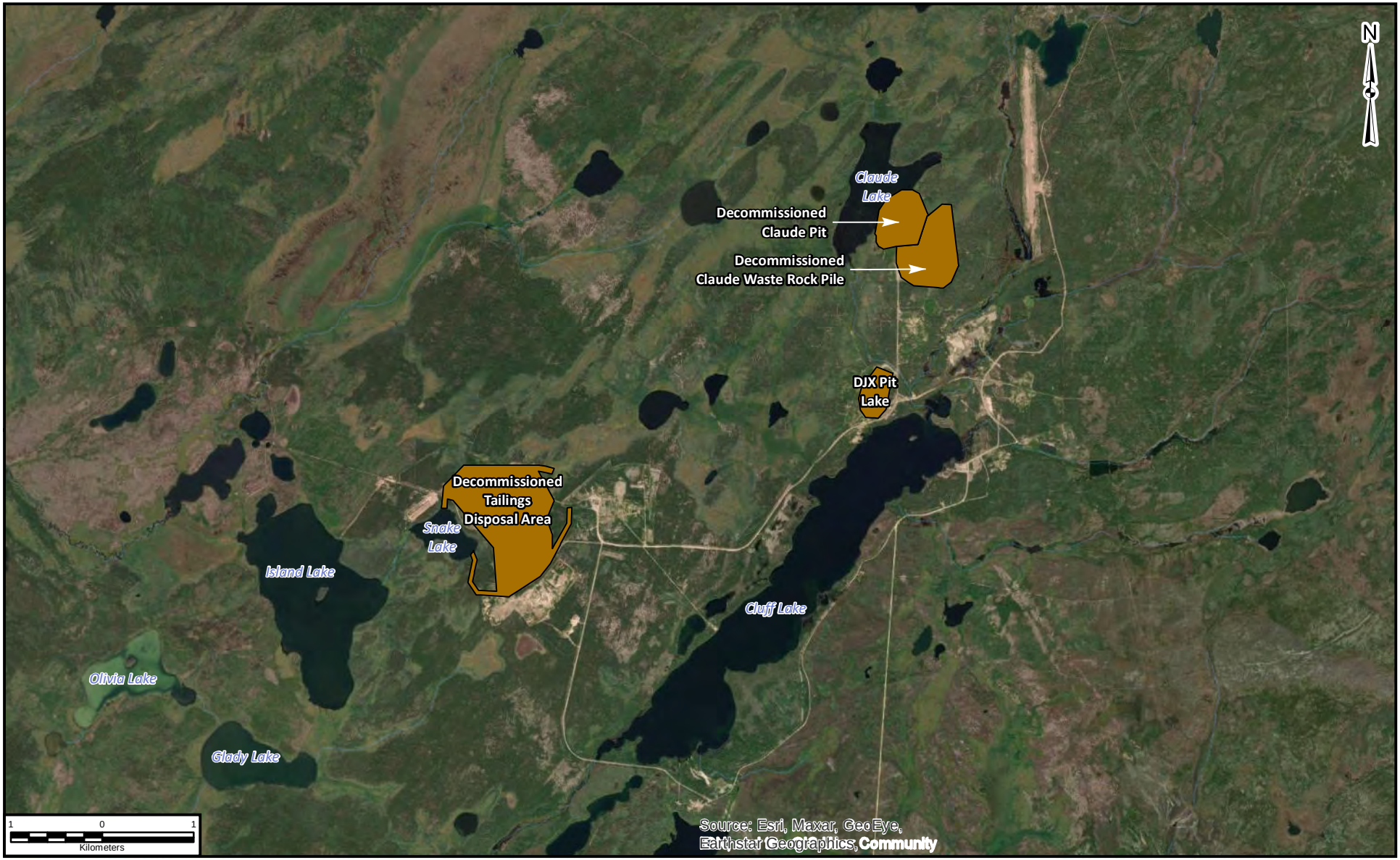
4.2 TMA Cover – ponding

Decommissioning of the TMA involved placement of an engineered cover (minimum 1 m glacial till) over tailings that would promote surface runoff, minimize infiltration, and provide a medium for revegetation. With backfilling and covering the area to an elevation above the anticipated post-closure phreatic surface and grading, ponding of water and/or groundwater seepage was intended to be minimal with positive drainage towards the spillway maintained. Ephemeral ponded water and areas with wetland features have been observed on the TMA. Monitoring results of generally low concentrations of COPC indicates that the majority of ponding is due to localized depressions holding fresh surface water but there is a possibility of intermittent groundwater daylighting on the TMA cover driven by seasonal and climatic influences on the water table despite overall net percolation.

Animals are expected to use, and have been observed on, the TMA. Orano undertook to evaluate and better quantify the associated potential risks to wildlife. The report providing an ecological risk assessment of the ponded areas was provided in August 2018 (CanNorth 2018).

The VECs selected for the TMA assessment included aquatic plants, phytoplankton, zooplankton, aquatic invertebrates, leopard frog, hare, muskrat, fox, moose, mallard, and nighthawk.

From an aquatic perspective, the ponded water on the TMA is not considered to be high quality habitat and does not support fish due to their shallow nature. 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.



Projection: NAD 1983 UTM Zone 12N
Compiled: T.Lohman Drawn: T.Lohman
Date: 2022-04-28 Scale: 1:60,000
Data Sources: Natural Resources Canada, Geobase®, Nation Topographic Database, ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 4.1
CLUFF LAKE DECOMMISSIONED NUCLEAR FACILITY
DECOMMISSIONED NUCLEAR FACILITIES WITH RADIOACTIVE INVENTORY >10^{15} Bq

orano

File: Q:\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 4.1 Cluff Lake Decommissioned Mine and Mill Site.mxd

The terrestrial assessment demonstrated that no adverse effects are expected for terrestrial VECs (wildlife) that use the TMA. In addition, there is no potential for risk for molybdenosis in moose. An assessment of potential effects on species at risk using the nighthawk as a reference species demonstrated that individuals will not experience adverse effects.

In conclusion, from an ecological perspective, it is not expected that ponded water on the TMA would result in population-level effects in ecological receptors that use the area and there will not be effects in species at risk.

4.3 D-pit – elevated COPC

Concentrations of several COPCs showed increases in the 2020 surface water sample results including sulphate, molybdenum, selenium, nickel, and uranium (which exceeded DSWQO). These increases carried over into the 2021 sampling although decreases in surface water concentrations were noted for most affected COPCs. Orano associates these increases with a large precipitation event in August 2020, which is suspected to have washed a higher-than-normal loading of COPCs from the adjacent D-pit waste rock pile into the D-pit. The decrease in most COPC concentrations in the 2021 surface water samples is in line with the expected performance of the D-Pit after such an inflow event.

Elevated concentrations of COPCs which initially report to the surface layer of the pit will gradually decline as COPCs fall out through the water column to be sequestered below the chemocline. This movement of COPCs deeper in the pit is most noted in uranium values which have decreased slightly in 2021 surface water quality values and increased in the 10 m interval sampling as predicted. It is expected that surface water quality and 10 m depth interval values of uranium in the D-Pit will gradually decrease to again achieve DSWQO objectives. The chemocline remains stable in D-Pit which restricts the interaction of the deep pit water with the surface. In general, for D-Pit surface water samples molybdenum concentrations remained well below available provincial guidelines for the protection of freshwater aquatic life while, uranium concentrations continued to exceed the available provincial guideline of 15 µg/L for the duration of the decommissioning and monitoring period.

5 Institutional Controls

The Cluff Lake site decommissioning has been designed such that no active maintenance is expected. An evaluation of permanent occupancy indicates low risks. The Cluff Lake property has a very low reliance on institutional controls for the protection of people or the environment.

Decommissioning involved the removal or stabilization of constructed structures and the reclamation of disturbed areas. Orano's key objective was to remove, minimize, or control potential contaminant sources and thereby minimize the potential for adverse environmental effects associated with the decommissioned property. Decommissioning was designed to minimize the need for care and maintenance activities and long-term institutional controls taking into consideration socio-economic factors. The objectives for decommissioning have been achieved.

Long-term monitoring requirements are expected to be infrequent and minimal as the site will be stable and self-sustaining upon transfer to the provincial IC Program.

The provincial IC Program will protect areas of land to make sure they are only used for appropriate uses in the future so that the decommissioned sites are not disturbed by other developments.

Administrative responsibility for the Cluff Lake site will be with the Province of Saskatchewan following successful transfer into the IC Program. Under the IC Program, acceptable land uses are defined, and administrative controls put into place. Sections 10 and 17 and of the *Reclaimed Industrial Sites Act* describes the ability of the Province to restrict or control access as follows:

> ***Controlling access to closed sites***
>
> *10(1) The minister may restrict or prohibit access to a closed site that has been accepted into the Institutional Control Program if the minister considers it to be in the public interest to do so.*
>
> *(2) No person who has knowledge of a restriction or prohibition imposed by the minister pursuant to subsection (1) shall fail to comply with that restriction or prohibition.*
>
> ***Offence and penalties***
>
> *17(1) No person shall fail to comply with subsection 10(2).*
>
> *(2) Every person who contravenes subsection 10(2) is guilty of an offence and liable on summary conviction to a fine not exceeding $50,000.*

(3) Every director, officer or agent of a corporation who directed, authorized, assented to, acquiesced in or participated in an act or omission of the corporation that would constitute an offence by the corporation is guilty of that offence and is liable on summary conviction to the penalties provided for the offence whether or not the corporation has been prosecuted or convicted.

Additionally, proposed Crown land use (e.g., quarrying, exploration) requires application and approval for the applicable lease, permit, easement, or licence to allow authorized use. The Ministry of Environment reviews applications to ensure that environmental and resource impacts are considered (including proximity to other land users, buffers from sensitive area(s), and designations that prohibit certain types of development) before issuing a decision.

In consideration of administrative controls, Orano recommends that:

- The decommissioned mine footprint has industrial and commercial uses and disturbances restricted. Some industrial and commercial uses such as exploration and quarrying may be compatible with the long-term decommissioning stability of the Cluff Lake site, depending on location. No exploration or quarry activities on the decommissioned mine footprint should take place without the Ministry outlining potential risks and consequences and, pending Ministry approval, having that land user accept liability. The CWRP, Claude pit, and TMA should have no approved industrial or commercial uses or disturbances.
- There should be no draining and/or dredging of Claude or Snake lakes.
- There should be no installation and use of wells to access groundwater for drinking water.

6 Lessons Learned

Key lessons learned from the decommissioning of the Cluff Lake Project, include:

- Mining is a temporary use of the land. Beginning a mining project with the end-state in mind leads to successful decommissioning.
- End-state expectations need to be developed in partnership with regulators and local stakeholders early in the project.
- Continual engagement with local stakeholders, especially land-users, throughout the development, operating, and decommissioning period ensures needs are met post-closure.
- Environmental assessment is a valuable planning tool.
- Having an actionable decommissioning plan during the operating period enables progressive decommissioning.
- Working in a jurisdiction with an institutional control framework (i.e. Saskatchewan) in place is enviable in the global mining industry.
- Implement systems to collect and maintain corporate knowledge and history.

7 Institutional Control Program

7.1 Long-Term Monitoring and Maintenance

7.1.1 Monitoring

With decommissioning objectives sustainably achieved and long-term stability of the site projected, monitoring requirements have been appropriately reduced. Environmental and ecological risk assessments provide the basis for the scope and complexity of monitoring programs and as such, the Cluff Lake Long-Term Monitoring and Maintenance Program (LTMMP) was proposed in the 2019 EP TID and subsequently removed to form its own independent document.

A LTMMP will continue, into the far future, at a reduced sample frequency focused on confirming and demonstrating the site's environmental performance against predicted performance and relative to decommissioning objectives. Notwithstanding major changes in the understanding of ecological and human health risk, if monitored surface water quality remains comparable to predicted surface water quality over time it can be reasonably assumed that the assessed risks (or absence of risk) remain valid. In this way, monitoring at a selection of key surface water quality locations can confidently validate the continued achievement of the following decommissioning objectives: I) achieving DSQWO and II) a site that poses no unreasonable risk to humans or the environment. The predicted rate of change in surface water quality should inform and influence the sampling frequency.

For the purpose of estimating the financial assurance, 16 key surface water quality sampling locations are assumed; a -one-time fish, sediment, benthic and vegetation survey and the associated program cost estimates for planning, travel, accommodations, equipment rental, sample analysis, report writing, and modest on-going public engagement/communication. It is expected that the frequency of site monitoring would diminish with time.

7.1.2 Maintenance

The need for long-term care and maintenance has been minimized through decommissioning design and completed reclamation. Long-term maintenance requirements are expected to be infrequent and minimal as the site is stable, self-sustaining, and under passive care. The LTMMP is assumed to comprise of periodic geotechnical inspections to monitor the stability of engineered structures, water management, and potential erosion and it is through this monitoring that potential maintenance would be identified.

For the purposes of estimating the financial assurance, a geotechnical inspection and associated site maintenance value is included in each monitoring year. The most probable future maintenance is expected with either I) potential settling in the landfills or in the TMA that would require localized work to fill holes or

maintain overall surface grading, respectively or II) potential erosion on the TMA or CWRP covers that would require localized works.

7.2 Funds and Assurance

With reclamation and decommissioning work completed, the ongoing cost of post-closure management includes monitoring and maintenance of the Cluff Lake property. The decommissioned end-state objective was to achieve a stable and self-sustaining site with perpetual passive care. Engineered structures including the CWRP and the TMA dam have been designed to require no routine on-going maintenance. Underground mine workings were backfilled as part of routine operations, vent raises were backfilled completely before capping, and declines were substantially backfilled before closure. Replacement of decommissioned features is not anticipated at the Cluff Lake property, e.g., there are no shaft caps to replace. Monitoring of the site will include geotechnical monitoring to ensure landforms are stable, and water quality monitoring to ensure continuous achievement of decommissioning objectives.

LTMMP funds have been estimated according to guidance provided in the provincial IC Program document (SMER 2009). Future costs are based on escalation of present costs using a 10-year average Bank of Canada inflation rate. The calculation of the net present value of an annuity that would support future site expenses assumes a conservative rate of return of 3.65%, i.e., inflation plus 2%. The present value of a cash payment sufficient to support monitoring and maintenance in perpetuity has been proposed to the Government of Saskatchewan.

The Province of Saskatchewan's *Reclaimed Industrial Sites Act* and its regulations require provision of a fund sufficient to pay for the perpetual monitoring and maintenance of the site, and an additional contribution of 20% of the monitoring and maintenance amount to an unforeseen events fund. Until such time as the provincial unforeseen events fund is self-sufficient, new entries into the IC Program are requested to provide an additional financial assurance for repair of a potential low-probability, worst-case failure event.

7.3 Schedule to IC Program

Briefly, some of the major decommissioning milestones for the Cluff Lake Project include:

- 2000 - Comprehensive Study for Decommissioning (CSD; AREVA)
- 2003 - Comprehensive Study Report (CSR; CNSC)
- 2004 – CNSC decommissioning approval
- 2004 to 2006 – primary decommissioning
- 2004 - partial surrender of provincial surface lease
- 2009 – revised Detailed Decommissioning Plan

- 2013 – physical decommissioning of remaining surface infrastructure, minor earthworks, continuous site presence discontinued
- 2013 – unrestricted access to site
- 2014 – environmental monitoring transitioned to campaigns 4X/year
- 2014 – revised Detailed Decommissioning Plan
- 2015 – reclassification of entire provincial surface lease to ‘undeveloped’
- 2015 – submission of the Cluff Lake Technical Information Documents demonstrating current and long-term achievement of decommissioning objectives
- 2015 – completion of Follow-Up Program (updates in 2004 and 2009)
- 2017 to current – environmental monitoring transitioned to 1X/year
- 2018 – completion of activities under DDP
- 2018/2019 – transition of DDP to Detailed Post Decommissioning Plan
- 2019 – submission of the Cluff Lake Technical Information Documents demonstrating current and long-term achievement of decommissioning objectives
- 2019 – CNSC license renewal and amendments
- 2019+ - development and review of Long Term Monitoring and Maintenance Plan and associated Funds with regulators and stakeholders
- 2020 – surface lease reduction to 336.39 hectares
- 2021 – conduct minor works and decommission groundwater wells
- 2022 – optimization of 2022 environmental monitoring program, generally reduced to sampling required in LTMMP

8 Traditional Land Use

Traditionally, the site was seasonally accessed by an aboriginal trapper who maintained a commercial trap line in the local study area. The trapper also hunted and fished for personal consumption. There is no evidence of other site activities by aboriginal or non-aboriginal peoples prior to site development. Throughout the Cluff Lake Project history, this same trapper continued to trap within the Cluff Lake area. The trapper-maintained cabins at both Cluff Lake and Sandy Lake. In addition, an outfitter also established a fishing/hunting lodge on the shore of Carswell Lake, approximately 20 km north of the site. While some fishing has occurred on Cluff Lake, most fishing is concentrated on the nearby Sandy and Carswell Lakes. Gathering and consumption of locally available low bush cranberries, blueberries, and mushrooms has also been conducted throughout the Project history.

Orano acknowledges and appreciates land use information shared from the representatives from the 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:

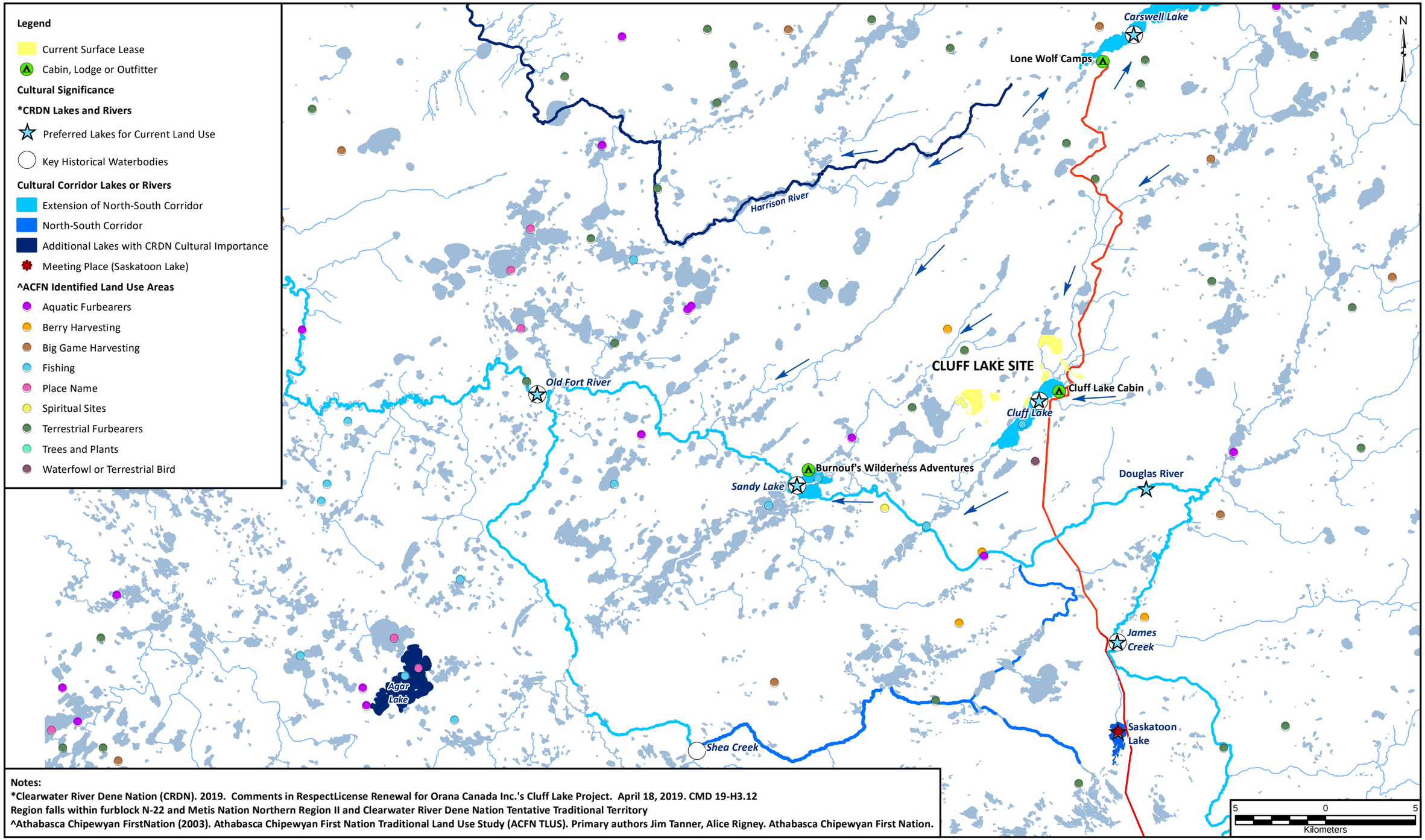
- Traditional land use, while sometimes utilizing land and resources in a small and preferred area, generally involves travelling over a wide area. The decommissioned Cluff Lake footprint is generally considered small relative to areas used for traditional purposes.
- Traditional land users would be 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 human-made 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 participants agreed upon a base case scenario to assess potential risk in the Human Health Risk Assessments (HHRA) conducted by Orano: 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.

Additionally – full time residency was considered in the HHRA - The full-time receptor is assumed to obtain 70% of drinking water from Cluff Lake and 30% from a background lake, such as Carswell Lake, which is a known popular fishing lake.

Results were comparable to the casual traditional land use receptor, with both scenarios indicating:

- decommissioned Cluff Lake site is safe for people who may hunt, fish, drink water and gather from the site and that the food from and near the site is safe to share with extended families, including children



Notes:
*Clearwater River Dene Nation (CRDN). 2019. Comments in RespectLicense Renewal for Orana Canada Inc.'s Cluff Lake Project. April 18, 2019. CMD 19-H3.12
Region falls within furblock N-22 and Metis Nation Northern Region II and Clearwater River Dene Nation Tentative Traditional Territory
^Athabasca Chipewyan FirstNation (2003). Athabasca Chipewyan First Nation Traditional Land Use Study (ACFN TLUS). Primary authors Jim Tanner, Alice Rigney. Athabasca Chipewyan First Nation.

Projection: NAD 1983 UTM Zone 12N
Compiled: T.Lohman Drawn: T.Lohman
Date: 2022-05-03 Scale: 1:200,000
Data Sources: Natural Resources Canada, Geobase®, Nation Topographic Database, ORANO Canada Inc.

CLUFF LAKE PROJECT

FIGURE 9.1
LAND USE NEAR THE DECOMMISSIONED CLUFF LAKE PROJECT

orano

File: Q:\SHEQ\GIS\CLUFF_LAKE\2022\End State DDP\Maps\Figure 9.1 Land Use Near the Decommissioned Cluff Lake Project.mxd

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Appendix A – Concordance Tables

Table A.1: Ministry Energy and Resources IC Program Process for application

Step/Requirement	Status
Decommissioning and Reclamation	Completed
Operator Applies for Release - Release from decommissioning and reclamation to SMOE - Release from licence to CNSC	Initially submitted in February 2020 - Provincial commitments are pending
SMOE issue release	Pending
CNSC issue exemption	Public hearing required
Operator applies for and is issued a release from Surface Lease Agreement	Submitted in February 2020
Operator applies for entry into IC Program	Submitted in February 2020
Items established required for IC Program entry - LTMMP and funds - Unforeseen Events Funds - Financial Assurance = to failure event - Registration fee = $500	LTMMP and funds under review between Orano, MOE and the ER Registration fee to be paid to Ministry of Finance

Table A.2 REGDOC 2.11.2 Decommissioning; Section 9 Completion of Decommissioning – End State Report requirements

	End State Report	Other Reference/Comment
Documentation that end-state has been met (with survey results)	Section 2.1	
Proposed further licence requirements/institutional controls	Section 6 and 8	
Release Criteria	Section 2.1	
Decommissioning works, noting deviations	Section 3.2, Appendix B3	
Remaining SSCs	NA	
Final physical and radiological status	Section 3.2	Gamma Radiation Clearance Reports: • Submission for Gamma Radiation Clearance – Cluff Lake Project, November 2007 (AREVA 2007a) • Review of Surface Gamma Radiation Survey of Disturbed Areas at Cluff Lake Site and validated by a third party survey (SENES 2009) • Addendum to Submission for Gamma Radiation Clearance – Cluff Lake Project, titled Submission for Gamma Clearance of the Germaine Camp Area, December 2009 (AREVA 2009) • 2014 Surface Gamma Clearance Report - Cluff Lake Project, October 2014 (AREVA 2014a) • Cluff Lake Project – Surface Gamma Clearance Report, October 2018 (Orano, 2018e)
List of SSCs designated for restricted use	Section 6	
Summary of remaining waste	Section 4	
Waste quantities and disposition	Section 4	
Summary of radiological doses received by workers during decommissioning	Appendix B4	
Summary of abnormal occurrences of incidents that occurred during decommissioning	Section 5	
Lessons learned	Section 7	
Reference to decommissioning records	Appendix B3	
Future use, or restrictions	Section 6	

Appendix B – Cluff Lake Operations and Decommissioning History

B1 Cluff Lake Environmental Assessment History

Initial exploration activities in the Cluff Lake area date back to the 1960's. Subsequent to the delineation of the "D" ore body, the proponent (Amok Ltd.), at the request of the Department of Environment Saskatchewan, submitted the initial Environmental Assessment and Safety Report (1976) for the development of a uranium mine and mill (Phase I). At the time of that request, there were provisions in the law for a proposed mine operator to provide certain information regarding the intended operations of a uranium mine and mill and the physical environment liable to be affected by it (AECB 1974).

The Minister of Environment asked the Lieutenant-Governor-in-Council for a public inquiry to review the Environmental Assessment and Safety Report, and to "contemporaneously study what have been termed the "broader implications" and "global implications" of expanding the uranium mining industry in Saskatchewan" (Bayda 1978). The Board of Inquiry, commonly referred to as the Bayda Commission, reviewed the expansion to uranium mining in northern Saskatchewan. The Atomic Energy Control Board (AECB, the precursor federal nuclear regulatory agency to the Canadian Nuclear Safety Commission (CNSC), and other federal regulatory agencies participated in the Board of Inquiry.

Subsequent to review of the EA, written briefs and public and formal hearings, the Board of Inquiry recommended that development of the Cluff Lake Project proposed mill and mine proceed, and that the uranium industry be allowed to expand in northern Saskatchewan (Bayda 1978). The AECB also used the findings and recommendations of the Board of Inquiry to proceed through the AECB licensing process.

Phase II of the Cluff Lake site development (Cluff Mining 1982) was the subject of a provincial environmental assessment under the Saskatchewan Environmental Assessment Policy (1978). The Phase II assessment encompassed uranium reserves identified as the Claude, N, N40, OP, and Dominique-Peter (DP) ore bodies (Cluff Mining 1982). Once again, the province and AECB, reviewed the EA. A Ministerial Approval was issued in June of 1983, to allow development of the abovementioned mining operations.

In 1985, Amok Ltd. advised the regulatory agencies that it had discovered a new ore body, the Dominique-Janine (DJ) ore body that was more appropriate for development than the N ore bodies. In late 1986, the regulatory agencies agreed that Amok Ltd. could proceed with the development of the DJ ore body. In 1989, the Saskatchewan government issued a Ministerial Approval that effectively added the DJ mining operations to the existing operating licence. Further investigations to delineate the DJ ore body indicated uranium mineralization extended continuously southward toward the edge of Cluff Lake (Amok Ltd. 1992).

The proposed extension of the DJ mining operation to encompass the reserves identified south of the existing mine development occurred at the same time that several other uranium mining projects were also

being proposed in northern Saskatchewan. These projects included the development of the Midwest, McArthur River and Cigar Lake projects along with AREVA's (then COGEMA) McClean Lake Operation. In response to these development proposals, the governments of Canada and Saskatchewan under their respective legislation, the federal Environmental Assessment Review Process Guidelines Order (EARPGO 1984) and the provincial Environmental Assessment Policy (EAP 1978), appointed a Joint Federal-Provincial Environmental Assessment Review Panel (Joint Panel) to study uranium mine developments in northern Saskatchewan. The mandate of the Joint Panel, as outlined in its terms of reference, was to review the environmental, health, safety, and socioeconomic impacts, including the benefits afforded by the proposals, and assess their acceptability. These projects became the subject of an environmental assessment by the Joint Federal-Provincial Panel on Uranium Mining Developments in northern Saskatchewan.

Ultimately, the Joint Panel, based on its terms of reference to review the environmental, health, safety, and socio-economic impacts including the benefits of the proposals, recommended to the governments of Saskatchewan and Canada that these projects should be allowed to proceed (Joint Panel 1993 and 1997). The Joint Panel also recommended a wide range of conditions that the federal and provincial governments should consider when allowing the proposals to be implemented (Government of Saskatchewan 1993, Government of Canada 1993). The Joint Panel recommendations and the provincial and federal government responses resulted in the establishment of a variety of mechanisms to minimize environmental impacts and maximize the economic benefits to northern Saskatchewan. Many of the recommendations facilitated opportunities for northern persons and businesses to benefit from the development of the uranium mining industry in northern Saskatchewan. Other recommendations were implemented as federal and provincial license conditions, which imposed constraints on the construction and operation of the proposed facilities.

In parallel with the Joint Panel review from 1992 to 1997 under EARPGO, the federal government moved to strengthen the environmental assessment process in Canada, replacing the federal EARPGO with the Canadian Environmental Assessment Act (CEAA 1992). The CEAA, which came into force in 1995, contains provisions to maintain valid environmental assessments conducted under EARPGO. With the promulgation of CEAA, new uranium mining activities, facilities, and substantive changes to existing uranium mining operations were subject to the requirements outlined in the Act.

Upon completion of the Joint Panel EARPGO environmental assessment, the licensing of activities at the Cluff Lake site were subject to the CNSC staged licensing process which authorizes the development and operation of a uranium production facility. The preliminary decommissioning plans arising from the DJX EA, and subsequent licensing requirements formed the basis of what would become the detailed decommissioning plan for the Cluff Lake Project.

In April 1999, COGEMA submitted a Project Description for the proposed Cluff Lake Decommissioning Project to regulators. In May 1999, the CNSC advised COGEMA that they had determined a Comprehensive Study level environmental assessment (EA) was required under CEAA, 1992, with the CNSC as the Responsible Authority[1]. The CNSC further established, in consultation with SMOE, that an EA of the decommissioning project was not required by the Saskatchewan Environmental Assessment Act. However, SMOE agreed to participate as technical reviewers in the assessment process and were required under the provincial process to approve the decommissioning plan prior to its implementation.

Guidelines for the scope of the project and the scope of the assessment were provided by the CNSC to COGEMA in October 1999. Pursuant to Section 17 of CEAA, 1992 the CNSC delegated COGEMA the responsibilities for public consultation and the preparation of technical EA studies and documentation

A detailed decommissioning plan and environmental assessment was developed. The Cluff Lake Project Comprehensive Study for Decommissioning (CSD, COGEMA 2000) was prepared to meet the requirements of the Canadian Environmental Assessment Act (CEAA 1992). The CSD (COGEMA 2000) was submitted to regulatory agencies, including the CNSC, Environment Canada, Health Canada, Natural Resources, SMOE and Saskatchewan Labour in 2000. Combined with subsequent technical reviews and responses (COGEMA 2001, COGEMA 2002), the CSD provided much of the basis of the CNSC Comprehensive Study Report (CSR; CNSC 2003). The CNSC CSR for decommissioning was submitted to the federal Minister of Environment and Canadian Environmental Assessment Agency in January 2004. The CNSC was the Responsible Authority under the CEAA for environmental assessment of the decommissioning plan developed by AREVA. The Minister of Environment issued its decision on the EA on April 15, 2004, determining that the project is not likely to cause significant adverse environmental effects. Subsequent to federal and provincial ministerial approval of the decommissioning environmental assessment, a decommissioning license was granted in 2004 from the CNSC, and an Approval to Operate Pollutant Control Facilities was granted from the SMOE. Approvals for decommissioning have been maintained over time.

B2 Cluff Lake Project Operations Summary

During its 22 years of operation, the Cluff Lake Project produced 62 million pounds of U_3O_8. The sequence of activities at the Cluff Lake Project is presented in the following sections. Project milestones are summarized as follows:

[1] Under the Nuclear Safety and Control Act (1997) and associated regulations, a uranium mining facility may only be decommissioned in accordance with a CNSC licence. The issuing of a decommissioning licence by the CNSC represented the exercise, by a federal authority, of a regulatory duty covered under the Law List Regulations of the CEAA, and thus triggered the application of the CEAA. A comprehensive study was required for the project pursuant to the Comprehensive Study List Regulations (CEAA 1992; section 19(b)).

Table B1.1 Cluff Lake Operational Milestones

Year	Milestone
Mid-1960s	Exploration
1978	Bayda Commission approves mine and mill operation at the Cluff Lake site
1979-81	D-Open pit mining (Phase I)
1982-89	Claude Pit mining (Phase II)
1983	D-Pit area decommissioned
1983-84	Re-milling of Phase I D ore gravimetric tailings
1983-99	OP/DP underground mining (Phase II)
1987-89	Gold extraction circuit added to the mill to recover gold from the Phase I tailings
1989-91	DJN Pit mining
1994-97	DJX Pit mining
1994	DJ underground mining
2002	After 22 years, mining (May) and milling (December) operations cease with a total production of 62 million pounds

The Cluff Lake ore bodies were first discovered in the mid-1960s. Mining activity commenced at the Cluff Lake Project in 1979 and ceased in 2002. Six different ore bodies were approved for extraction (D, Claude, OP, DP, N and DJ ore bodies) using a combination of open pit, underground, and surface-to-underground extraction methods. At the conclusion of the project, five ore bodies were extracted using either underground or open pit techniques. Mining of the N ore body was deferred in favour of the Dominique-Janine (DJ) ore body. The delineation of extent of the DJ ore body was completed in 1989. The surface-to-underground extraction method approved for the DJ ore pods proved to be uneconomical and did not proceed beyond the test phase. During operations, facilities included four mined-out open pits, two underground mines, a mill, a tailings management area with a two-stage liquid effluent treatment system, a residential camp area, and various other support and site infrastructure facilities.

The Cluff Lake Project was initiated in 1977 with the formation of the Board of Inquiry known as the Bayda Commission (Bayda 1978). The final report made by this Board in June 1978 stated that the proposed mining and milling operations at Cluff Lake should be allowed to proceed and that the expansion beyond the initial proposal should also be allowed, recognizing potential future development.

Construction of the Cluff Lake Project was completed in 1979 with operations commencing in early 1980. Phase I operations consisted of the mining and milling of ore from the D ore body. Ore from the D-Pit was milled in stages; first, using conventional milling methods, and second (phase I extension), by re-milling uranium-bearing gravimetric tailings that were generated from the first stage of milling.

To accommodate the additional tailings that would be generated during Phase II mining and milling, the TMA was sequentially expanded. Two additional dams were built in 1982 and a dike was constructed to divide the tailings ponds into a solids pond and a liquids pond area in 1984. In 1986, a berm was

constructed across the solids area to segregate the Phase I tailings. To optimize the TMA area, additional internal berms were constructed in the 1990s to further segregate tailings and improve existing storage capacities.

Post-mining clean-up and reclamation activities of the D-Pit and associated D waste rock pile included the removal of surface facilities, breaching of the Boulder Creek diversion dam, and removal of the half culvert diversion flume which had diverted Boulder Creek past the open pit. The Boulder Creek stream channel was re-established adjacent to the D-Pit in 1983. During the 1983 spring thaw, an ice dam formed in Boulder Creek, causing the creek to overflow and flood D-Pit. In response, a dyke was constructed between Boulder Creek and the open pit. D-Pit has remained flooded and isolated from Boulder Creek over the intervening years with no surficial outflow.

Subsequent to the removal of the D mining area surface facilities, the D waste rock pile and surrounding area disturbed during development was resloped and revegetated between 1983 and 1985.

In June 1983, ministerial approval was issued for Phase II operations, which allowed for the development of the Claude open pit, the N open pit and N40 underground (not developed), and the OP and Dominique Peter (DP) underground. Ore from the Claude open pit and from the OP underground mine supplied the initial mill feed for Phase II operations. At the completion of the underground mining of the OP ore body, the Company began extracting ore from the DP ore body, also using the underground mining method. In September 1986, the Dominique Janine (DJ) ore body (subsequently referred to as Dominique-Janine North (DJN)) was added to the existing license, which allowed for development of the DJN open pit.

The open pit mining of the Claude ore body ended in mid-1989. In order to prepare for continuing operations at the Cluff Lake Project, Amok Ltd., in April 1988, submitted to the various regulatory agencies, both federal and provincial, an application for approval to proceed with the open pit mining of the northern part of the DJ ore body. In 1993, subsequent to the Joint Panel environmental assessment review, regulatory approval was granted for the Dominique Janine extension (DJX) which consisted of the development of the DJX open pit, which was adjacent to and contiguous with the existing DJN open pit, and the development of the DJ underground.

To facilitate milling of lower grade ores generated from Phase II activities, the mill underwent modification/expansion in 1993-1994.

The scope of the Dominique-Janine Extension (DJX) Project was modified as described in the COGEMA Resources Inc. March 1994 proposal, to include the following components:

- Part 1 of the DJX pit;
- Placement of waste rock into the mined out Claude and DJ North pits only (i.e. none into Cluff Lake);
- No dam or dewatering wells within Cluff Lake, to significantly reduce the amount of liquid effluent;
- Creation of an underground mine using the cut and fill method; and

- Tests of jet boring and/or blind boring methods to mine the DJ ore pods (at the shoreline of Cluff Lake).

These approved modifications addressed four (4) recommendations of the 1993 Joint Federal-Provincial Report and provided enhancements to environmental protection. The DJX pit was mined out in August 1997. After testing in 1995-1996, the DJ Pods area proved to be an uneconomical deposit. The test site was closed down in 1996 and reclaimed in 1999-2000.

In 1997, approval was received to haul the OP/DP waste rock pile to Claude pit. Haulage was completed in 2000. In the fall of 1999, the DP underground mine was shut down due to depleted ore reserves. Permanent closure was completed in 2000 with the backfilling and capping of the raises and decline completed in 2002. Natural flooding of the DP underground working was complete in August 2002.

The company announced in August 1998 that it would indefinitely suspend operations at the Cluff Lake Project as of December 31, 2000, due to depletion of economically viable ore reserves and the volume of tailings approaching the authorized capacity of the existing TMA. Additional ore reserves in the DJ underground mine, with a higher grade than the historical average, made it economically feasible to extend the operation into 2002. The raises and declines were backfilled and capped in the summer and fall of 2002. Flooding of the mine was assisted using water from the adjacent DJX Pit. The higher grade also reduced the rate at which tailings are generated; thereby extending the period until the TMA reached its authorized capacity. Mining operations extended through May of 2002, while milling, to process all of the remaining ore, was completed in December of 2002. The mill was subsequently put into care and maintenance in preparation for decommissioning.

History of Incidents and Accidents

Throughout the twenty-two-year operational life of the project, there were a number of minor spills and incidents. These events have been described in detail in Section 2.4.3.2 of COGEMA, 2000.

There was also one incidence of surface-expressed subsidence of an underground mine working which occurred on February 28, 1999. A complete account of this incident can be found in Section 5.5.6 of COGEMA, 2000.

B3 Cluff Lake Project Decommissioning Summary

The Cluff Lake Project site was largely decommissioned in 2004 and 2005 with minimal infrastructure left to support ongoing reclamation activities and environmental monitoring. In 2013, decommissioning of remaining structures was completed and permanent site occupancy was discontinued. In 2017 and 2018, the final minor works at the Cluff lake site were completed and the activities listed under the Detailed Decommissioning Plan completed.

Table B1.1 Cluff Lake Decommissioning Milestones

Year	Milestone
2002	After 22 years, mining (May) and milling (December) operations cease with a total production of 62 million pounds
2003	CNSC Comprehensive Study Report (CSR) for Decommissioning submitted to the Minister of Environment and Canadian Environmental Assessment Agency
2004	Decommissioning licence granted by CNSC and physical decommissioning work begins
2004	ISO 14001 certification for environmental management system-the first North American uranium mine in the process of being decommissioned
2006	Physical decommissioning substantially complete; Cluff Lake Project officially recognized as a Closed Mine under the Metal Mining Effluent Regulations (EC 2002)
2009	CNSC 10-year decommissioning licence obtained
2013	Final physical decommissioning of the Cluff Lake site completed – end of continuous site occupancy
2018 and 2020	Minor works
2019	CNSC licence amendment/renewal issued for 5 years Reduced surface lease; releasing parcels that would not be transferred into IC Program
2013-2022	Campaign environmental monitoring

Following shut down, the Cluff Lake Project was in a state of care and maintenance until July 2004 when decommissioning approval was received. From 1999 until the summer of 2004, a number of miscellaneous clean up and reclamation activities were carried out to reduce risks to health, safety and the environment.

In 1999, as part of ongoing operations and in an effort to reduce potential environmental impacts or eliminate radiological or safety hazards, COGEMA initiated several site cleanup and reclamation activities. Reclamation activities were focused on the DJ pods area, the B1-B2 ponds at the outlet of the Secondary Treatment System, the Claude pit area and a fuel storage area north of the mill complex. Also in 1999, a south diversion ditch was constructed at the TMA to divert surface water runoff around the Southeast portion of the TMA.

In 2000, site cleanup and reclamation efforts were concentrated on the ore storage bins, gold plant and mine water holding ponds at the mill complex. A second diversion ditch, which diverts flow around the Northwest portion of the TMA, was constructed in the fall of 2000.

In 2001, a number of redundant surface facilities at the DP, DJ and Claude mines and Germaine Camp were removed. A nominal 1 m leveling course was placed on the Upper Solids of the TMA to reduce gamma fields, LLRD and RnP levels to near background levels. Resloping and compaction tests were conducted on the Claude Waste Rock pile. The environmental monitoring program underwent an initial review, which lead to the installation of additional piezometers around waste rock piles and landfill sites.

In 2002, most of the remaining surface facilities and contaminated surface materials at the DP and DJ mines were removed and hauled to Claude pit for disposal. All DJ underground (DJU) raises and the DJU decline were backfilled with till material in 2002. The DJU decline was backfilled from approximately 181 m down the ramp to the portal opening. Reinforced concrete caps were placed above all backfilled raises and a

concrete plug was poured at the DJU portal opening. The mine was flooded in 2002 using minewater from the adjacent DJX pit.

The Claude Waste Rock Pile (CWRP) was recontoured in 1993 to reduce side slopes to 2H:1V or less. In 2001 and 2002, resloping and compaction tests were conducted on the CWRP to evaluate constructability and potential performance limitations in support of the final cover design.

In 2003, the leveling course initiated in 2001 was extended to cover all remaining exposed tailings in the TMA. Mill mothballing was completed. The batch plant was sold and removed in 2003. Decommissioning activities were completed with final regrading and revegetation of the area.

In 2004, approvals from the CNSC and SMOE were received for demolition of the mill, backfilling of the Claude Pit, and covering of the TMA. Mill demolition was completed in December of 2005 with demolition materials backfilled into the Claude Pit. At the TMA, backfilling of the liquids pond and placement and grading of glacial till material for the cover commenced.

In 2005, work at the former DJ mining area included radiological cleanup, removal of the DJ fuel tank, and backfilling of the DJN sump. Flooding of DJX Pit with water from Cluff Lake commenced in May 2005. Waste rock excavation from DJN Pit (initiated in 2004) was completed and all waste was disposed of in Claude Pit. Claude mining area activities included completion of the Claude Pit dewatering, excavation, and relocation of waste rock from the CWRP, regrading and compaction of the CWRP, initiation of cover placement, removal of the Claude pit dykes, reclamation of the ore pad area. Where final grading was complete, tree seedlings were planted as part of the revegetation project.

In 2006, final landscaping of the DJ yard and pit areas was completed. Flooding of DJX Pit was completed in January. TMA activities included completion of the Grading Course, completion of the Liquids Pond backfilling, buttressing of the Main Dam, and construction of the storm water/runoff management structures. Claude mining area activities included completion of the covers for Claude Pit and the waste rock pile and removal of the Claude Shop. The Claude Yard was covered with glacial till and graded to match the surrounding contours. To address a contaminated groundwater plume originating from the waste rock pile, a permeable reactive barrier (peat trench) was constructed southwest of the pile to intercept the plume. Revegetation activities included planting tree seedlings where final grading was completed, as well as seeding the TMA and Claude Waste Rock Pile with a blend of grasses and legumes.

In 2007, reclamation work was essentially limited to continued revegetation of the major decommissioned areas and removal of power poles and power lines that were no longer needed. Some erosion gullies were observed along the TMA Main Dam and along the slopes of the Claude Waste Rock Pile. These gullies were repaired and revegetated. A second permeable reactive barrier was constructed next to the first barrier.

In 2008, reclamation activities included fertilizing the TMA and Claude Waste Rock Pile grass/legume covers. Hydro seeding was completed on areas of the TMA and Claude pile that showed poor germination. Some minor erosion gullies were repaired at the TMA Main Dam and some restructuring and relining of the runoff channel at the Claude Waste Rock Pile.

From 2009 to 2012, activities at the Cluff Lake Project mainly related to environmental monitoring, monitoring under the Follow-Up Program, and monitoring and maintenance of the physical performance of the completed decommissioning projects. During this time, minimal infrastructure remained to support activities. Remaining facilities included the Secondary Treatment System (STS) water treatment plant and settling ponds, heated shop and warehouse storage buildings, fuel farm, sewage and potable water treatment plants, five dormitory structures, kitchen facility, main office building, and power generators.

Site cleanup and decommissioning of remaining infrastructure took place from April to September 2013. Earthwork was completed to improve drainage in the TMA area and the STS was demolished. Horizontal drains were installed in the Claude Pit area to improve groundwater movement and lower groundwater elevation. The warehouse, fuel farm, water treatment plants, and camp facilities were demolished and disposed of in the landfill. Some culverts were removed, and streambanks reconstructed.

In 2017, 2018 and 2020 final minor works on site were completed. Reports on the 2017 and 2018 were submitted in support of closing the Cluff Lake DDP submitted for regulatory review.

In 2019, regulators acknowledged that decommissioning objectives had been met and a portion of the Cluff Lake surface lease was surrendered, releasing the following parcels without restrictions:

- Undeveloped/undisturbed areas – 508.11 hectares
- Surface water bodies (Cluff Lake and Island Lake as they do not require long-term controls or maintenance) – 527.21 hectares
- Remediated areas of previous surface disturbance – 260.76 hectares

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B4 Cluff Lake Project Decommissioning – Worker Doses Received during Decommissioning

Year	Total Collective Dose mSv	Average Dose mSv	Maximum Dose mSv
2004[1]	26.8	0.15	1.91
2005	16.7	0.10	1.20
2006	1.28	0.02	0.27
2007	0.41	0.03	0.08
2008	0.04	0.003	0.02
2009	0.06	0.005	0.03
2010	0.02	0.002	0.01
2011	0.05	0.005	0.05
2012	0.03	0.005	0.03
2013[2]	0	0	0
2014+[3]	-	-	-

[1]decommissioning occurred primarily during the final 5 months of the year – the presented results for the whole year

[2] In 2013 all workers received doses below the OLD detection limit of 0.01 mSv. Workers received no incremental dose while working on site.

[3] the level of dosimetry issued to workers is based on risk exposure. Worker exposure had been at background levels for several years before routine monitoring worker radiation ceased in 2013

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Ministry File: 25020-50\Cluff\06 Recl_Decom_FA\Decom 2022\06-87

November 10, 2022

Mr. Dale Huffman, Vice President, Operations
Orano Canada Inc.
100-833 45th Street West
SASKATOON, CANADA S7L 5X2
dale.huffman@orano.group

Dear Mr. Huffman:

Re: Letter of Intent - Orano Canada Inc. – Cluff Lake Project Release from Decommissioning and Reclamation Requirements

Ministry of Environment (ministry) staff have completed a review of the following Orano Canada Inc. (Orano) submissions:

- Letter dated September 9, 2022 titled, *Transfer of the Decommissioned Cluff Lake Project site into the Saskatchewan Institutional Control Program and Submission of Cluff Lake End-State Report*, Project File # 2022:06-51
- September 2022 report, *Orano Canada Inc.: Cluff Lake Project – End State Report for Provincial Intitutional Control*. Project File # 2022:06-51
- Letter dated February 28, 2020 titled, *Re: Request to Transfer the Decommissioned Cluff Lake Mine and Mill Site into the Provincial Institutional Control Program*, Project File # 2020:06-08.

Based on our review of the submissions and the minsitry's inspections of the properties in 2017, 2018, and 2022, ministry staff have the following comments:

a) The ministry acknowledges the letter and supporting report as Orano's application for release from decommissioning and reclamation requirements per Section 22 of *The Mineral Industry Environmental Protection Regulations, 1996*, for the properties listed in Table 1.

b) It is the minsitry's opinion that Orano has fulfilled their requirements and obligations as described in the approved decommissioning and reclamation plan submitted to the ministry; Therefore, it is the intent of the ministry to grant Orano a release from decommissioning and reclamation requirements per Section 22 of

…3

The Mineral Industry Environmental Protection Regulations, 1996, on the following conditions:

1) The parcels that require long-term monitoring and maintenance or fall within an area identified for institutional control (Table 1), are accepted into the Institutional Control Registry admininstered by Saskatchewan Ministry of Energy and Resources (MER).
2) The Canadian Nuclear Safety Commission (CNSC) exempts the Province of Saskatchewan from licensing requirements under *The Nuclear Safety and Control Act* and associated regulations.

Once the above mentioned conditions are met, the ministry will issue a release from decommissioning and reclamation requirements. Once the release is granted, the Orano Cluff Lake mine and mill site Surface Lease Agreement number N0585-18S can be amended to remove the land in question so it may be entered into the Institutional Control Registry.

It is expected that this letter will provide the necessary information for CNSC determination to exempt the Province of Saskatchewan from licensing requirements. If you have any questions, or require additional information, please contact the undersigned.

Sincerely,

Tim Moulding, M.Sc.
Manager, Northern Region

Attachment: Table 1. List of completed decommissioned parcels with current and proposed status.

cc: Tina Searcy, Manager Regulatory and Environmental Science, Orano
Ron Stenson, Canadian Nuclear Safety Commission
Dustin Zmetana, Ministry of Energy and Resources
Alan Merkowsky, Environmental Protection, Ministry of Environment
Collin McGuire, Environmental Protection, Ministry of Environment
Orano Distribution
File, Ministry of Environment

Table 1. List of completed decommissioned parcels with status.

Planning Envelope	Parcel	Status
D-Mining Area	D-Pit	Transfer to Institutional Control Program
Claude Mining Area	Claude Pit	Transfer to Institutional Control Program
	Claude Waste Rock Pile	Transfer to Institutional Control Program
DJ Mining Area	DJN/DJX Pit	Transfer to Institutional Control Program
	DJN Waste Rock Pile Area	Released in 2019
	DJ Underground	Transfer to Institutional Control Program
	DJX Overburden Pile	Released in 2019
OP/DP Mining Area	OP/DP Underground	Transfer to Institutional Control Program
Mill Complex Area	Mill Complex Area	Transfer to Institutional Control Program
Tailings Management Area	Cover and Main Dam	Transfer to Institutional Control Program
Landfills	domestic, industrial, secondary treatment system ponds, mill landfill and Cluff Centre landfill	Transfer to Institutional Control Program
Ancillary Buildings and Services	Germaine Camp	Released in 2019
	Cluff Center	Released in 2019
	Southgate Entrance	Released in 2019
	Airstrip	Released in 2019
	Site Roads	Released in 2019
	Highway 955	Released in 2019 *Responsibility of three crossing locations on the portion of road between the end of highway 955 and the airstrip are currently held by Orano under a provincial land use permit. These areas will be transferred to the Province or local lodge owner (permit pending)