



UNPROTECTED/NON PROTÉGÉ

ORIGINAL/ORIGINAL

CMD: 19-H3

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Reference CMD(s)/CMD(s) de référence : 09-H7, 16-M49, 16-M49.4, 18-M48, 18-H102

A Licence Renewal

Un renouvellement de permis

**Orano Canada Inc.
Cluff Lake Project**

**Projet de Cluff Lake
d'Orano Canada Inc.**

Commission Public Hearing

Audience publique de la Commission

Scheduled for:
15 May 2019

Prévue pour :
Le 15 mai 2019

Submitted by:
CNSC Staff

Soumise par :
Le personnel de la CCSN

Summary

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

- final decommissioning activities during 2016 to 2018 reporting period;
- post decommissioning site safety and stability assessment; and
- anticipated path forward.

CNSC staff recommend the Commission take the following actions:

- accept the new licensed area provided in appendix A of the proposed licence;
- accept CNSC staff's conclusion that the objectives of the Detailed Decommissioning Plan have been met and accept the new Detailed Post-Decommissioning Plan;
- accept CNSC staff's recommendation to approve the revised financial guarantee of C\$3.5 million for the Cluff Lake Project; and
- accept CNSC staff's recommendation to renew the CNSC licence issued to Orano Canada Inc., UMDL-MINEMILL-CLUFF.01/2019, with a standardized licence conditions handbook for a period of five years, expiring July 31, 2024.

The following items are attached:

- current licence UMDL-MINEMILL-CLUFF.01/2019
- proposed amended licence UML-MINEMILL-CLUFF.00/2024
- draft licence conditions handbook

Résumé

Le présent CMD présente de l'information sur un ensemble de questions d'ordre réglementaire concernant le renouvellement du projet de Cluff Lake d'Orano Canada Inc. :

- les activités de déclassement final pendant la période de rapport de 2016 à 2018;
- l'évaluation de la stabilité et de la sûreté du site après le déclassement;
- les prochaines étapes anticipées.

Le personnel de la CCSN recommande les mesures suivantes à la Commission :


- accepter la nouvelle zone autorisée décrite à l'annexe A du permis proposé;
- accepter la conclusion du personnel de la CCSN à l'effet que les objectifs du Plan détaillé de déclassement ont été atteints et accepter le nouveau Plan détaillé post-déclassement;
- accepter la recommandation du personnel de la CCSN visant à approuver la garantie financière révisée de 3,5 million de dollars canadiens pour le projet de Cluff;
- accepter la recommandation du personnel de la CCSN concernant le renouvellement du permis, UMDL-MINEMILL-CLUFF.01/2019, délivré à Orano Canada Inc. avec un manuel des conditions de permis uniformisées pour une période de cinq ans qui viendra à échéance le 31 juillet 2024.

Les pièces suivantes sont jointes :

- permis actuel, UMDL-MINEMILL-CLUFF.01/2019
- permis modifié proposé, UML-MINEMILL-CLUFF.00/2024
- ébauche du Manuel des conditions de permis

Signed/signé le

18 March 2019

A handwritten signature in black ink, appearing to read 'Peter Fundarek', written over a horizontal line.

Peter Fundarek

Acting Director General

Directorate of Nuclear Cycle and Facilities Regulation

Directeur général (Intérimaire) de la

Direction de la réglementation du cycle et des installations nucléaires

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EXECUTIVE SUMMARY

Orano Canada Inc.'s (Orano) Cluff Lake Project is currently licensed under UMDL-MINEMILL-CLUFF.01/2019, which authorizes the licensee to modify and decommission the site. The licence specifically authorizes the licensee to possess, manage, and store nuclear substances, and to possess and use prescribed equipment and prescribed information.

Orano (formerly AREVA Resources Canada Inc.) has applied to the Canadian Nuclear Safety Commission (CNSC) for a five year licence renewal to the uranium mine and mill decommissioning licence. The application [1] included a request for the following four amendments to the current licence:

- a new CNSC licensed area that only includes parcels of land on which CNSC licensable activities will continue;
- replace the completed Detailed Decommissioning Plan (DDP) with the submitted Detailed Post-Decommissioning Plan (DPDP) [2];
- reduce the financial guarantee to reflect the completion of decommissioning activities and the conduct of ongoing monitoring and maintenance activities proposed in the DPDP; and
- modernize the licence to better reflect the post-closure activities on site.

Details of the Cluff Lake Project have been communicated to the Commission three times since its last licence renewal on June 10, 2009 (CMD 09-H7) [3].

Hearing/Meeting Date	CMD	CMD title
December 14, 2016	16-M49	Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015*
April 25, 2018	18-H102	Cluff Lake Project – Amended Financial Guarantee and Company Name Change
December 12, 2018	18-M48	Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2017

* included the Cluff Lake Mid-Term Update (CMD 16-M49.4)

The current CNSC licence for the Cluff Lake Project authorizes Orano to decommission the Cluff Lake site. The majority of the site was decommissioned prior to the last licence renewal in 2009. CNSC staff confirm that the remaining decommissioning objectives identified in Orano's DDP have now been met and Orano has presented, with this application for licence renewal, a DPDP which includes a reduced value for their financial guarantee.

The proposed licence, with the associated Licence Conditions Handbook (LCH), better reflects the licensable activities to those required to satisfy the DPDP. These activities are to possess, manage, and store nuclear substances that are associated with the Cluff Lake Project and additional remediation activities, if necessary.

The purpose of this Commission Member Document (CMD) is to advise the Commission of the results of CNSC staff's review of the licensee's application and to provide CNSC staff's recommendations. This CMD addresses the requirements of subsection 24(4) of the *Nuclear Safety and Control Act* (NSCA). The CNSC conducts Environmental Protection Reviews under the NSCA for all projects, in accordance with its mandate, to ensure the protection of the environment and health of persons. The safety component of the CNSC's mandate is covered in the safety case assessment carried out for all projects. An Environmental Protection Review under the NSCA and its Regulations was conducted for this application (see appendix D). CNSC staff conclude that the licensee will continue to make adequate provision for the protection of the environment.

This CMD also provides information on the assessments and compliance activities CNSC staff performed since the mid-term report presented in 2016 [4]. CNSC staff activities included review of the licensee's plans, oversight activities CNSC staff have been working on during this period, the status of these areas, and expectations of Orano for the proposed licence period. CNSC staff's "review period" for this CMD covers from January 1, 2016 to December 31, 2018 as CNSC staff provided a mid-term report of Orano's performance up to December 31, 2015 [5].

CNSC staff assessed policies, plans and procedures specific to the maintenance, monitoring and decommissioning activities at Cluff Lake, and evaluated the performance of the facility under the current licence in conjunction with Orano's plans.

The Cluff Lake Project is a decommissioned site and Orano has met the objectives identified in the DDP. As part of adaptive management, CNSC staff will continue to work with Orano to minimize the possible impacts of uncertainty in their long-term modelling and verify the performance of the actions taken to ensure long-term site safety. Given the lack of activity at the site since the 2016 update to the Commission, only four SCAs remain relevant to CNSC staff's assessment of the site.

Functional Area	Safety and Control Area	2016	2017	2018
Management	Management System	SA	SA	SA
Core Control Processes	Radiation Protection	SA	SA	SA
	Conventional Health and Safety	SA	SA	SA
	Environmental Protection	SA	SA	SA

SA = satisfactory

CNSC staff assessed the licensee's performance under four relevant safety and control areas (SCAs). Orano's overall performance over the period of the current licence has consistently been satisfactory.

CNSC Staff Recommendation

CNSC staff recommend that the Commission:

- accept the new licensed area provided in appendix A of the proposed licence;
- accept CNSC staff's conclusion that the objectives of the Detailed Decommissioning Plan have been met and accept the new Detailed Post-Decommissioning Plan;
- accept CNSC staff's recommendation to approve the revised financial guarantee of C\$3.5 million for the Cluff Lake Project; and
- accept CNSC staff's recommendation to renew the CNSC licence issued to Orano Canada Inc., UMDL-MINEMILL-CLUFF.01/2019, with a standardized licence conditions handbook for a period of five years, expiring July 31, 2024.

Referenced documents in this CMD are available to the public upon request.

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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 recommendations
3. general discussion pertaining to the safety and control areas (SCAs) that are relevant to this submission
4. discussion about other matters of regulatory interest
5. addenda material that complements items 1 through 4.

Part Two of this CMD provides all available information pertaining directly to the current and proposed licence including the:

1. proposed licence changes
2. proposed licence
3. draft licence conditions handbook
4. current licence

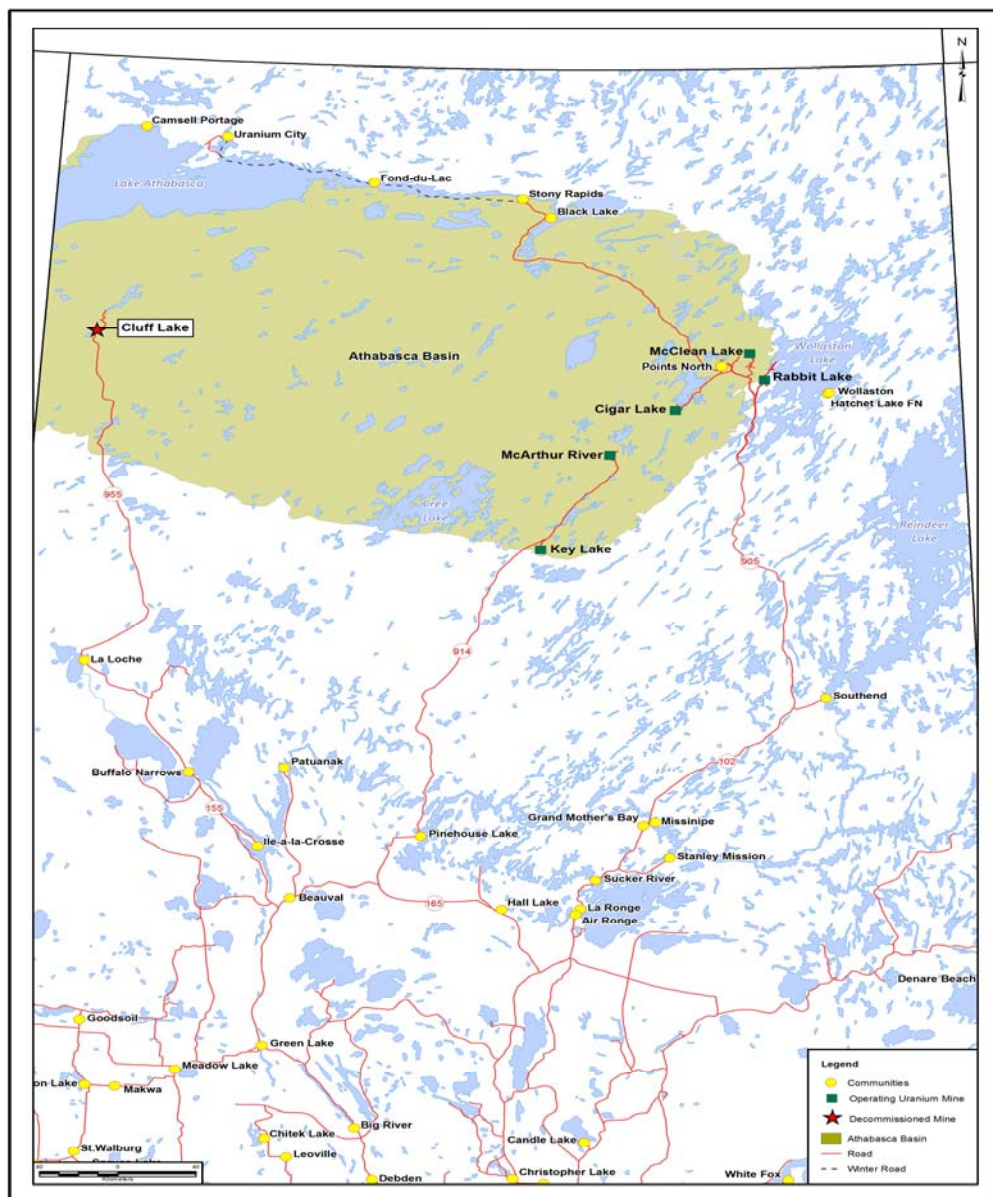
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1. OVERVIEW

1.1 Background

The Cluff Lake Project is located in northwestern Saskatchewan, approximately 75 kilometres south of Lake Athabasca, 15 kilometres east of the Alberta border, and 900 kilometres north of Saskatoon. Mining activity commenced at the Cluff Lake Project in 1979 and ceased in 2002. Decommissioning began at the site in 2004 and was completed in 2006. Figure 1 displays the Cluff Lake location within the Athabasca Basin.

Figure 1 - Cluff Lake Project - Location map



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

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

The active decommissioning 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. After this work was completed, there was a small residential camp which included potable and sewage treatment plants, two steel outbuildings, and the Secondary Treatment System, that were demolished in 2013. The Cluff Lake Project has now met the objectives identified in the DDP. As part of adaptive management, CNSC staff will continue to work with Orano to minimize the possible impacts of uncertainty in their long-term modelling (100 to 500 years).

It should be noted that Orano will be submitting a post-decommissioning, long-term environmental monitoring program to the Province of Saskatchewan and to the CNSC. This will include, among other things, surface water monitoring downstream of Snake Lake and Claude Lake, to verify recovery of contaminated surface water and long-term predictions.

1.2 Highlights

The decommissioned Cluff Lake Project site area is accessible to the public. The nearest community by road is La Loche which is approximately 4.5 hours (250 kilometres) from Cluff Lake. There is some seasonal activity near the site, but not within the immediate watershed. Ongoing activities by Orano include annual monitoring and surveillance, and periodic maintenance of significant safety features. Traditional land use is not impacted by the site. There have been no permanent licensee staff on site since 2013.

CNSC staff confirmed that Orano has met all decommissioning objectives established in the Comprehensive Study Report [6].

The Cluff Lake decommissioning objectives were to achieve:

- 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 (ALARA) social and economic factors considered principle;
- a stable, self-sustaining landscape;

- 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; and
- 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 humans or the environment.

Over the period of the current CNSC licence (UMDL-MINEMILL-CLUFF.01/2019 - valid from August 1, 2009 to July 31, 2019) the following milestones have been achieved:

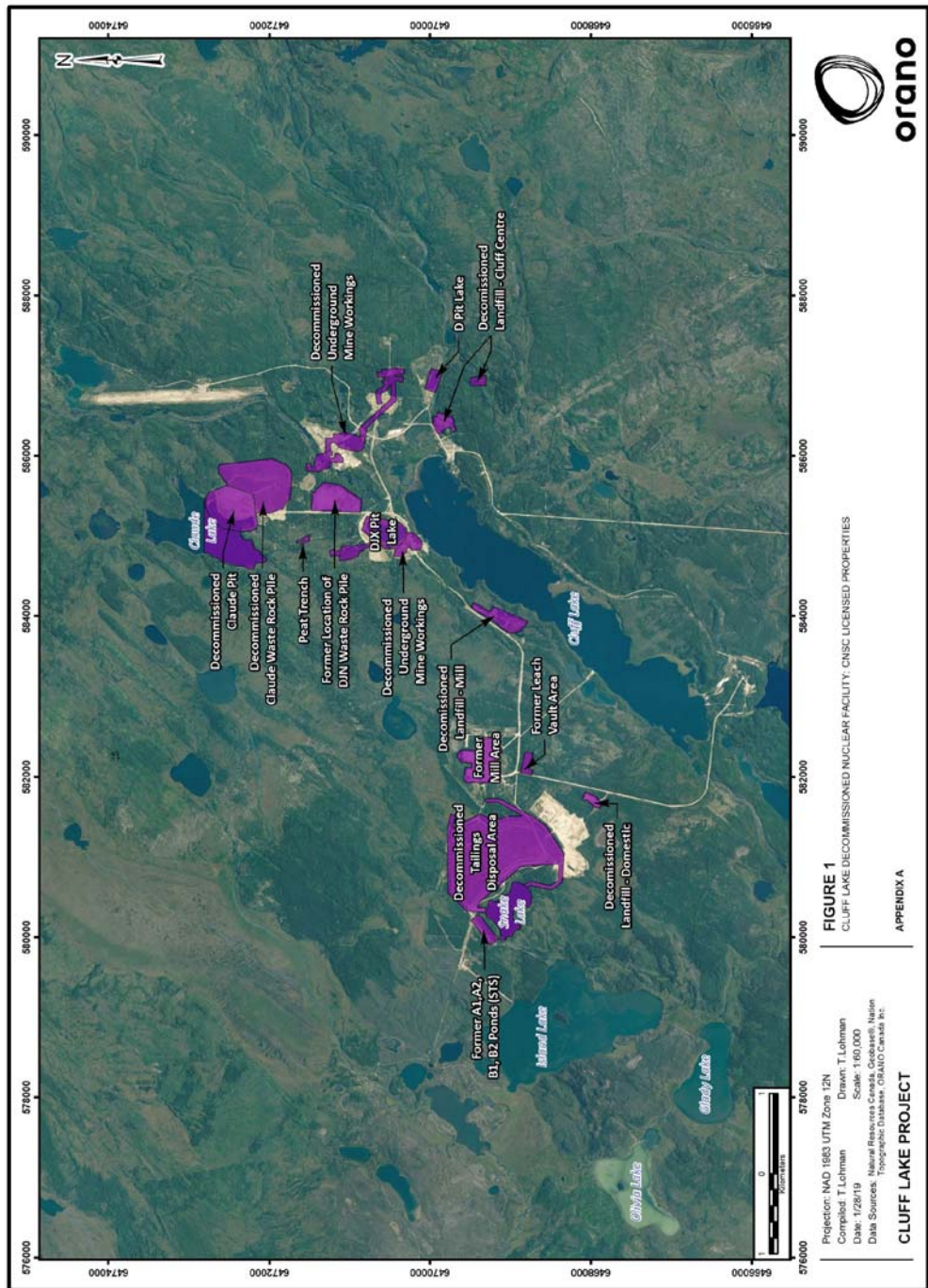
- 2013 – physical decommissioning of remaining surface infrastructure, minor earthworks, discontinuation of continuous site occupancy as confirmed through CNSC on-site compliance inspections;
- 2015 – closure of the Follow-up Program [7];
- 2018 – licensee corporate name change from AREVA Resources Canada Inc. to Orano Canada Inc.[8], and;
- 2018 – reduction in the financial guarantee to reflect completion of decommissioning activities [8].

The physical footprint of the CNSC licensed area, as depicted in the revised appendix A of the proposed licence, 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 underground mine workings or the decommissioned pits). The remainder of the parcels, which are not being carried forward under the proposed 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 province has no provisions or requirements to bring these parcels into the Saskatchewan Institutional Control Program (ICP). Figure 2 displays aerial photographs of the tailings management area while figure 3 shows the licensed areas under the proposed licence.

Figure 2 - Cluff Lake Project - Aerial photographs of tailings management area (source: Orano Canada Inc.)



Figure 3 – Cluff Lake Project - Proposed licence areas



Although Orano indicated it will apply to the Province of Saskatchewan to take over management of the remaining areas of the Cluff Lake Project site through the Saskatchewan ICP, this contingency is outside of the scope of the current licence renewal and will be addressed in a future Commission proceeding.

1.3 Overall Conclusions

CNSC staff have concluded the following with respect to paragraphs 24(4)(a) and (b) of the *Nuclear Safety and Control Act* (NSCA), in that Orano Canada Inc.:

- (a) is qualified to carry on the activity that the licence will authorize the licensee to carry on; and
- (b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

1.4 Overall Recommendations

CNSC staff recommend that the Commission:

- accept the new licensed area provided in appendix A of the proposed licence;
- accept CNSC staff's conclusion that the objectives of the Detailed Decommissioning Plan have been met and accept the new Detailed Post-Decommissioning Plan;
- accept CNSC staff's recommendation to approve the revised financial guarantee of C\$3.5 million for the Cluff Lake Project; and
- accept CNSC staff's recommendation to renew the CNSC licence issued to Orano Canada Inc., UMDL-MINEMILL-CLUFF.01/2019, with a standardized licence conditions handbook for a period of five years, expiring July 31, 2024.

2. MATTERS FOR CONSIDERATION

2.1 Environmental Protection Review

CNSC staff have determined that *the Canadian Environmental Assessment Act, 2012* does not apply. Appendix D of this CMD provides an Environmental Protection Review under the NSCA and its regulations which was conducted for this application. CNSC staff conclude that the licensee has, and will, continue to make adequate provision for the protection of the environment and health of persons.

2.2 Relevant Safety and Control Areas

CNSC staff use the SCA framework in evaluating each licensee's safety performance. The framework includes 14 SCAs which are further subdivided into specific areas that define its key components.

CNSC staff assess licensee performance in each applicable SCA according to the following four ratings:

- FS – fully satisfactory
- SA – satisfactory
- BE – below expectations
- UA – unacceptable

A discussion of performance rating methodologies and definitions are found in appendix B; appendix C provides definitions of the specific SCAs.

This document reports on the four key SCAs that are most relevant to the proposed licensed activities. The remaining SCAs reflect areas with little or no impact on current and future site safety as the Cluff Lake Project is no longer operating, is unoccupied, and is a decommissioned site. As such, any remaining processes, procedures and overall responsibilities not covered by the four key SCAs discussed in this CMD are easily evaluated through Orano's Integrated Management System. The Cluff Lake site is now a decommissioned site, at which no reasonable scenario would result in a member of the public approaching the public dose limit.

The SCAs reported on for the three-year period since the last mid-term report are management system, radiation protection, conventional health and safety, and environmental protection. The last mid-term report can be found as appendix J to CMD 16-M49 as reported to the Commission on December 14, 2016 [5].

The risk ranking column in table 2.1 indicates the overall level of risk associated with each SCA at the Cluff Lake Project (see appendix A, "Risk Ranking").

The rating level for each relevant SCA indicates the overall compliance with regulatory requirements for implementation (see appendix B, "Rating Levels").

Table 2.1 – Cluff Lake Project - Risk ranking

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

N/A - not applicable

SA – satisfactory

2.3 Other Matters of Regulatory Interest

Table 2.2 identifies other matters that are relevant to this CMD.

Table 2.2 – Cluff Lake Project - Other matters of regulatory interest

Area	Relevant to this CMD?
Aboriginal Consultation	Yes
Other Consultation	Yes
Cost Recovery	Yes
Financial Guarantees	Yes
Licensee Public Information Program	Yes
Improvement Plans and Significant Future Activities	N/A
Nuclear Liability Insurance	N/A

N/A – not applicable

The relevant “other matters of regulatory interest” are discussed in section 5 of this CMD.

3. GENERAL ASSESSMENT OF SCAS

The specific areas that comprise the SCAs for this facility or activity type are identified in appendix C, section C.2.

3.1 Management System

The “management system” SCA covers the framework that 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.

3.1.1 Relevant Regulations

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.

3.1.2 Relevant Program Manuals

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 any licensed activities at the site will be expected to adhere to the IMS.

3.1.3 CNSC Staff Conclusion

CNSC staff reviewed Orano’s IMS and conclude 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 uranium fuel cycle projects which includes the Cluff Lake Project.

During compliance inspections CNSC staff routinely review relevant documents managed through the IMS. For example, during the 2017 CNSC compliance inspection, Orano’s conformity to the following IMS documents were reviewed:

- procedure CLP-151 *Compliance Monitoring (V.7, R.0)* November 19, 2015;
- procedure CLP-152 *Surface Water Monitoring (V.9, R.1)* September 27, 2013;
- procedure CLP-156 *QA/QC Monitoring (V.4, R.0)* June 26, 2013;
- procedure CLP-150 *Environmental Monitoring Locations & Schedule (V.6, R.1)* February 2014; and
- CanNorth standard operating procedures (SOP) Water Quality (V.12) and Basic Hydrology-Steam Gauging.

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

CSNC staff observed Orano's safety culture during meetings and on-site inspections. Safety awareness by all staff and contractors is reinforced and encouraged through safety briefings and daily work reviews. Visitors to the site receive orientation and safety briefings and are escorted at all times by Orano staff.

3.1.4 Trends

The following table indicates the overall rating trends for the management system SCA since the Cluff Lake mid-term report (2016):

TRENDS FOR MANAGEMENT SYSTEM	
Overall Compliance Ratings	
2016	2017
SA	SA
There was no change in the management system with the corporate name change from AREVA Resources Canada Inc. to Orano Canada Inc.	

3.1.5 Discussion

The Cluff Lake IMS has not changed since the mid-term update. As the site continues towards demonstrable stable closure, fewer systems and procedures actively apply. Orano continues to defer to the IMS as required.

As per the Cluff Lake procedure, ARC-100-03 - Annual Review of Documents, Orano staff reviews all IMS documentation for current applicability. The review requires the incorporation of ongoing operational experience and future work planning. As a result, during 2017 Orano made changes to procedures that support compliance monitoring, quality assurance/quality control monitoring, incident and non-conformance investigation and reporting, and radiological monitoring.

3.1.6 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 no concerns related to the Cluff Lake management system.

3.2 Radiation Protection

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 continues 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.

For the time period of 2009 to 2012, workers at Cluff Lake were designated as Nuclear Energy Workers (NEWs) and were issued dosimeters for monitoring gamma exposures from a licensed dosimetry service provider. The NEW designation was removed in 2013 based on an assessment which found that quarterly gamma exposures were typically at the dosimeters detection limit of 0.01 mSv. However, conservative issuance of licensed dosimetry for gamma exposure continued in 2013 based on assigned work activities.

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. Since 2014, dosimetry has not been issued as the risk of exposure did not meet the criteria specified in the Cluff Lake radiation protection program. Worker doses are no longer routinely measured and monitored as Orano has ascertained that worker exposures have been at background levels for several years with the transition from remediation to monitoring and surveillance. Considering activities performed on site and submitted radiological monitoring documentation, CNSC staff concur with Orano's conclusions.

3.2.1 Trends

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

TRENDS FOR RADIATION PROTECTION		
Overall Compliance Ratings		
2016	2017	2018
SA	SA	SA
No comments		

3.2.2 Effective Doses to Workers

Throughout the current licence period, exposures to workers were near or at background radiation levels as shown in table 3.1.

Table 3.1 – Cluff Lake Project – Exposures to workers

Doses	2009	2010	2011	2012	2013*	2014-2018**
Average dose (mSv)	0.005	0.002	0.008	0.005	--	--
Maximum dose (mSv)	0.03	0.01	0.05	0.03	--	--

* Although dosimetry was issued for gamma radiation, no incremental dose was observed in 2013 during routine activities, demolition, or decommissioning activities.

** Dosimetry was not assigned as workers involved in campaign monitoring activities did not require personal dose monitoring as predicted exposure levels were less than the 0.1 mSv criteria.

3.2.3 Maximum Effective Dose to a Member of the Public

Radiological area monitoring has been maintained by Orano to provide assurance that the final decommissioning activities are behaving as predicted. This includes area monitoring for gamma, radon and dust and 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 the public are well below the annual public dose limit of 1 mSv.

3.2.4 Reduction of Licensed Area to Affected Properties

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 Cluff Lake Project Surface Gamma Clearance Report, 2018 [9]. If a parcel meets the "as low as reasonably achievable" (ALARA) objectives described below, the parcel will not be brought forward under the proposed new licence. The reference values and ALARA objectives are:

Lower Screening Value

The lower screening value is a specified value below which no further action is required. It is based on the natural background levels established for the area and potential radiation dose to users of the site. Based on the background gamma survey results, the lower screening value was set at 0.063 $\mu\text{Sv/h}$ (the 97.5 percentile value of the local background survey results). The purpose of the lower screening value is to fast-track parcels to final clearance which have been unaffected, or minimally affected, by the mining activity.

Upper Screening Value

The upper screening values are the test values required to meet the radiological cleanup criteria. They are as follows:

- Individual Value Test: no individual value may exceed 2.5 $\mu\text{Sv/h}$;
- Dose Limit Test: the gamma radiation level averaged over 10,000 m^2 (1 ha) area may not exceed 1 $\mu\text{Sv/h}$;
- if either upper screening value test is failed, mitigative measures will be applied; or, where mitigative measures are not practicable, a case will be prepared for consideration by Orano management; and
- if both tests pass, the parcel is screened for ALARA objectives.

ALARA Objectives

The ALARA assessment process defines three ALARA objectives, as listed below:

- *ALARA Objective #1:* Gamma radiation exposure rates, when averaged over 100,000 m^2 (10 ha) areas, will not exceed 0.3 $\mu\text{Sv/h}$.
- *ALARA Objective #2:* Where localized areas (1,000 m^2) exceed an average of 1 $\mu\text{Sv/h}$, the area will be investigated to provide confidence that point sources which exceed 2.5 $\mu\text{Sv/h}$ are identified and mitigated appropriately. A minimum data density of 100 readings in the 1,000 m^2 area must be collected to determine the presence of radiation levels above 2.5 $\mu\text{Sv/h}$. In practice, this will result in additional data being collected in the 1,000 m^2 area surrounding the identified point or simply mitigating the area to pass the ALARA test.
- *ALARA Objective #3:* If 10 aggregated localized areas (1,000 m^2) exceed 1 $\mu\text{Sv/h}$ within a large area (100,000 m^2), mitigation is required.

The report documents post-decommissioning gamma survey results for all disturbed parcels at the site. Relevant areas not being carried forward in the proposed licence include the airstrip, former haul roads, other roads and trails and areas not directly impacted by former mining and milling activities.

Orano concludes that the end-state radiological conditions for all areas not being carried forward to the proposed new licence meet the approved cleanup criteria and ALARA objectives established for the Cluff Lake Project.

3.2.5 Conclusion

CNSC staff reviewed the ALARA objectives and conclude that these would be protective of human health. CNSC staff have reviewed the report [9] and, based on expert opinion and general gamma readings by CNSC staff during site inspections for the same reporting period, accept the reported conclusions.

CNSC staff are satisfied with Orano's implementation of the radiation protection SCA at Cluff Lake.

3.3 Conventional Health and Safety

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

CNSC staff last verified compliance of Orano's Cluff Lake Project conventional health and safety program during their 2017 site inspection. CNSC staff reviewed the contents of related Orano documentation:

- *Cluff Lake Project IMS Manual* (V.15, R.0), February 2016;
- Procedure HSER-707 - *Field Safety Guide* (V.2, R.0), April 14, 2015;
- Procedure HSER-900 - *Hazard Identification, Risk Assessment and Determination of Controls* (V.1, R.0), December 5, 2013;
- Cluff Lake Training Log, AREVA office, September 7, 2017;
- Form CN140 - *Work Site Inspection* records, June 16-27, 2017;
- Form 900-01-01 - *Safe Work Plan for 2017 Minor Earthworks Program* (templates for each work activity); and
- Form 900-01-01, completed copies for Claude waste rock pile regrading and Claude waste rock pile manhole decommissioning.

One action item related to this SCA was issued and is now closed.

Conventional health and safety is observed by CNSC staff during all site visits and inspections, even if it is not the focus of the inspection. Any recommendations that might arise are conveyed to Orano and the Province of Saskatchewan as appropriate.

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;
- accident prevention through the use of the 5-point safety system;
- communication through daily tool box meetings;
- trained first aid workers on site during campaigns;
- an Emergency Response Plan; and
- record keeping and reporting.

During 2016 and 2017 there were zero lost-time injuries (LTI), zero modified work injuries, zero medical incidents, zero first aids, and no dangerous occurrences reported.

3.3.1 Conclusion

Since the last update to the Commission, Orano met CNSC staff's expectations with respect to the conventional health and safety SCA.

3.4 Environmental Protection

CNSC staff reviewed the DPDP and found that Orano's Cluff Lake Project is achieving the Decommissioning Surface Water Quality Objectives (DSWQO) and is predicted to continue to achieve the DSWQOs in the long-term.

3.4.1 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		
2016	2017	2018
SA	SA	SA

SA - satisfactory

3.4.2 Discussion

CNSC staff reviewed the DPDP and concluded the Cluff Lake Project achieved Orano's decommissioning objectives in the DDP. When established, the surface water criteria used was based on the Saskatchewan Surface Water Quality Guidelines since no federal government values existed. Orano has demonstrated compliance with these guidelines. Since that time, the Canadian Council of Ministers of the Environment (CCME) has established more modern guidelines. CNSC staff have requested that Orano evaluate and report on the risk of minor exceedances of the CCME guideline for uranium at some sites. Surface water quality at key waterbodies will continue to be monitored by Orano. Values for surface post-decommissioning water monitoring are found in tables 2 and 3 of appendix D.

To complement ongoing compliance activities, the CNSC has implemented its own Independent Environmental Monitoring Program (IEMP). In the summer of 2017, CNSC staff took samples of fish, surface water, blueberries, Labrador tea, and radon in ambient air in publicly accessible locations in the vicinity of the Cluff Lake Project. The IEMP results for the Cluff Lake Project are published on the CNSC's website (<http://www.nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/index-iemp.cfm>).

The IEMP results verify that the public and the environment in the vicinity of the Cluff Lake Project are protected.

3.4.3 Summary

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

Past Performance

Although no longer maintaining a permanent site presence, Orano continues to monitor and inspect the Cluff Lake site features and report their results to the CNSC and the Province of Saskatchewan as agreed to under their management system. The site has no effluent discharges and no longer produces any contaminants or waste. Orano's environmental performance is directly linked to the successful completion of decommissioning activities for the site. Over the 2016 to 2018 reporting period, Orano has not identified any issues that would constitute a failure of the decommissioning objectives established through the DDP.

Regulatory Focus

CNSC and the Province of Saskatchewan's Ministry of the Environment have inspected the decommissioned site annually (as described below) and have determined there are no issues of environmental or safety concern. CNSC staff will verify that the vegetation on the engineering cover is adequately considered to ensure Claude Lake and Cluff Lake are protected in the long-term. Recommendations resulting from these inspections are based on international best practice and are meant to strengthen CNSC understanding of the long-term stability and sustainability of safety at the site. CNSC staff found no safety-significant concerns at the site.

CNSC staff (accompanied by Orano and the Province of Saskatchewan) inspected the site in June 2016 and found no safety-significant concerns.

In September 2017, CNSC staff (accompanied by Orano and the Province of Saskatchewan) conducted an inspection of the Cluff Lake site. One action item related to training has since been resolved to the CNSC staff's satisfaction.

AREVA-CL-2017-01-A1: AREVA shall ensure that the training requirements stated in the *Cluff Lake Project IMS Manual* and any associated procedures and/or work instructions are revised to reflect current training practices. AREVA shall submit an amended training manual to CNSC staff for review. (CLOSED)

CNSC staff (accompanied by Orano and the Province of Saskatchewan) inspected the Cluff Lake site again in June 2018. CNSC staff found no safety-significant concerns at the site.

No outstanding action items remain from CNSC inspections of the post-decommissioning Cluff Lake Project.

There are no outstanding issues related to immediate site safety or CNSC regulatory non-compliance for the Cluff Lake site.

CNSC Staff Requests

CNSC staff are confident that Orano has and will continue to make adequate provision for the protection of the environment. CNSC staff also acknowledge that Orano has achieved the decommissioning objectives established through the DDP and is currently meeting the DSWQO. To help ensure clarity and to reassure the Canadian public, CNSC staff have requested that the licensee address the following two items which staff believe will strengthen Orano's conclusions that the site is stable and will remain stable for the long-term. These items are:

- CNSC staff have requested that Orano adopt the CCME guideline for uranium as a screening tool, acknowledge areas where the CCME guideline for uranium is exceeded and present conclusions in the next revision of their environmental risk assessment regarding the risks in these areas. Orano has agreed to accept the CCME guideline for uranium as a screening tool and their report is expected to be published by the end of 2019.
- CNSC staff request that Orano re-assess if any further remediation is needed for the Claude Pit horizontal drains. Specifically that the parameters currently used to model contaminant mobility and contribution to Claude Lake over the next 500 years be more clearly defined and justified.

These items do not affect CNSC staff's current conclusions of human and environmental safety at the site. Orano has committed to addressing these items as part of their next submission of revised Technical Information Documents. CNSC are anticipating revised Hydrogeology and Groundwater Modelling and Risk Assessment Technical Information Documents, reflecting post-decommissioning site conditions, by the end of 2019.

3.4.4 Conclusion

The Cluff Lake Project has achieved the decommissioning objectives established through the DDP and is currently meeting the DSWQO. The modelled forecast predicts that the natural increase in contaminants in receiving lakes, as the source term moves through the environment, is predicted to remain below the DSWQOs for the long-term. CNSC staff conclude that the licensee will make adequate provision for the protection of the environment.

4. SAFEGUARDS AND NON-PROLIFERATION

4.1 Discussion

Nuclear substances located at the site for which the licence renewal is being recommended are limited to natural uranium and its decay products, including radium-226. There is no Category I, II or III Nuclear Material, as defined in the *Nuclear Security Regulations*, at this site. In addition, there is no prescribed equipment or prescribed information at this site.

As part of Canada's international obligations under the Additional Protocol to its existing Safeguards Agreement with the International Atomic Energy Agency (IAEA), the CNSC has supplied, as part of a broader description of its nuclear fuel cycle activities, a list of past and present waste management locations including locations subject to this request. Under the terms of Canada's Additional Protocol, the IAEA may request physical access (called "complementary access") to locations declared by the CNSC.

4.2 Conclusion

CNSC staff conclude that the licence renewal being recommended would not pose an unreasonable risk to national security. Based on past experience and the general accessibility of the site, CNSC staff conclude that the licence renewal being recommended would not result in a failure to achieve conformity with international obligations to which Canada has agreed in relation to IAEA safeguards.

5. OTHER MATTERS OF REGULATORY INTEREST

5.1 Aboriginal Consultation

The common law duty to consult with Indigenous groups 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 licensing 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.

5.1.1 Discussion

The Cluff Lake Project area is situated within historic Treaty 8 (1899) as well as the Métis Nation-Saskatchewan Northern Region 2. CNSC staff have identified First Nation and Métis groups who may have an interest in the proposed licence decision. The Athabasca Chipewyan First Nation (Treaty 8), Clearwater River Dene Nation (Treaty 8), Black Lake Denesuline First Nation (Treaty 8), Fond-du-Lac Denesuline First Nation (Treaty 8), Ya'thi Néné Land and Resource Office, Prince Albert Grand Council, Buffalo River Dene Nation (Treaty 10), Birch Narrows Dene Nation (Treaty 10), and the Métis Nation – Saskatchewan were identified because all have previously expressed interest in being kept informed of CNSC licensed activities occurring in their traditional territories.

CNSC staff sent letters of notification in January 2019 to the identified groups above, providing information regarding the proposed licence renewal application, the availability of participant funding to facilitate participation in the hearing process, and details on how to participate in the Commission's public hearing process in May 2019. Follow-up phone calls were conducted with the identified groups to ensure they had received the letters and to answer any questions about the regulatory process as well as how to get involved in the Commission proceedings.

During the reporting period, information on the Cluff Lake Project has been presented to the Commission in a public forum through CMD 16-M49 - *Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015* [5], CMD 17-M47 *Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2016* [10], and CMD 18-M48 *Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2017* [11]. Participant funding was offered by CNSC for interventions for 2016 and 2017 reports. The following Indigenous participants received funding.

CMD 17-M47:

- Ya'thi Néné Land and Resource Office
- Birch Narrows Dene Nation
- Buffalo River Dene Nation

CMD 18-M48:

- Ya'thi Néné Land and Resource Office
- Prince Albert Grand Council
- English River First Nation
- Athabasca Chipewyan First Nation

CNSC REGDOC-3.2.2 *Aboriginal Engagement*, published in February 2016, 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. 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 meeting its consultation obligations.

As Orano's licence renewal application does not propose any new activities, regulatory requirements set out in CNSC REGDOC-3.2.2 pertaining to formal consultation do not apply. However, CNSC staff encourages Orano to continue to engage with interested Indigenous communities on the licence application and on-going activities of interest to the communities.

Most opportunities to engage Indigenous groups during the reporting period did not specifically focus on the Cluff Lake Project. Significant interaction with local peoples has taken place within a broader context of local interests or associated with Orano's other licence – the McClean Lake Operation. Table 5.1 presents CNSC staff's community engagements from December 2016 to February 2019.

Table 5.1 – Community engagements

Date	Method of Engagement
February 8, 2019	Teleconference, English River First Nation
February 8, 2019	Meeting with Clearwater River Dene Nation, Edmonton
January 30, 2019	Meeting with English River First Nation, Saskatoon
January 18, 2019	Meeting with Clearwater River Dene Nation, Saskatoon
November 4 to 9, 2018	Western Saskatchewan Community Tour
July 24 and 25, 2018	EQC meeting, Saskatoon
February 28, 2018	EQC meeting, La Ronge
November 6, 2017	meeting with Ya'thi Néné Land and Resource Office
September 25 and 26, 2017	participate in La Loche Dene High School / Clearwater School Minerals and Products Education Event
April 24 and 25, 2017	participate in La Loche Dene High School / Clearwater School Minerals and Products Education Event
December 8, 2016	meeting with Ya'thi Néné Land and Resource Office

5.1.2 Conclusion

Based on the information received and reviewed, CNSC staff determined that as Orano's operations at Cluff Lake ceased uranium production in 2002 and the decommissioning of the site is now fully complete, the environmental monitoring of the site's performance and its conditions continues, and there are no planned changes to the site which could adversely impact the surrounding environment, this licence renewal application will not cause any adverse impacts to any potential or established Indigenous and/or treaty rights.

Therefore, CNSC staff conclude that the decision on the licence renewal for Orano's Cluff Lake Project going before the Commission does not raise the duty to consult.

5.2 Other Consultation

The CNSC have made funding available through its participant funding program (PFP) to Indigenous peoples, members of the public, and stakeholders for the provision of value-added information to the Commission through informed and topic-specific interventions. This funding was offered to review Orano Canada Inc.'s Cluff Lake Project licence renewal application and associated documents and to prepare for and participate in the Commission's public hearing.

5.2.1 Discussion

The deadline for PFP applications was February 15, 2019. Five applications were received:

- Ya'thi Néné Land and Resource Office
- Saskatchewan Environmental Society
- Athabasca Chipewyan First Nation
- Clearwater River Dene Nation
- Métis Nation Saskatchewan Region 2

After assessing the applications received, the Funding Review Committee recommended the funding listed in table 5.2 below.

Table 5.2 – Cluff Lake Project - PFP funding awarded

Applicant	Applicant funding request	PFP funding granted
Ya'thi Néné Land and Resource Office	\$55,000.07	\$38,810.05
Saskatchewan Environmental Society	\$4,200	\$4,200
Athabasca Chipewyan First Nation	\$19,400	\$19,400
Clearwater River Dene Nation	\$53,910.20	\$40,360.20
Métis Nation Saskatchewan	\$69,853.80	\$32,953.80
TOTAL	\$202,364.07	\$135,724.05

5.3 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.

5.4 Financial Guarantees

Based on the information provided in section 7 and appendix A of the DPDP, the proposed financial guarantee for the Post-Closure Monitoring and Maintenance is adequate.

5.4.1 Discussion

Currently, Orano has a financial guarantee in the amount of C\$26.8 million. The status of all decommissioning planning envelopes is now complete. Based on Orano's DPDP, for the next post-closure monitoring and maintenance phase, Orano proposes the total amount of C\$3.5 million for its financial guarantee. This includes the estimated cost for the long-term monitoring program prior to any proposed transfer to the ICP, Institutional Control Funding and a contingency Low-Probability Failure Event Fund as an additional financial assurance until such time as the provincial unforeseen events fund included in the IC funding is self-sufficient.

5.4.2 Conclusion

CNSC staff conclude that the DPDP meets the criteria of the CNSC Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities* and of the Standards Council of Canada, CSA N294-09, *Decommissioning of facilities containing nuclear substances*. CNSC staff also conclude that the financial guarantee is adequate [12].

5.4.3 Recommendation

Based on the restricted activities permitted (only monitoring and maintenance of existing licensed features) on the Cluff Lake Project site, and CNSC staff's conclusion that decommissioning objectives have been met, CNSC staff recommend that the Commission approve the revised financial guarantee of C\$3.5 million for the Cluff Lake Project.

5.5 Licensee Public Information Program

The availability and clarity of information pertaining to nuclear activities is essential to establishing an atmosphere of openness, transparency and trust between the licensee and the public. Since 2012, the CNSC requires major licensees to maintain a Public Information and Disclosure Program (PIDP) supported by a robust disclosure protocol that addresses stakeholders' needs.

CNSC's REGDOC-3.2.1, *Public Information and Disclosure*, (formerly RD/GD-99.3) sets out the requirements for public information and disclosure. The primary goal of the program, as it relates to the licensed activities, is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities are effectively communicated to the public. This information promotes transparency and improves the public's understanding of the licensed activities and operations. The program includes a commitment to and protocol for ongoing, timely communication of information related to the licensed facility during the course of the licence period.

The CNSC's expectations of a licensee's PIDP are commensurate with the public's perception of risk and the level of public interest in the licensed activities. The program and protocol may be further influenced by the complexity of the nuclear facility's lifecycle and activities, and the risks to public health and safety and the environment perceived to be associated with the facility and activities.

Details of Orano's PIDP are found in their annual reports and include ongoing correspondence with stakeholders and government, communication of ongoing activities through the media, maintaining a website and interacting with stakeholders through social media, periodic site tours and sponsoring an annual public opinion survey on uranium mining in Saskatchewan.

5.5.1 Discussion

CNSC staff have reviewed Orano's PIDP and determined that it:

- identifies clear goals and measurable objectives in terms of dissemination of information to targeted audiences;
- is available to the public and is posted on the licensee's website;
- provides sufficient information on Cluff Lake operations through a variety of communication activities, including: a community information session, facility tours, website updates, and press releases;
- targets multiple audiences such as local residents, elected and government representatives, business leaders and local Indigenous groups; and
- provides contact information for members of the public who want to obtain additional information.

CNSC staff will continue to monitor Orano's compliance with public information requirements and ongoing implementation of the PIDP.

5.5.2 Conclusion

CNSC staff conclude that Orano's PIDP meets the regulatory requirements for public information and disclosure. CNSC staff continue to oversee Orano's implementation of the PIDP to ensure that they meet their obligations regarding dissemination and notifying the public and Indigenous communities regarding their licensed activities. CNSC staff also encourage Orano to review and update their PIDP on a regular basis to meet the changing information needs of their target audiences.

6. OVERALL CONCLUSIONS AND RECOMMENDATIONS

CNSC staff conclude that:

- an Environmental Protection Review under the NSCA and its Regulations was conducted for this application. CNSC staff conclude that the licensee will make adequate provision for the protection of the environment; and
- Orano Canada Inc. is qualified to carry on the activity authorized by the licence and will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

CNSC staff recommends the Commission take the following actions:

- accept the new licensed area provided in appendix A of the proposed licence;
- accept CNSC staff's conclusion that the objectives of the Detailed Decommissioning Plan have been met and accept the new Detailed Post-Decommissioning Plan;

- accept CNSC staff's recommendation to approve the revised financial guarantee of C\$3.5 million for the Cluff Lake Project; and
- accept CNSC staff's recommendation to renew the CNSC licence issued to Orano Canada Inc., UMDL-MINEMILL-CLUFF.01/2019, with a standardized licence conditions handbook for a period of five years, expiring July 31, 2024.

REFERENCES

1. Correspondence to Mr. M. Leblanc (CNSC) from Mr. D. Huffman (Orano), “Application to Renew and Amend Cluff Lake Project’s Uranium Mine Decommissioning Licence UMDL-MINEMILL-CLUFF.00/2019”, dated September 17, 2018 (5647515).
2. Correspondence to Mr. R. Stenson (CNSC), from Mr. D. Huffman (Orano), “Cluff Lake Project – Detailed Post Decommissioning Plan - Revision”, dated March 8, 2019 (5726086).
3. CMD 09-H7 – AREVA Resources Canada Inc., Cluff Lake Project “Renewal with Amendment of the Cluff Lake Project Uranium Mine and Mill Decommissioning Licence”, June 10, 2009 (3523731).
4. CMD 16-M49.4 – Submission from AREVA Resources Canada Inc., Cluff Lake Mid-Term Update, December 14 and 15 2016 (5123560).
5. CMD16-M49 - Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015. December 2016 (5065732).
6. Canadian Nuclear Safety Commission. Comprehensive Study Report – Cluff Lake Decommissioning Project. December 2003 (5066035).
7. AREVA Resources Canada Inc. Cluff Lake Project – Follow-up Program. October 2015 (4858983).
8. CMD 18-H102 – Cluff Lake Project - Amended Financial Guarantee and Company Name Change, May 2018 (5286288).
9. Correspondence to Mr. R. Stenson (CNSC), from Mr. D. Huffman (Orano), “Cluff Lake Project – Surface Gamma Clearance Report”, dated October 2019 (5692290).
10. CMD 17-M47 – Regulatory Oversight Report for Uranium Mines and Mills in Canada: 2016. December 13, 2016 (5309714).
11. CMD18-M48 - Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2017. December 12, 2018 (5561699).
12. Canadian Nuclear Safety Commission. Review of Detailed Post-Decommissioning Plan and Financial Guarantee for Post-Decommissioning and Provincial Institutional Control Program for Orano’s Cluff Lake Project, dated January 17, 2019 (5761861).

ACRONYMS

ALARA	as low as reasonably achievable
CCME	Canadian Council of Ministers of the Environment
CMD	Commission member document
CNSC	Canadian Nuclear Safety Commission
CSA	CSA Group (formerly Canadian Standards Association)
DDP	Detailed Decommissioning Plan
DPDP	Detailed Post-Decommissioning Plan
DSWQO	Decommissioning Surface Water Quality Objectives
IAEA	International Atomic Energy Agency
ICP	Institutional Control Program
IEMP	Independent environmental monitoring program
IMS	Integrated Management System
LCH	licence conditions handbook
LTI	lost-time injury
mSv	millisievert
NEW	nuclear energy worker
NSCA	<i>Nuclear Safety and Control Act</i>
Orano	Orano Canada Inc.
PDP	preliminary decommissioning plan
PFP	participant funding program
PIDP	Public Information and Disclosure Program
REGDOC	Regulatory Document
SCA	safety and control area
TMA	tailings management area

A. RISK RANKING

The CNSC uses a risk-informed regulatory approach in the management and control of regulated facilities and activities. CNSC staff have therefore established an approach to identifying appropriate levels of regulatory monitoring and control for specific classes of licensed facilities and types of licensed activities based on risk ranking.

Risk ranking is applied to each SCA, and is determined by considering the probability and consequence of adverse incidents associated with each SCA as it relates to the given facility and activity types.

The methodology used to determine risk ranking is based on Canadian Standards Association guideline CAN/CSA-Q850, *Risk Management: Guideline for Decision Makers*. This guideline provides a description of the major components of the risk management decision process and their relationship to each other, and describes a process for acquiring, analyzing, evaluating, and communicating information that is necessary for making decisions.

In section 2.2 of the CMD, in the Relevant Safety Control Areas table, the “Risk Ranking” column shows a high (H), moderate (M) or low (L) indicator for each SCA that is relevant to the current facility and activities being addressed in this CMD. The risk rankings are not static and will change over time for a given facility and activities (e.g., facilities age, facilities and equipment are upgraded, activities cease or begin, licensees change, technology and programs mature, knowledge and understanding of impacts and probabilities increase, etc.).

The following matrix provides a high-level overview of risk ranking, and the management and monitoring approach associated with the various degrees of risk.

APPROACH TO ASSESSING AND MANAGING POTENTIAL RISK			
CONSEQUENCE	MANAGEMENT/MONITORING APPROACH		
Significant Impact	Considerable management of risk is required	Must manage and monitor risk with occasional control	Extensive management is essential. Constant monitoring and control
Moderate Impact	Occasional monitoring	Management effort is recommended	Management effort and control is required
Low Impact	Random monitoring	Regular monitoring	Manage and monitor
Probability of Occurrence	Unlikely to occur	Might occur	Expected to occur
RISK RANKING SCALE			
L	Low Risk	M	Moderate Risk
		H	High Risk

On this basis, a high-risk SCA would be subject to increased regulatory scrutiny and control while a low-risk SCA would generally require minor verification and control.

B. RATING LEVELS

Fully Satisfactory (FS)

Safety and control measures implemented by the licensee are highly effective. In addition, compliance with regulatory requirements is fully satisfactory, and compliance within the safety and control area (SCA) or specific area exceeds requirements and CNSC expectations. Overall, compliance is stable or improving, and any problems or issues that arise are promptly addressed.

Satisfactory (SA)

Safety and control measures implemented by the licensee are sufficiently effective. In addition, compliance with regulatory requirements is satisfactory. Compliance within the SCA meets requirements and CNSC expectations. Any deviation is minor and any issues are considered to pose a low risk to the achievement of regulatory objectives and CNSC expectations. Appropriate improvements are planned.

Below Expectations (BE)

Safety and control measures implemented by the licensee are marginally ineffective. In addition, compliance with regulatory requirements falls below expectations. Compliance within the SCA deviates from requirements or CNSC expectations to the extent that there is a moderate risk of ultimate failure to comply. Improvements are required to address identified weaknesses. The licensee is taking appropriate corrective action.

Unacceptable (UA)

Safety and control measures implemented by the licensee are significantly ineffective. In addition, compliance with regulatory requirements is unacceptable and is seriously compromised. Compliance within the SCA is significantly below requirements or CNSC expectations, or there is evidence of overall non-compliance. Without corrective action, there is a high probability that the deficiencies will lead to unreasonable risk. Issues are not being addressed effectively, no appropriate corrective measures have been taken and no alternative plan of action has been provided. Immediate action is required.

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 3.4 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 that licensee staff is sufficient in number in all relevant job areas and that licensee staff 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.

SAFETY AND CONTROL AREA FRAMEWORK		
Functional Area	Safety and Control Area	Definition
	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.
Core Control Processes	Radiation Protection	Covers the implementation of a radiation protection program in accordance with the <i>Radiation Protection Regulations</i> . This program must ensure that contamination and radiation doses received are monitored and controlled.
	Conventional Health and Safety	Covers the implementation of a program to manage workplace safety hazards and to protect personnel and equipment.
	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 <i>Treaty on the Non-Proliferation of Nuclear Weapons</i> .

SAFETY AND CONTROL AREA FRAMEWORK		
Functional Area	Safety and Control Area	Definition
	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 decommissioned uranium mines and mills:

SPECIFIC AREAS FOR THIS FACILITY TYPE		
Functional Area	Safety and Control Area	Specific Areas
Management	Management System	<ul style="list-style-type: none"> ▪ Management System ▪ Organization ▪ Performance Assessment, Improvement and Management Review ▪ Operating Experience (OPEX) ▪ Safety Culture ▪ Management of Contractors
Core Control Processes	Radiation Protection	<ul style="list-style-type: none"> ▪ Application of ALARA ▪ Worker Dose Control ▪ Radiation Protection Program Performance ▪ Radiological Hazard Control ▪ Estimated Dose to Public
	Conventional Health and Safety	<ul style="list-style-type: none"> ▪ Performance ▪ Practices ▪ Awareness
	Environmental Protection	<ul style="list-style-type: none"> ▪ Effluent and Emissions Control (releases) ▪ Environmental Management System ▪ Assessment and Monitoring ▪ Protection to the Public ▪ Environmental Risk Assessment

D. ENVIRONMENTAL PROTECTION REVIEW REPORT

e-Doc# 5819325

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**Environmental Protection Review Report:
Orano Canada Inc.
Cluff Lake Uranium Mine
Licence Renewal
UMDL-MINEMILL-CLUFF.01/2019**

March 2019
e-Doc: 5719632 (Word)
e-Doc: 5819325 (PDF)



REVISION HISTORY

The following table identifies the revision history of this document.

Revision number	Change	Summary of changes	Date
000	Initial release	N/A	

EXECUTIVE SUMMARY

The Canadian Nuclear Safety Commission (CNSC) conducts Environmental Protection Reviews (EPR) under the *Nuclear Safety and Control Act* (NSCA) (formerly known as Environmental Assessments under the NSCA) for all projects, in accordance with its mandate, to ensure the protection of the environment and health of persons. The safety component of the CNSC's mandate is covered in the safety case assessment carried out for all projects.

This EPR Report, written by CNSC staff for the Commission, Indigenous peoples and the public, describes the findings of the EPR under the NSCA completed for the licence application by Orano Canada Inc. (Orano), formerly Areva Resources Canada Inc., to renew the Cluff Lake Project licence UMDL-MINEMILL-CLUFF.01/2019. This EPR under the NSCA includes CNSC staff's assessment of the licence application and the documents submitted in support of compliance verification activities (e.g., inspections) conducted at the Cluff Lake Project by CNSC staff.

The EPR report focuses on items that are of current public and regulatory interest such as releases to air and surface water and radiation protection to terrestrial and human environments.

CNSC staff's conclusions are based on, but are not limited to, the following:

- the predictions of radionuclides and hazardous substances in the receiving environment presented in the 2003 Comprehensive Study Report for the Cluff Lake Decommissioning Project, which were accepted by the Commission
- CNSC staff's verification that environmental monitoring data reported by Orano's annual compliance reports are within the predictions accepted by the Commission for the Cluff Lake Project
- the Detailed Post-Decommissioning Plan prepared by Orano for the proposed post-closure monitoring, maintenance, and administrative activities for the Cluff Lake Project
- Orano's 2015 Environmental Risk Assessment for the Cluff Lake Project
- environmental sampling data collected by the CNSC's Independent Environmental Monitoring Program
- regional health studies in proximity to the Cluff Lake Project

Based on the EPR under the NSCA conducted for this licence application, CNSC staff conclude that Orano has made adequate provisions for the protection of the environment and the health of persons.

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Environmental Protection Review (EPR) is to report the outcome of Canadian Nuclear Safety Commission (CNSC) staff review of licensing and environmental compliance activities conducted under the *Nuclear Safety and Control Act* (NSCA). These serve to determine whether Orano has and will continue to make adequate provisions for the health and safety of persons and the protection of the environment. This EPR presents CNSC staff recommendations to the Commission regarding the proposed licence renewal of the Cluff Lake Project by Orano Canada Inc. (Orano), formerly Areva Resources Canada Inc.

CNSC staff recently changed the title of the environmental review process, formerly known as Environmental Assessments (EA) under the NSCA. Environmental reviews and subsequent reports carried out by CNSC staff are now referred to as EPRs, which better align with the Environmental Protection Safety and Control Area, in which the process and report, represent.

1.2 Project Background

Previously, the Cluff Lake Project was a uranium mine and mill in northern Saskatchewan, approximately 75 kilometres south of Lake Athabasca and 30 kilometres east of the provincial border with Alberta (figure 1), which operated from 1981 to 2002. Over the 22-year operating life of the mine, ore was extracted from five ore bodies using either underground or open pit techniques and produced 28 million kilograms of uranium concentrate (U_3O_8). Operational facilities at the Cluff Lake Project included three open pits and two underground mines, a central mill, a tailings management area (TMA) with a two-stage liquid effluent treatment system, associated rock piles, and site infrastructure including an airstrip and a residential camp. An aerial overview of the overall Cluff Lake Project site is shown in figure 2.

At the Cluff Lake site, there are two watersheds. The first is the Island Lake watershed, where milling occurred and where tailings were disposed into a depressional area adjacent to Snake Lake which now is the TMA (figure 2). 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 towards the Island Lake fen, where one channel discharges directly into Island Creek and the other channel into Agnes Lake, which is upstream of Island Creek. The second watershed is the Cluff Lake watershed where four mining activities occurred: the D open pit mine area, the Claude open pit mine area, the DJ underground mine and the DJX open pit mine area (figure 2). The Claude Waste Rock Pile (CWRP) is the main remaining mining feature which was covered to reduce infiltration of rain water 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 (figure 2). Peter River then discharges into Cluff Lake. On figure 2, the red arrows indicate seepage and blue arrows indicate the flow direction of water.

Figure 1: Location of Cluff Lake site in the Athabasca Basin of northern Saskatchewan

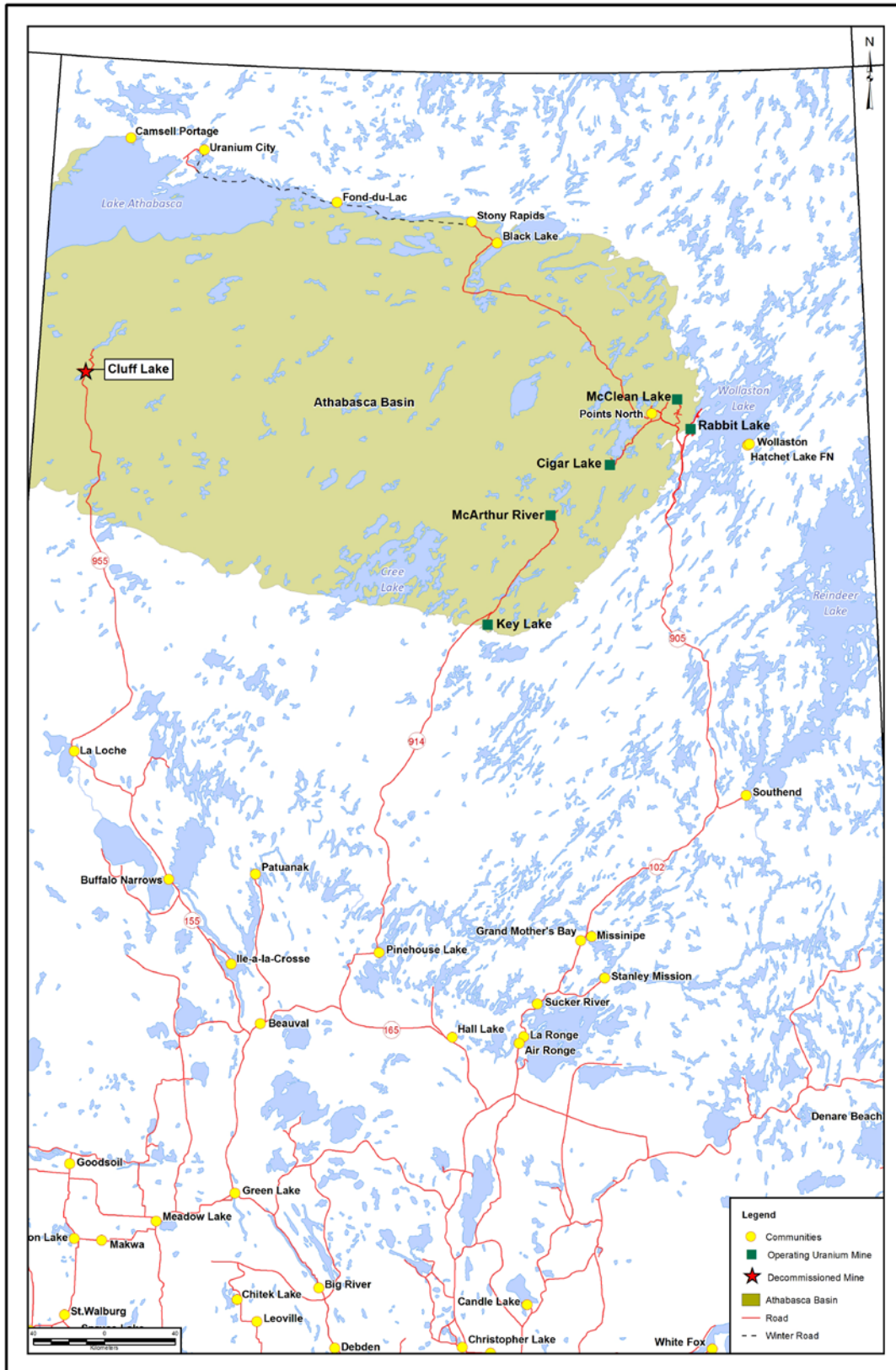
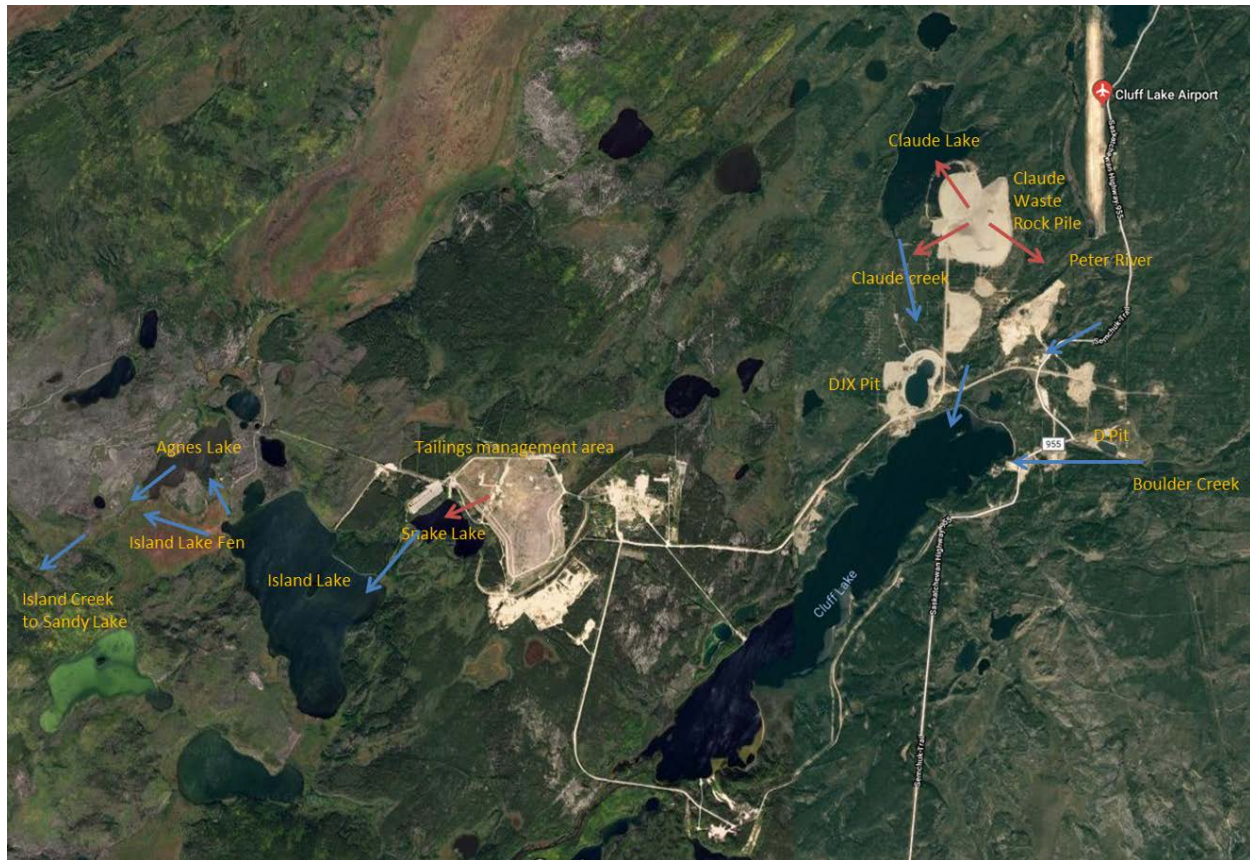


Figure 2. Aerial overview of the key components of the Cluff Lake Project site



CNSC staff developed a Comprehensive Study Report (CSR) in 2003 under the *Canadian Environmental Assessment Act, 1992* [1]. This report included long-term water quality predictions and proposed Decommissioning Surface Water Quality Objectives (DSWQO) and Decommissioning Sediment Quality Objectives (DSQO) for several water bodies in both the Island Lake and Cluff Lake watersheds. These long-term predictions and decommissioning objectives were accepted by the Commission in 2004, resulting in the authorization to proceed with decommissioning activities. The majority of the physical decommissioning was completed between 2004 and 2006 [2].

As part of decommissioning activities, the Claude pit was completely backfilled with waste rock from the DJX pit, the entire DJN waste rock pile and some waste rock from the CWRP and subsequently a cover was installed. The DJ/DJX and D pits were flooded and an engineered cover was placed on a re-contoured CWRP to reduce acidic and contaminant seepage. The portals and vents to the underground mines were closed with reinforced concrete caps and concrete plugs and the TMA was contoured, covered and revegetated. Some infrastructure was left in place to support site monitoring and for Orano to maintain a full-time presence while other decommissioning work continued.

During the 2009 Commission proceedings when Orano (then Areva) was issued the 10-year Uranium Mine Decommissioning Licence for the Cluff Lake Project, the Commission requested

that CNSC staff provide a mid-term update to the Commission. This update was given to the Commission in 2016 via the annual *Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015* [3] and provides an overview of decommissioning activities from 2009 to 2015, including the findings of CNSC staff's review of the 2015 Environmental Risk Assessment (ERA) [4].

Also during the *Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015* proceedings, an intervenor provided chemistry results of a moose that the intervenor had gathered near the Cluff Lake Project. 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 are provided in Appendix A and were included in the 2017 Independent Environmental Monitoring Program (IEMP) Technical Report for the Cluff Lake Project [5]. CNSC staff concluded that the moose that was sampled was safe to eat.

In 2013, Orano requested to discontinue a full-time site presence. CNSC staff accepted the request and plans were made to continue site-wide environmental monitoring and site access was changed to unrestricted use, making it completely accessible to the public.

Prior to 2018, environmental monitoring was completed either quarterly or semi-annually. Moving forward, only annual monitoring will be conducted [6].

Orano continues to ready the site to be released into the Province of Saskatchewan's Institutional Control Program (ICP) under the *Reclaimed Industrial Sites Act*. Once the Province of Saskatchewan is satisfied and is ready to accept the site into the ICP, CNSC staff will present to the Commission a request to release the site from CNSC licensing. This will be a separate application from the current request and will be the subject of its own public hearing.

The current Uranium Mine Decommissioning Licence held by Orano for the Cluff Lake Project, UMDL-MINEMILL-Cluff.01/2019 [7], was issued on July 31, 2009 and is valid for a period of 10 years, with an expiry date of July 31, 2019. The current CNSC licence for the Cluff Lake Project authorizes Orano to continue decommissioning the Cluff Lake site (figure 1) as committed in the Detailed Decommissioning Plan [8]. During this licencing period, Orano completed the planned decommissioning work. In September 2018, Orano submitted a licence application to the CNSC to request a licence renewal for a 5-year term [9]. The application includes requests to:

- Reduce the CNSC licensed area to include only parcels of land where mining activities occurred and where radionuclide inventories are above exemption quantities.
Replace the now complete Detailed Decommissioning Plan with the submitted Detailed Post-Decommissioning Plan (DPDP) [2].
- Reduce the Financial Guarantee to reflect the completion of decommissioning and the ongoing monitoring and maintenance activities proposed in the DPDP.
- Modernize the licence to reflect the post-closure activities on site.

2.0 SCOPE OF ASSESSMENT

An EPR under the NSCA is a technical review by CNSC staff of information required to support the Commission's determination on whether Orano has made adequate provisions for the protection of the environment and the health of persons while carrying on a licensed activity, and will continue to do so into the future. This assessment is commensurate with the scale and complexity of the environmental risks associated with the Cluff Lake Project.

This EPR Report under the NSCA includes CNSC staff's assessment of the licence application and the documents submitted in support of the application, including: decommissioning activities undertaken in support of the 2003 CSR objectives, annual compliance reports, the DPDP, regional health studies, an independent moose-meat sample collected by a hunter, as well as the findings of CNSC's IEMP.

3.0 ASSESSMENT FINDINGS

The 2003 CSR established site-specific water and sediment quality objectives meant to establish criteria to indicate the success of the site's decommissioning. In addition, the CSR predicted long-term sediment and water quality in the receiving environment to assure all site-specific objectives would be met. CNSC staff have reviewed annual compliance reports annually and ERAs on a 5-year cycle, with the most recent for the Cluff Lake Project having been submitted in 2015, which was reviewed and accepted by CNSC staff. CNSC staff's findings of the ERA were presented in the *Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015* and remain valid: environmental recovery is occurring as predicted in Island Lake, levels of hazardous contaminants and radionuclides in Cluff Lake and Snake Lake are as predicted by the 2003 CSR and that the public and the environment remain protected. Annual compliance reports and environmental risk assessments updated on a 5-year basis are used to verify that the risk to the environment and human health remain stable or improving and are in line with the predictions made in the 2003 CSR. The 2003 CSR objectives and Orano's ongoing performance in each of these areas is discussed in the following sections.

3.1 Decommissioning Surface Water and Sediment Quality Objectives

3.1.1 Decommissioning Surface Water Quality Objectives (DSWQO)

CSR Objective: Achieving DSWQO and other accepted decommissioning objectives at surface water and flooded pit locations.

The DSWQOs were based on the 1997 Saskatchewan Surface Water Quality Objectives and accepted by the CNSC. For nickel and uranium, derivation of water quality objectives at the time considered that increasing hardness alleviated toxicity. As a result, the DSWQOs change with hardness, which can be seen in table 1.

Locations chosen by Orano to meet the DSWQOs for key surface water bodies were identified by considering of the locations and distances of contaminants of potential concern (COPC) sources in relation to potentially impacted natural surface water bodies, and in consultation with federal and provincial authorities, including the CNSC, the Province of Saskatchewan's Ministry

of the Environment, Natural Resources Canada, Health Canada, Fisheries and Oceans Canada, Environment and Climate Change Canada and the Canadian Environmental Assessment Agency. Table 1 shows the selected locations and the DSWQOs, as listed in the CSR [5] and table 2 shows a range of environmental monitoring data collected between 2015 and 2017 [10, 11, 12] at these locations. All results presented in table 2 except the DJX and D flooded pits are below the DSWQOs.

Status: Orano currently achieves the DSWQOs, except in the flooded pits.

In flooded pits, the DSWQOs are not always achieved, namely at the bottom of the flooded pits where remobilization of uranium occurs. The flooded pits are isolated from the receiving environment and are not considered to be aquatic habitat. Water quality will improve in the long-term, as predicted by the CSR. The DSWQOs are being achieved by Orano for the other locations.

It should be noted that uranium in the Cluff Lake watershed was predicted by the CSR to eventually increase and peak 300 years from now before concentrations slowly decline to final decommissioned levels. Peak concentration of uranium predicted in Claude Lake is 74 µg/L, with 13 µg/L in Peter River, and 15 µg/L in Cluff Lake. Similarly, nickel is expected to increase and peak more than 300 years from now with peak concentrations predicted in Claude Lake of 43 µg/L, 13 µg/L in Peter River and 7 µg/L in Cluff Lake [3]. The future peaks are attributed to the delay in contaminated groundwater reaching surface water. The peak concentrations are expected to remain below the DSWQO.

In the Island Lake watershed, Orano currently achieves the DSWQO in both Island Lake and Snake Lake. Levels of uranium and selenium are expected to decrease within the next 50 years in Island Lake. In Snake Lake, which receives seepage from the TMA, the predicted peak concentrations for radium-226 (0.039 Bq/L), arsenic (2 µg/L), nickel (5 µg/L) and uranium (2 µg/L) are all below the DSWQOs. The aquatic ecosystem of Snake Lake is expected to remain protected.

Monitoring is ongoing and will continue to be conducted by Orano. Through annual compliance reports and ERAs updated every 5 years, CNSC staff review contaminant trends and verify that these remain below DSWQOs and within the predictions made in the 2003 CSR. In addition, CNSC staff review long-term predictions to ensure their robustness. Once CNSC staff and the Province of Saskatchewan are satisfied with the long-term predictions, the remaining properties could be transferred under the ICP. Once in the ICP, the Province of Saskatchewan would be responsible for the long-term monitoring of the site. Funding for this monitoring is made possible through Orano's financial guarantee, a requirement of the CNSC, and through the provincial ICP.

In the next licensing period, Orano will submit its updated ERA. In this ERA, CNSC staff have requested that Orano adopt the 2011 Canadian Council of Ministers of the Environment (CCME) guidelines for uranium of 15 µg/L, which is lower than the accepted DSWQOs in 2003. In particular, CNSC staff requested Orano use this lower guideline as a screening tool and acknowledge areas where uranium concentrations are above the more recently derived CCME

guideline and assess the environmental risk. Orano has agreed to meet these requests and will revise the ERA and future DPDPs to include the use of the CCME guidelines [13].

Table 1: Summary of decommissioning surface water quality objectives and locations [5]

Parameter	Snake Lake	Island Lake	Claude Lake	Claude Creek	Peter River	Earl Creek	Cluff Lake	Flooded Pits ⁽¹⁾
Arsenic (µg/L)	50	50	50	50	50	50	50	50
Barium (mg/L)	1	1	1	1	1	1	1	1
Cadmium (µg/L)	1	1	1	1	1	1	1	1
Chromium (µg/L)	20	20	20	20	20	20	20	20
Copper (µg/L)	10	10	10	10	10	10	10	10
Iron (mg/L) ⁽²⁾	3.2	1	7.3	7.3	1	5.2	1	7.3
Lead (µg/L)	20	20	20	20	20	20	20	20
Mercury (µg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Nickel (µg/L) ⁽³⁾	100	100	100	100	25 - 100	25	25	25 - 100
Selenium (µg/L)	10	10	10	10	10	10	10	10
Silver (µg/L)	10	10	10	10	10	10	10	10
Zinc (µg/L)	50	50	50	50	50	50	50	50
Radium ²²⁶ (Bq/L)	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Uranium (µg/L) ⁽⁴⁾	358 - 516	346 – 552	402 - 644	498 - 1158	74 -252	38 - 168	148 - 162	126 - 1000
Molybdenum (µg/L)	73	500	73	73	73	73	73	500
Cobalt (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 25µg/L when [Hardness] <100 mg/L and 100ug/L when [Hardness] >100 ⁽⁴⁾ Uranium objective was determined as a function of location specific hardness (was calculated as 0.002 * hardness (Hardness in mg/L) at the site in question) ⁽⁵⁾ Cobalt objective was set as a site-specific decommissioning objective								

Table 2: Range of surface water data at selected locations for 2015 to 2017 [10, 11, 12]

Parameter	Snake Lake	Island Lake	Claude Lake at Outlet	Claude Creek above entry to Peter River	Peter River	Earl Creek	Cluff Lake at Outlet	Flooded Pits
Arsenic (µg/L)	0.2 - 0.6	1.1 - 2.1	0.4 - 0.7	0.2 - 0.8	<0.1 - 0.2	0.1 - 0.2	0.1 - 0.2	0.3 - 11
Barium (mg/L)	0.0098 - 0.021	0.083 - 0.14	0.012 - 0.042	0.011 - 0.032	0.0029 - 0.0085	0.0021 - 0.0062	0.005 - 0.0056	0.0039 - 0.021
Cadmium (µg/L)	<0.01 - 0.02	<0.01 - 0.04	<0.01 - 0.05	<0.01 - 0.02	<0.01 - 0.08	<0.01	<0.01 - 0.02	<0.01 - 0.65
Chromium (µg/L)	<0.5 - 3.4	<0.5	<0.5 - 0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper (µg/L)	<0.2 - <1	<0.2 - 0.4	<0.2 - 0.4	<0.2	<0.2 - 0.8	<0.2 - 0.3	<0.2	<0.2 - 6.8
Iron (mg/L) ⁽²⁾	0.013 - 1.4	0.024 - 0.24	0.098 - 1.42	0.23 - 1.47	0.0088 - 0.81	0.28 - 0.76	0.025 - 0.3	17 - 9000
Lead (µg/L)	<0.1 - 0.2	<0.1 - 0.1	<0.1 - 0.4	<0.1 - 0.3	<0.1 - 1	<0.1	<0.1	0.9 - 19
Mercury (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel (µg/L) ⁽³⁾	1.1 - 6.4	1.8 - 3.6	1.4 - 8.8	1.1 - 25	0.1 - 3.6	0.3 - 0.5	0.7 - 1	2.9 - 1080
Selenium (µg/L)	<0.1 - 0.2	1 - 1.7	<0.1 - 0.4	<0.1 - 0.1	<0.1	<0.1	<0.1	0.2 - 0.9
Silver (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc (µg/L)	<0.5 - 4.2	<0.5 - 8	<0.5 - 9.2	<0.5 - 4.7	<0.5 - 7	<0.5	0.9 - 44	<0.5 - 110
Radium ²²⁶ (Bq/L)	0.01 - 0.02	0.01 - 0.03	<0.005 - 0.05	0.007 - 0.03	<0.005 - 0.02	<0.005 - 0.009	<0.005 - 0.009	0.005 - 0.24
Uranium (µg/L) ⁽⁴⁾	0.4 - 5.6	76 - 143	1.8 - 5.2	0.1 - 1	<0.1 - 1.1	<0.1 - 0.2	0.6 - 0.8	45 - 302
Molybdenum (µg/L)	1.5 - 12	242 - 424	<0.1 - 0.2	<0.1 - 0.3	<0.1 - 0.5	<0.1 - 0.2	0.1 - 0.2	0.9 - 19
Cobalt (µg/L)	0.1 - 0.5	0.1 - 0.4	0.2 - 1.3	0.7 - 5.2	<0.1 - 0.7	<0.1 - 0.1	<0.1	0.1 - 220
<p>Note: Peter River data is collected at the following six sampling locations:</p> <ul style="list-style-type: none"> • Peter River at north end of airstrip • Peter River North • Peter River South • Peter River above confluence with Claude Creek • Peter River at Mill Road • Peter River below confluence with Claude Creek 								
<p>Note: Earl Creek data is collected at the following two sampling locations:</p> <ul style="list-style-type: none"> • Earl Creek Upstream • Earl Creek at Mill Road 								
<p>Note: Flooded pits data is collected at D-pit and DJX-pit and contains data for the upper 50% of the water column only.</p>								
<p>Bolded numbers indicate exceedances of the DSWQOs.</p>								

3.1.2 Decommissioning Sediment Quality Objectives

CSR Objective: Achieving DSQO in water bodies in both the Island Lake and Cluff Lake watersheds.

Similarly to water quality, the 2003 CSR established site-specific sediment quality objectives meant to establish criteria to indicate the success of the site's decommissioning. Orano adopted the CCME and CNSC sediment quality guidelines as DSQOs.

Orano conducts sediment monitoring every five years in Snake Lake, Island Lake and Cluff Lake. The latest sampling was conducted in 2014 and the results of this sampling are presented below in table 3. CNSC staff review contaminant trends and ensure they meet the CSR predictions. In addition, CNSC staff review the long-term predictions and ensure their robustness.

The CSR made long-term predictions of sediment quality in Snake Lake and Island Lake downstream of the TMA (Table 3). While Snake Lake was not contaminated during operations, seepage from the TMA will result in a slow increase in arsenic, nickel, selenium, uranium and radium that will peak marginally above the lowest effect levels (LEL), published by Thompson et al. (2005), in 2000 years before slowly returning to natural levels [14]. The LEL represents the lowest level of concentration of a contaminant before harmful effects would be expected to occur in an organism. CNSC staff reviewed the predicted peak in metal concentrations in sediments within the ERA presented in the 2003 CSR and confirmed that organisms dwelling in sediments at peak concentrations will remain protected.

While these are long-term predictions, CNSC staff ensure through annual review of monitoring data and updated risk assessments that current levels of metals in Snake Lake remain within the predictions of the 2003 CSR. CNSC staff confirms that current sediment concentrations of contaminant remain below long-term predictions accepted by the Commission. It should be noted that contaminants are all below the LEL except for nickel. Exceedance of the nickel LEL does not indicate impacts; ERAs and biological monitoring are tools used to evaluate impacts (see section 3.1.3 below). ERAs presented within the CSR in 2003 (updated on a 5 year basis and whenever a significant change occurs in either the facility or activities that could alter the nature of the interaction with the environment within the ERA predictions) confirmed that current contaminant levels in Snake Lake do not affect organisms dwelling in sediments.

Island Lake received liquid effluent during operations and contaminants have accumulated in sediments, which explain the relatively high contaminant concentrations in Island Lake (table 3) and associated impacts (see section 3.1.3 below). With the end of liquid effluent discharge, the contaminated sediments are predicted to recover, as clean sediments accumulate on top of the contaminated sediment. The CSR predicted recovery to be below the lower effect levels [14] within 100 years for molybdenum and nickel, and within 150 years for uranium and selenium.

Finally, sediment concentrations of COPCs are predicted to slowly increase in Cluff Lake and peak within the next 2000 years and marginally exceed the lowest effect levels [14] before eventually decreasing below the lowest effect levels. It should be noted that arsenic and nickel are already above the long-term sediment concentration predictions, the regional background

values and the LELs. CNSC staff reviewed the updated ERA in 2015 and concluded that organisms dwelling into sediment remained protected at these current levels.

Status: Orano currently achieves the DSQOs in Snake Lake and Cluff Lake, except for arsenic and nickel, and the DSQO should be achieved within the next 100-150 years in Island Lake.

Table 3. Mean sediment concentrations from the 2014 environmental monitoring campaign [15]

Parameter	Location			Benchmarks				
	Snake Lake	Island Lake	Cluff Lake	CCME ⁽¹⁾ ISQG	CCME ⁽¹⁾ PEL	CNSC ⁽²⁾ LEL	CNSC ⁽²⁾ SEL	Natural levels
Arsenic (µg/g)	3.2 (20)	14.3 (10)	48.6 (30)	5.9	17	9.8	346.4	21
Copper (µg/g)	9.2 (39)	10.1 (38)	29.2 (44)	35.7	197	22.2	268.8	9
Lead (µg/g)	7.5 (48)	4.5 (51)	15.0 (49)	35	91.3	36.7	412.4	16
Molybdenum (µg/g)	10.2 (49)	1038.6 (1200)	3.8 (34)	-	-	13.8	1238.5	23
Nickel (µg/g)	35.6 (57)	39.4 (50)	46.0 (15)	-	-	23.4	484	21
Selenium (µg/g)	1.6 (7.6)	20.9 (25)	2.1 (8)	-	-	1.9	16.1	3.6
Uranium (µg/g)	19.6 (17)	342.4 (950)	18.4 (200)	-	-	104.4	5874.1	96
Zinc (µg/g)	53.6 (117)	67.8 (130)	140 (190)	123	315	-		--

Note: Bolded values indicate higher than at least one of the DSQOs, LEL or background concentrations. Values in parentheses represent the long-term peak sediment concentration predictions (95th percentile).

⁽¹⁾ Canadian sediment quality guidelines for the protection of aquatic life (CCME 2015)

⁽²⁾ Canadian Nuclear Safety Commission working benchmarks (Thompson et al. 2005)

- = no data available

ISQG = interim sediment quality guideline

PEL = probable effect level

LEL = lowest effect level

SEL = severe effect level

3.1.3 Effects on non-human biota

As a result of historic liquid effluent discharges, the benthic organisms dwelling in sediments and fish in Island Lake were impacted. Liquid effluent discharges provided well oxygenated water and larger volumes which allowed for fish population growth in Island Lake during operations. Once liquid effluent discharge ended, lower volumes in Island Lake led to fish kills over the winter because of low oxygen levels. Discharges of liquid effluent containing selenium

in Island Lake during operations did not negatively affect fish [16], nor did uranium levels, as these remain lower than toxicity levels reported in the literature [17, 18]. However, environmental effects monitoring at the site indicated that organisms dwelling in Island Lake sediments were impacted. The CSR predicted recovery of this aquatic ecosystem within 100 years. In Snake Lake, no impacts to aquatic biota are expected. Finally, in Cluff Lake, the aquatic community was not impacted during operations. Although, uranium loading to Cluff Lake post-decommissioning may affect algae and grazers in the water column, the probability of these species being affected is low. As for fish, they are not expected to be affected.

With regard to wildlife health at the site, it is safe for animals to drink Island Lake water, ponded water on the TMA and water in the flooded pits. Concentrations of COPCs are within the bounds of the wildlife drinking water risk analysis conducted in the CSR. Downstream of Island Lake in Island Creek, there is a low risk of COPC exposure for the mink, muskrat, otter, and yellowleg (local populations), and common nighthawk individuals, but no concern for other terrestrial species. The common nighthawk is listed as a threatened species under the *Species at Risk Act* (SARA) and was identified to potentially inhabit the study area in the 2015 ERA, though it was not observed during field surveys. Risk to the common nighthawk was assessed at the individual level, as is required under SARA, and it was also used as an indicator species to represent other SARA species, such as the olive-sided flycatcher and the rusty blackbird, which were identified as having the potential to inhabit the site. The assessment showed that exposure to COPCs will decline as the system begins to recover [7].

CNSC staff conclude that results of the environmental monitoring presented in the above tables are comparable to the assessment findings in the CSR, which predicted recovery of the Island Creek watershed within the next 100 to 150 years. Seepage from the TMA to Snake Lake is currently not affecting the receiving aquatic environment and should not be affected in the long-term. Similarly, seepage to Cluff Lake is not currently affecting the receiving aquatic environment. In the long-term, plankton may be affected but the probability is low. Fish in Cluff Lake are expected to be protected. Finally conditions in the Cluff Creek watershed are not predicted to affect terrestrial species.

3.1.4 Effects on human health

CNSC staff conclude that the results of Orano's assessments 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 annually at the Cluff Lake Project, will not experience adverse effects from exposure to radionuclides or non-radionuclides [4].

3.2 Post-Decommissioning Radiological Objectives

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

As per CNSC's *Radiation Protection Regulations*, the limit on annual effective dose to a member of the public is 1 millisievert (mSv) per year above natural background level. To achieve this, radon and long-lived radioactive dust (LLRD) were reduced through removal of the

source term or by covering with clean soil. LLRD was eliminated with sufficient soil coverage and radon levels were brought to near background conditions. Gamma radiation is the primary exposure pathway and has been addressed through surface gamma clearance survey and remediation, as necessary.

Status: Radiological levels achieved protect public health by maintaining doses to future users that are well within regulatory limits for members of the public. CNSC staff has reviewed the progression of this objective and consider the risk of exposure to the public from radiological substances at the Cluff Lake Project to be below regulatory limits and ALARA. Radon levels have remained consistently within the range for natural background and thus CNSC staff accepted Orano's request to cease radon monitoring during the summer of 2018.

3.3 Post-Decommissioning Landscape

CSR Objective: A stable, self-sustaining landscape.

Orano's decommissioning of the Cluff Lake Project site included works to stabilize the landscape and minimize public safety hazards. This objective was completed through a number of decommissioning projects such as the backfilling or flooding of the mined pits, the covering of the TMA and the CWRP, and the capping of the portals and vents. Orano was also required to complete a number of revegetation projects under this objective. These are discussed in section 3.4 and 3.5.

Status: The Cluff Lake Project site is considered stable and most of the reclamation activities have been completed or are on a long-term maintenance schedule. Orano considers decommissioning works for this objective as complete [4]. CNSC staff concur that Orano continues to meet this objective. To strengthen these conclusions, CNSC staff have requested that Orano address the two requests, as identified in sections 3.1 and 3.4 of this report.

3.4 Engineered Soil Covers

CSR Objective: Reduction of infiltration rates around the TMA and the CWRP to levels that adequately restrict contaminant movement in groundwater and are suitably protective of downstream surface water receptors.

A 1 m thick glacial till cover was installed on the TMA and CWRP between 2001 and 2006 to promote surface runoff, minimize infiltration and the release of contaminants to groundwater. In 2006 a soil cover monitoring program was implemented following the final grading of the areas. Monitoring stations were installed at locations to monitor soil and weather conditions, in order to assess the success of the cover system.

In 2006, the TMA and CWRP were further transformed by the initiation of a cover crop using hydroseeding techniques to incorporate and promote the growth of shallow-rooting grasses and forbs on the soil cover.

Status: Orano reports that the cover systems are performing on a stable trajectory and are expected to continue to be stable. These covers are proposed as being self-sustaining and

therefore effective in controlling erosion. Orano proposes that long-term monitoring for erosion and minor repair to covers is appropriate under the ICP and considers soil cover objectives to be met.

CNSC staff have reviewed the Cluff Lake Project's DPDP to assess whether the soil and vegetation covers continue to meet the decommissioning objectives. CNSC staff have requested additional information to assess the long-term effectiveness of the soil and vegetation covers. CNSC staff have also requested more information regarding the performance of horizontal drains installed at the Claude Pit cover to confirm the drains are performing as designed. The drains were designed to eliminate ponding water on the Claude Pit cover and the incremental contaminant loading from the drains to Claude Lake was bounded by the flow through the drains to no more than 10% of the total flow/contaminant loading from the Claude Pit flowpath. This information is pending receipt of the Hydrogeology and Groundwater Modelling Technical Information Document (TID) in 2019 [19].

3.5 Post-Decommissioning Aesthetics

CSR Objective: 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 humans or the environment.

Activities under this objective include re-vegetation to re-establish native species of grasses, other flowering plants, and woody species to accelerate the process of natural ecological succession and return the Cluff Lake Project site to a forested environment similar to that which existed prior to the mine's development. Progress of the re-vegetation aspect of this objective in key areas can be seen in figures 3 through 8, showing a comparison of the landscape at different periods [4]. The latter half of this objective, absence of unreasonable risk, has been discussed throughout section 3.

Status: The Cluff Lake Project site has been given unrestricted access and public health and safety does not require the control of human behaviour on the site (e.g., fences, signs, and advisories). Orano has stated that ecological integrity is being maintained, that aquatic and terrestrial systems are recovering and are expected to continue to do so in the future. Orano considers that the aesthetic and risk objectives for the Cluff Lake Project have been met.

While CNSC staff agree that Orano currently continues to meet this decommissioning objective, staff continue to evaluate the long-term status based on a number of CNSC staff requests that Orano has agreed to follow-up on, as described in sections 3.1 and 3.4 of this report [13, 19]. CNSC staff will continue to evaluate how Orano addresses these requests in their TIDs to be submitted later in 2019.

Figure 3: Aerial photographs of D mining area [4]



Figure 4: Aerial photographs of Claude mining area [4]



Figure 5: Aerial photographs of DJ mining area [4]



Figure 6: Aerial photographs of mill complex area [4]

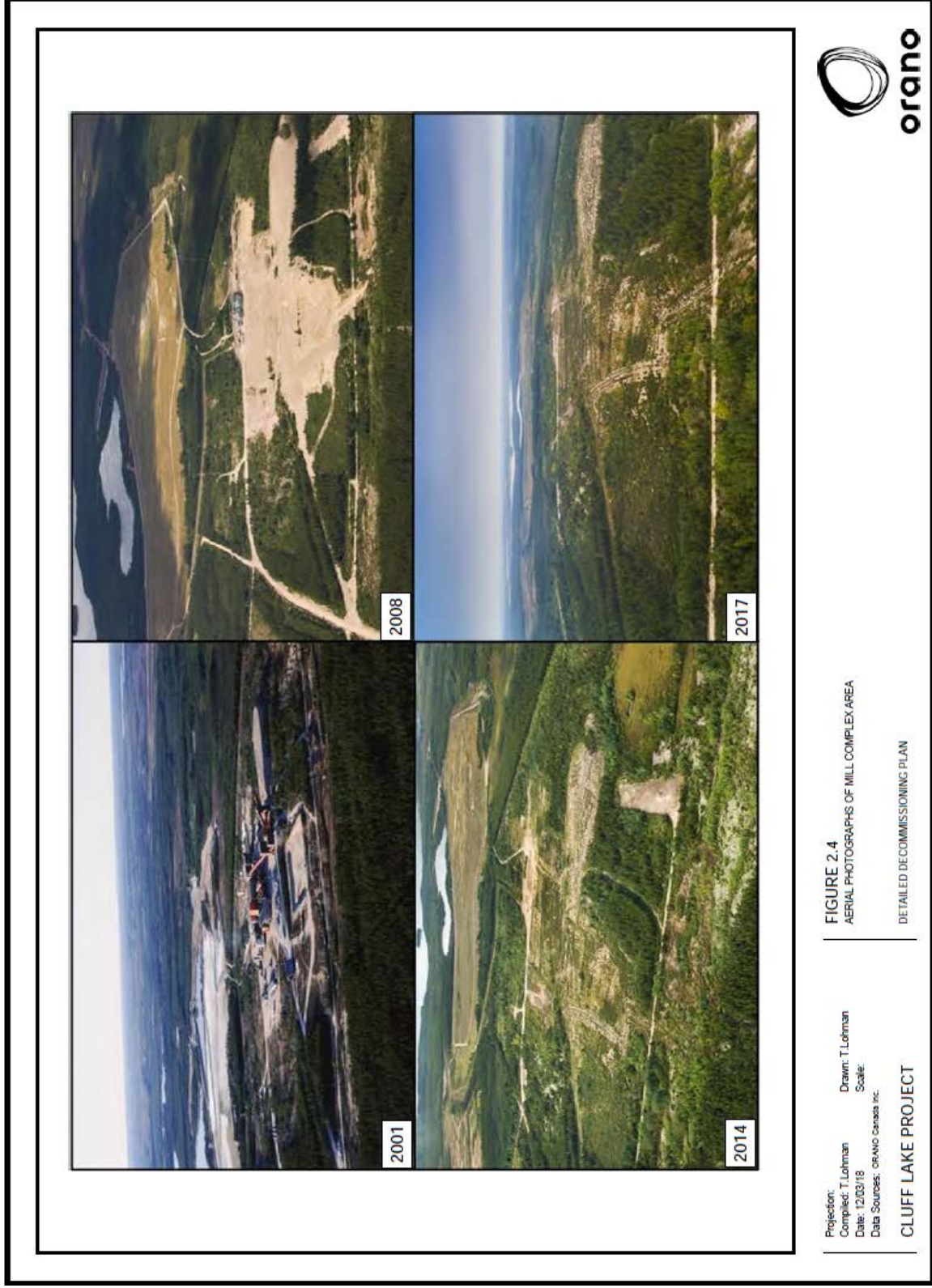


Figure 7: Aerial photographs of tailings management area [4]

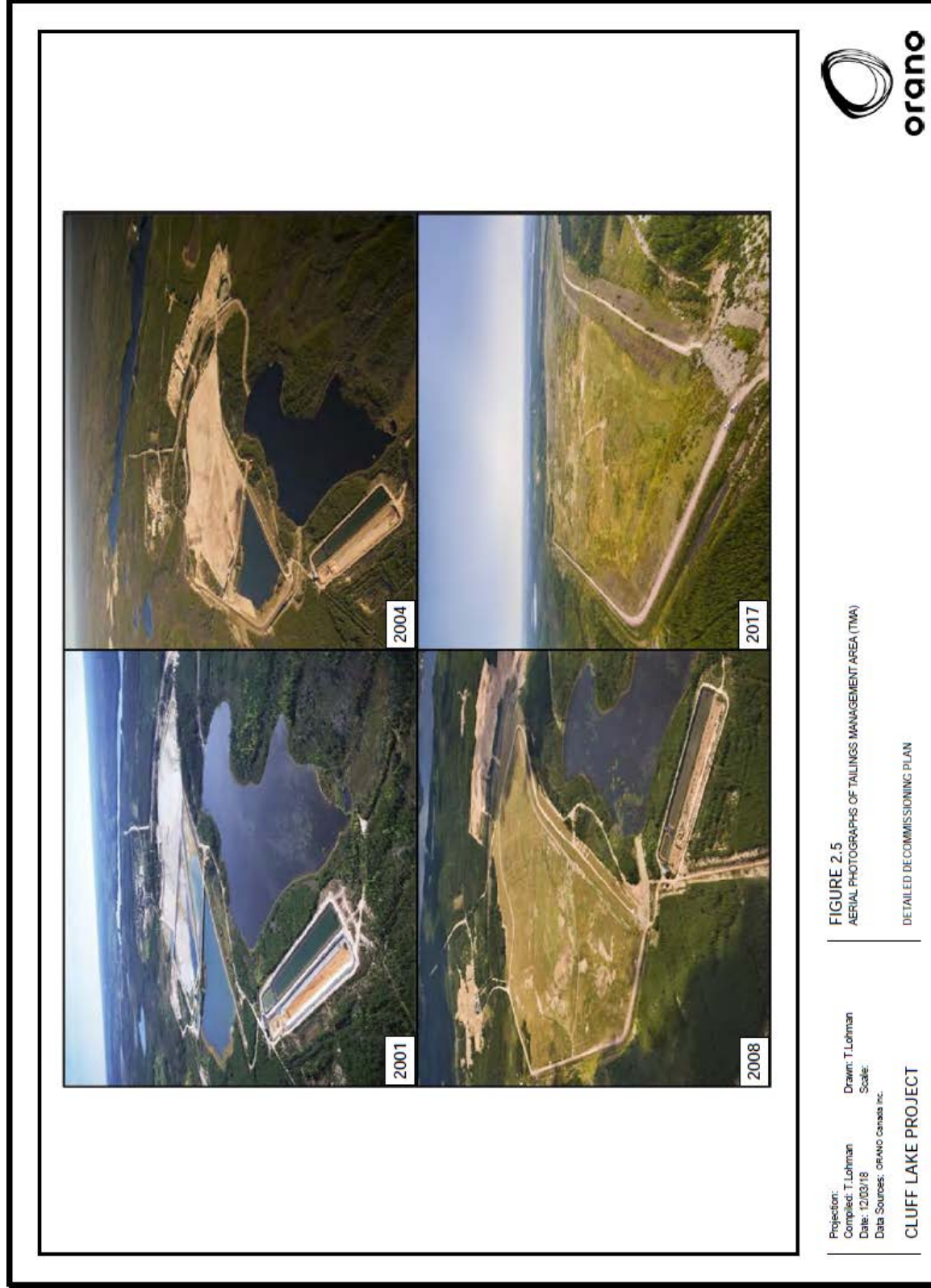


Figure 8: Aerial photographs of Germaine camp area [4]



3.6 Land Parcels to be Released from CNSC Regulatory Oversight

Included in Orano's licence renewal application was a request to update the CNSC licensed area to only include the parcels of land on which CNSC licensable activities will continue. The parcels of land that will remain under CNSC licence either have licensable inventories of nuclear substances (primarily uranium and its daughter products) or will require future institutional controls (such as the underground mine workings or the decommissioned pits).

The remainder of the parcels that do not include CNSC licensed activities have been surveyed and verified by CNSC staff to assure they are below the CNSC regulatory limits for licensable materials or activities. These parcels include roadways, service corridors, the former residential camp site and the conventional waste landfill. The province has no provisions or requirements to bring these parcels into Saskatchewan's ICP and the parcels of land meet the CNSC requirement for unconditional release.

Figure 9 on the following page depicts an overview of the currently licensed surface lease for the Cluff Lake Project site [1]. Figure 10 shows the updated land parcels which will continue to be under CNSC licence, shown in purple [20].

Of note are the proposed removal of Island Lake and Cluff Lake from the licensed area. Environmental-related aspects of these two water bodies have been discussed in section 3 and are summarized below.

For Cluff Lake, DSWQOs and DSQOs are being met currently and predicted to be met in the long-term, except for the arsenic and nickel DSQO. From a risk perspective, these levels remain protective of the aquatic environment. In addition, no risks to terrestrial biota are occurring currently or predicted to occur in the future.

For Island Lake, DSWQOs are being met currently and predicted to be met in the long term while DSQOs are expected to be met in 100 to 150 years. From a risk perspective, large ungulates are not at risk at the site, but there are localized risks to certain small terrestrial species with limited home range that are predicted to continue to decrease as the system recovers. For aquatic biota, fish are not currently being impacted or predicted to be affected in the long-term. Benthic organisms were impacted by operations and are expected to recover in the long-term.

The above are in alignment with the predictions in the CSR and related environmental monitoring information. Environmental monitoring will continue in the future.

Figure 9: Overview of the currently licenced surface area for the Cluff Lake Project [1]

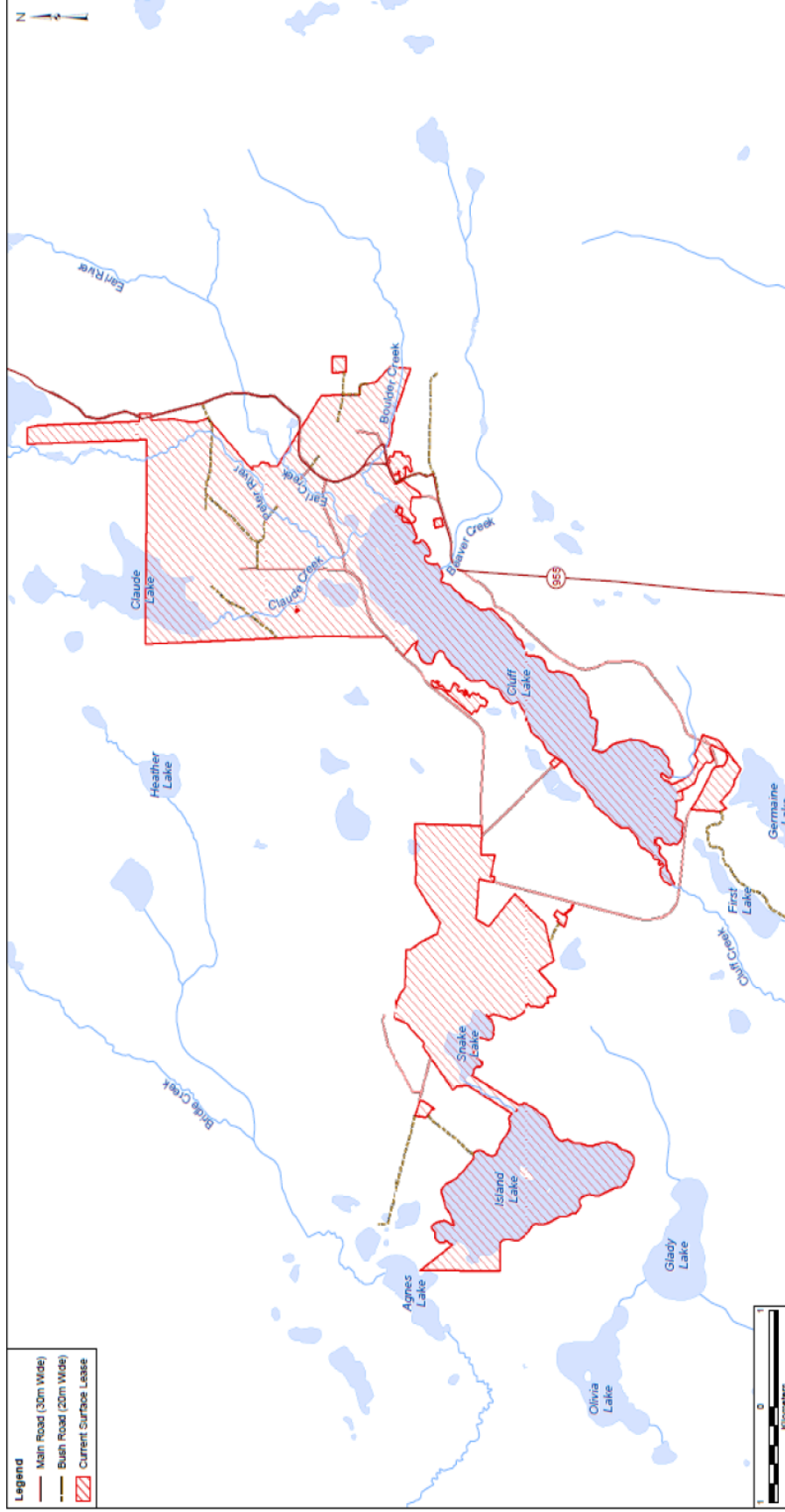
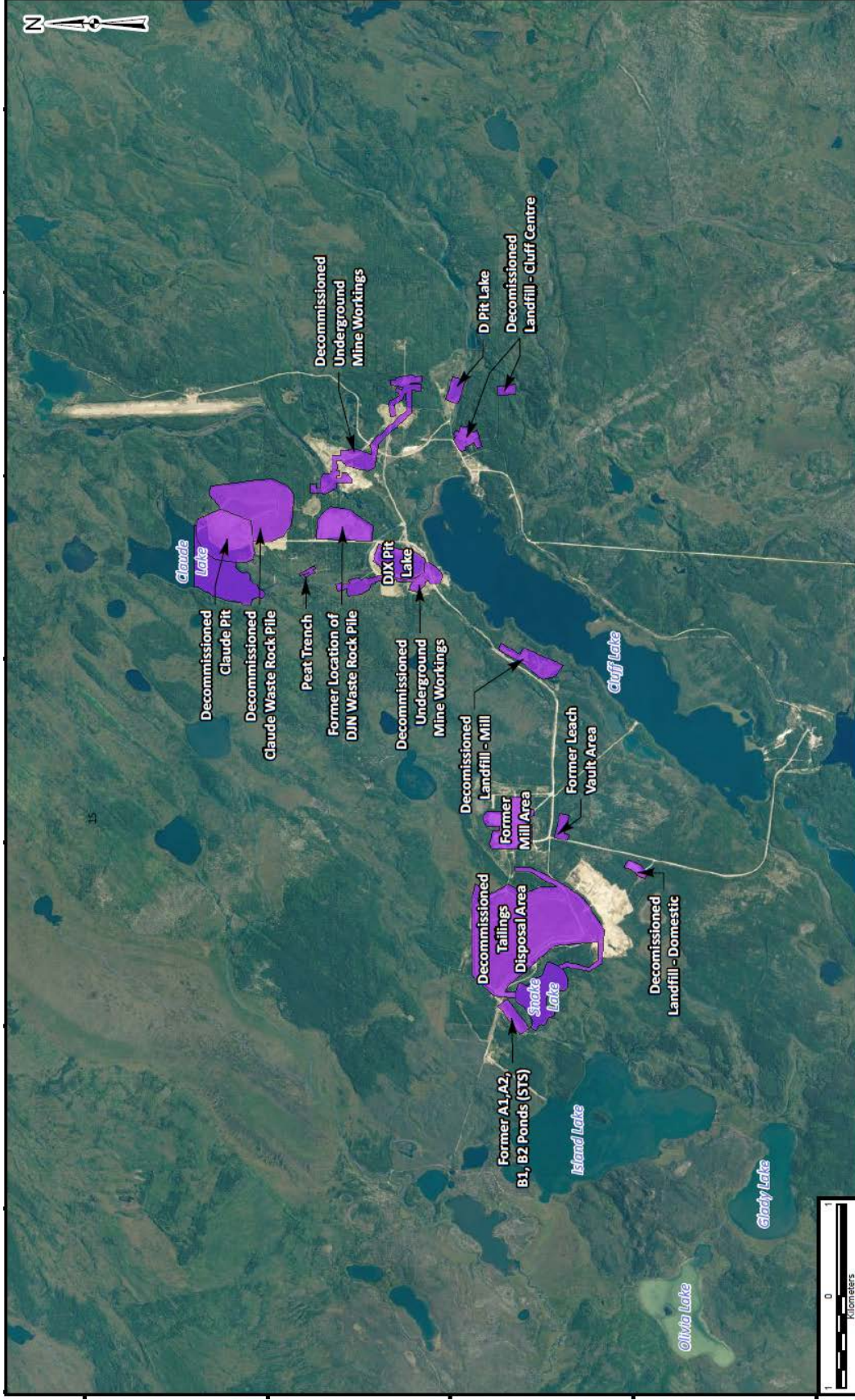


Figure 10: Updated licence area for the Cluff Lake Project site highlighted in purple [20]



3.7 Conclusions

CNSC staff based their review of Orano’s environmental performance on annual compliance reports and technical assessments of decommissioning activities to assure adherence to the 2003 CSR objectives, as well as the 2015 ERA which was discussed in 2016 at the *Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015* [4]. In its current state the Cluff Lake Project is a decommissioned site with no liquid effluent discharge or atmospheric emissions. All effects are constrained to existing contamination and current and future contaminant seepage from the decommissioned TMA, flooded and backfilled pits and the covered CWRP. CNSC staff concur that Orano continues to meet the decommissioning water quality objectives and is expected to continue to meet the other CSR objectives in the short-term. To strengthen these conclusions, CNSC staff expect Orano to address the two requests. While some contaminants have yet to peak before declining to final decommissioned levels, CNSC staff are overseeing that Orano’s progression is occurring as modeled in the CSR [3]. Therefore, CNSC staff confirm that the environment and human health are protected.

4 CNSC’s Independent Environmental Monitoring Program

The CNSC has implemented its IEMP to verify that 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. The IEMP involves taking samples from public areas around the facilities, and measuring and analyzing the amount of radiological and non-radiological contaminant substances in those samples. For the uranium mines and mills in northern Saskatchewan, CNSC staff, with the assistance of a contractor, collected samples which were analyzed at the Saskatchewan Research Council (SRC)’s laboratory for testing and analysis.

4.1 IEMP at the Cluff Lake Project

The 2017 IEMP sampling plans for the Cluff Lake Project focused on both radiological and hazardous contaminants. Site-specific sampling plans were developed based on Orano’s approved environmental monitoring program and the CNSC’s regulatory experience with the site. In 2017, samples were collected in publicly accessible areas in the vicinity of the Cluff Lake Project and included radon in ambient air, surface water, fish (northern pike and lake whitefish), blueberries, and Labrador tea. The site-specific sample plans are reviewed by CNSC staff on an ongoing basis to continuously



Figure 11: CNSC staff installing a radon sampler near the Cluff Lake Project site in 2017

improve and refine the plans to meet the objectives of the program.

CNSC staff sampled the following at Saskatoon Lake (reference location), Sandy Lake (exposure location) and Cluff Lake (exposure location):

- radon in ambient air (3 samples at each of the 3 locations)
- water (1 sample at each of the 3 locations)
- fish (5 lake whitefish and 5 northern pike at each of the 3 locations)
- blueberries (5 samples at each of the 3 locations)
- Labrador tea (5 samples at each of the 3 locations)

Samples collected were analyzed at SRC's laboratory in Saskatoon, using appropriate protocols. The following analytes were measured:

- nuclear substances – such as radium-226, polonium-210, lead-210, and thorium-230
- hazardous substances – such as arsenic, copper, lead, molybdenum, nickel, selenium, uranium, and zinc

All radon samples were submitted to Radonova, Inc. for analysis. Radonova is fully accredited with numerous global organizations to conduct radon measurements.

Figures 11 to 14 provide an overview of the Cluff Lake Project and sample locations for the 2017 IEMP sampling campaign.

Figure 12: Overview of the Cluff Lake Project and 2017 IEMP sampling locations

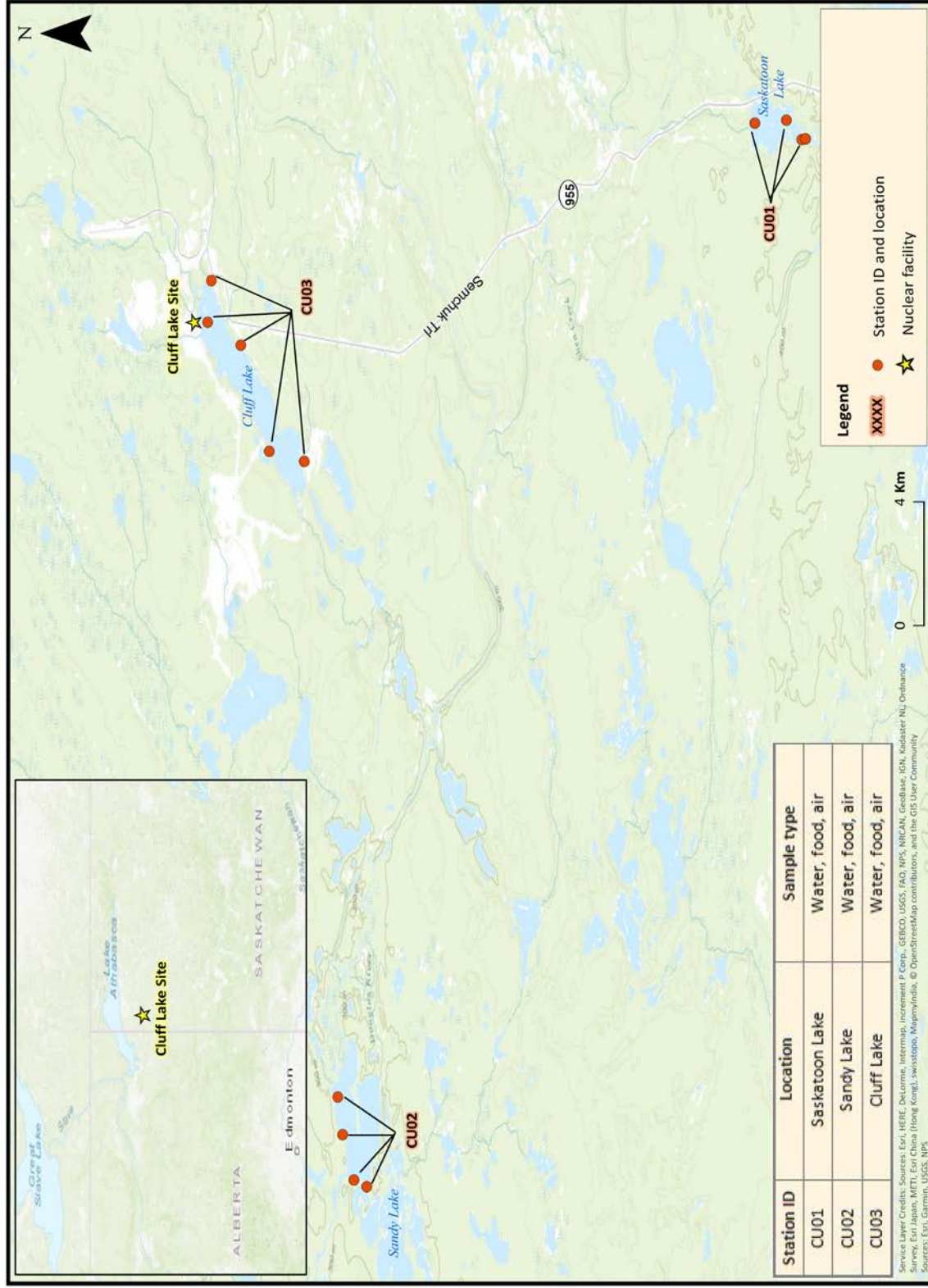


Figure 13: Location of samples at Saskatoon Lake, southeast of the Cluff Lake Project

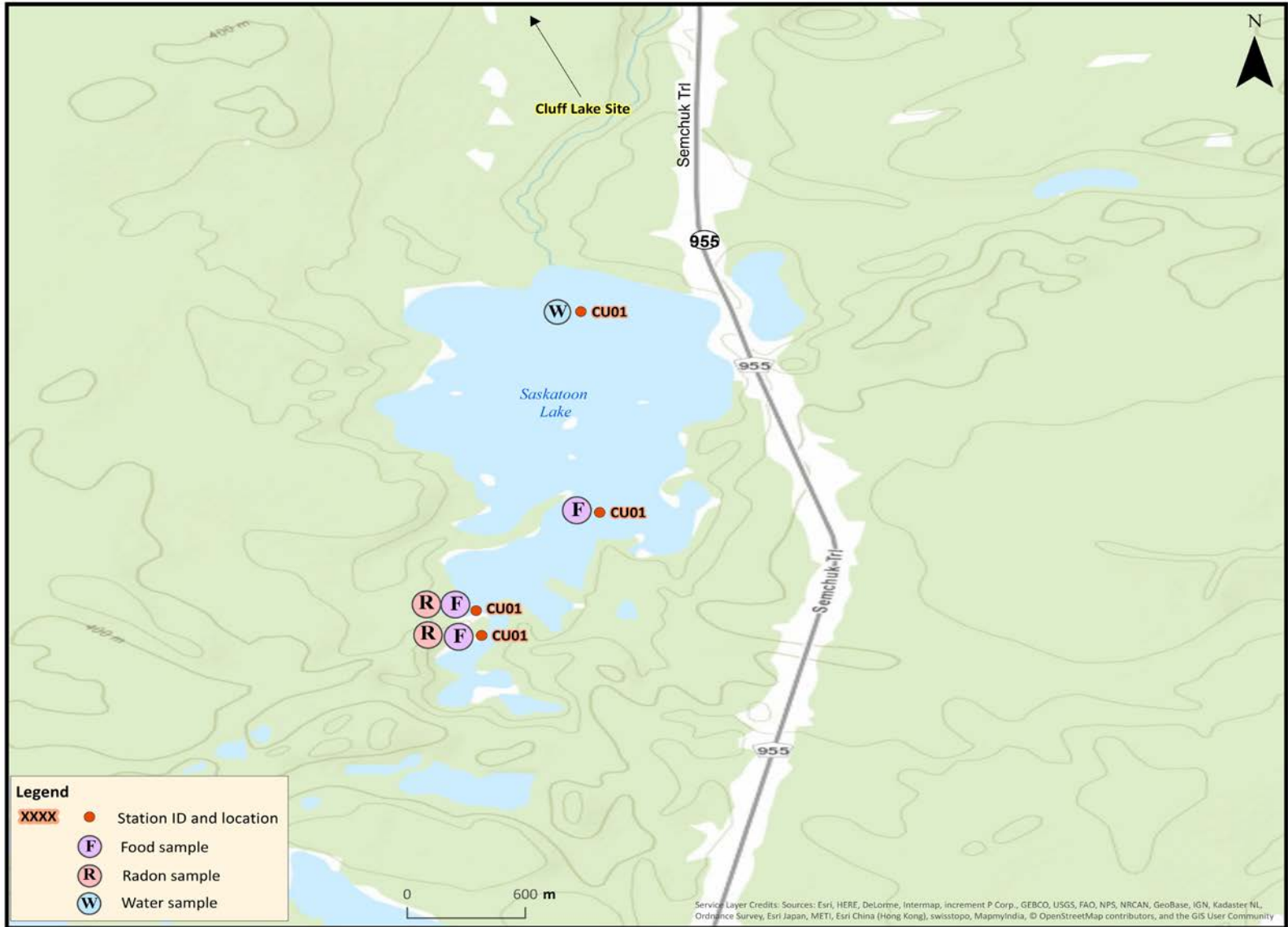


Figure 14: Location of samples at Sandy Lake, southwest of the Cluff Lake Project



Figure 15: Location of samples at Cluff Lake, south of the Cluff Lake Project



4.2 Results

CNSC staff compares results to screening levels to ensure that human health and the environment are protected. CNSC reference levels for radionuclides are based on conservative assumptions about the exposure that would result in a dose of 0.1 mSv per year. For hazardous substances, CNSC staff calculated toxicological reference values, also known as screening levels for hazardous substances, to screen for potential risks from hazardous contaminants measured in food. These screening levels represent the concentration required for a hypothetical representative person (most exposed member of a critical group) to receive a chemical dose of 10% of the tolerable daily intake (TDI) due to exposure to the given contaminant from multiple primary exposure pathways.

A TDI is a daily dose that is deemed to be tolerable and unlikely to cause harm based on the assumption that a threshold dose exists at, or below which, toxic effects do not occur. Therefore, screening levels for hazardous substances represent the concentration of a hazardous substance in the food (e.g., fish, blueberries or Labrador tea) that would have to be present in order for 10% of the TDI to be exceeded in an adult or child receptor based on their assumed conservative ingestion rates and body weight. The ingestion rates were taken from dietary surveys done in Indigenous communities in northern Saskatchewan. An exposure above a screening level does not mean that an effect will occur, but the higher exposure level triggers a more in-depth assessment of the monitoring results to confirm that the TDI has not been exceeded and that the health and safety of people and the environment are protected.

Appendix B provides the range of results from the 2017 IEMP sampling campaign. The full IEMP results are available through a public-friendly [dashboard](#) [21] on the [CNSC website](#) [22].

As expected, levels of polonium-210 in some fish samples collected from both the reference and exposure stations were above the highly conservative screening levels. The reference station is not impacted by the operation of the facility and is considered background. These levels are within the natural background range for the region of 0.01942 – 14 Bq/kg fresh weight as identified in the CNSC report, *Environmental Performance of Uranium Mine or Mill Regulated Under the Nuclear Safety and Control Act: Based on Environmental Data Associated with Operating Uranium Mines and Mills (2000 – 2012)* [23]. These levels are also below the incremental public dose limit of 1 mSv per year (i.e., 1 mSv per year above natural background dose). These levels are not expected to result in any adverse health effects.

Selenium concentrations measured in fish flesh samples from both the exposure and reference stations were higher than the screening level. CNSC staff examined these elevated levels and found that the highest concentration of selenium in fish was 0.81 mg/kg fresh weight and analyzed from a sample collected at Cluff Lake (exposure location). This represents approximately 45% of the TDI of 1.84 mg/kg fresh weight. The contribution from other ingestion pathways including blueberries was approximately 2% of the TDI, from water was 1% of the TDI, and from Labrador tea was negligible. Considering that only a fraction of the TDI has been reached, and the margin of safety built into the screening level, CNSC staff conclude that no adverse health effects due to selenium at these levels are expected from the consumption of fish.

At each of the three locations, results from all samples collected (10 fish, 5 blueberry, and 5 Labrador tea samples) did not vary significantly and so CNSC staff are confident in the results, thus confidence levels are not necessary.

The IEMP results confirm that the public and the environment around the Cluff Lake Project are protected, and that there are no expected health impacts. These results are consistent with the results submitted by Orano confirming that the licensee's environmental protection program protects the health of persons and the environment.

5 Health Studies

The following section draws from the results of regional health studies to provide further independent verification that the health of people in northern communities are not impacted by the Cluff Lake Project. The health of populations around the Cluff Lake Project is monitored by various organizations and institutions in Saskatchewan and disease rates are compared to other populations to detect any potential health outcomes that may be of concern. CNSC staff remains abreast of any publications related to the health of populations living near nuclear facilities.

There are numerous health studies and reports that have assessed the health of populations living near the Cluff Lake Project. Additionally, CNSC conducts studies to assess health effects of occupational radiation exposure among Saskatchewan uranium workers. The CNSC continues to carefully monitor and conduct health studies to ensure the protection of human health. For additional information on health studies related to nuclear facilities, please visit the [CNSC webpage on Health Studies](#) [24].

The following sections (5.1 and 5.2) provide a list of health studies carried out in the region.

5.1 Population and Community Health Studies and Reports

Northern Saskatchewan Health Indicators Reports and collaborative health research projects in Northern Saskatchewan

The Northern Saskatchewan Health Indicators Reports provide an overview of the population of northern Saskatchewan. They includes important community characteristics, the determinants of health (personal, social, economic, and environmental factors that influence health status), and health status and well-being indicators. The Northern Saskatchewan Population Health Unit has published two Northern Saskatchewan Health Indicators Reports [25, 26] and updates and publishes health monitoring chapters on their [website](#) [27]. Also, there are older reports available by the Athabasca Health Authority, Keewatin Yatthe Health District, and Mamawetan Churchill River Health District.

The Northern Saskatchewan Population Health Unit also collaborates on various health research projects in northern Saskatchewan. For a number of health indicators including income, smoking, life expectancy, and obesity, northern Saskatchewan fares poorly compared to Saskatchewan as a whole. Leading causes of death in northern Saskatchewan are injuries, cancers, heart diseases and respiratory diseases. Cancer rates in northern Saskatchewan are lower for males and similar for females when compared to southern Saskatchewan. Lung cancer rates are greater compared to the province; however, the number of daily cigarette smokers is

significantly higher in northern Saskatchewan compared to the provincial average and cigarette smoking is the leading cause of lung cancer.

Northern Inter-Tribal Health Authority (NITHA) Health Reports

The Northern Inter-Tribal Health Authority (NITHA) is a First Nations partnership organization between the Prince Albert Grand Council, Meadow Lake Tribal Council, Peter Ballantyne Cree Nation and Lac La Ronge Indian Band. The NITHA partnerships provide and maintain health services and public health programs in 33 First Nations on-reserve communities in Northern Saskatchewan. The NITHA develops health reports for First Nations living on-reserve which are available on their [website](#) [28]. The leading causes of death for NITHA partnership communities from 2010 to 2015 were cancer, diabetes, pneumonia, and heart attack. Lung cancer was the most common cause of cancer death.

Saskatchewan Health Status Reports

The Province of Saskatchewan produces health status reports which describe the health of the population, and offer regional comparisons and, where possible, national comparisons. Information in the [Saskatchewan Health Status Report](#) [29] use a variety of sources including the Ministry of Health's administrative health services databases, vital statistics, census data, and survey data such as the Canadian Community Health Survey. The leading causes of mortality in Saskatchewan in 2009 were heart disease and cancer.

5.2 Saskatchewan Uranium Workers Studies

The Saskatchewan Uranium Miners' Cohort Study, which was a partnership between the CNSC, the Saskatchewan government and industry stakeholders, conducted two studies on uranium workers, including miners previously employed at the Cluff Lake Project. The CNSC is currently proposing a Canadian wide study of uranium workers including miners, millers and processing workers. This study will include Saskatchewan uranium workers.

Part 1 of the Saskatchewan Uranium Miners' Cohort (SUMC) Study

The updated analysis of the cohort of Eldorado uranium workers: *Part I of the Saskatchewan Uranium Miners' Cohort Study* [30] looked at the relationship between lung cancer (deaths and new cancer cases) in relation to radon decay products (RDP) exposures in uranium miners. The cohort included Eldorado uranium workers who started work at the Beaverlodge and Port Radium mine sites and the Port Hope radium and uranium facility from 1932 to 1980 and followed up through 1999. It is an update of the original Eldorado cohort study. The study concluded that overall, mining 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 mine workers. Overall, the excess risk of lung cancer death and cancer incidence increased linearly with increasing RDP exposure. There was no statistically significant evidence of a relationship between RDP exposure and any other disease other than lung cancer.

Part 2 of the Saskatchewan Uranium Miners Cohort Study

Part two of the SUMC study [31] consisted of a feasibility study to assess whether a study of modern miners could detect excess lung cancers due to the relatively low workplace RDP exposures in modern mines (1975 onward). The specific risk of interest was the increased risk of lung cancer due to RDP exposure. Factors such as smoking and residential radon exposure were considered as potential confounding factors of the relationship between lung cancer and RDP. The study concluded that modern Saskatchewan uranium miners had RDP exposures that were significantly lower than those of past miners because of dose limits, improved mining techniques and other radiation protection practices. The study calculated that about 24,000 workers will have spent time working at an uranium mine by the year 2030. During this period, 141 miners could be expected to develop lung cancer, primarily from tobacco smoking. Only one additional miner could expect to get lung cancer from exposure to RDP in the workplace. The study concluded that it would not be feasible to investigate the risk of excess lung cancer in modern miners because exposures are so low. It would also be practically impossible to accurately correct for the effects of smoking and residential radon, factors that could greatly impact the study results. However, workers' exposures would continue to be monitored to ensure they remained ALARA and would be sent to the National Dose Registry for ongoing exposure surveillance.

The Canadian Uranium Workers Study

The Canadian Uranium Workers Study (CANUWS) is a proposed four year project to assess the health effects of occupational radiation exposure among uranium workers, and will update and expand on the work of the SUMC study. The retrospective cohort study will include over 80,000 Canadian uranium mine, mill and processing workers who will have their occupational radiation exposures (1932–2017), mortality (1950–2017) and cancer incidence (1969–2017) followed-up using data from the National Dose Registry, the Canadian Mortality Database and the Canadian Cancer Registry. The main objective of the study is to update information on the radon-lung cancer relationship. Importantly, the study will assess the potential health effects of low cumulative exposures and exposure rates. This is possible due to high quality exposure measurements and long-term follow-up of health outcomes of workers employed after radiation protection measures were put in place (i.e., Cluff Lake Project workers). As indicated in the part two of the SUMC study, we do not expect to see the high rates of lung cancer in Cluff Lake Project workers, since their exposures were very low. The findings of the study will contribute to the verification, and if required, updating of occupational radiation safety standards. This information is relevant for radiation protection of current and future uranium workers with low cumulative exposures and exposure rates. The study is planned to begin in 2019.

5. 3 Summary of Health Studies

Reviewing and conducting health studies and reports is an important component of ensuring that the public and workers are protected around and at nuclear facilities. The population and community health studies and reports indicate that common causes of death between the Saskatchewan populations include heart disease and cancers. This is similar to other provinces in Canada where heart disease and cancers are the two leading causes of death, aside from Nunavut, where heart disease and respiratory diseases are the leading causes of death [32].

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 First Nations living on-reserve in northern Saskatchewan. To put this into perspective, lung cancer is the most common type of cancer and leading cause of cancer death in Canada [33]. According to the Canadian Cancer Society, in Canada, over 85% of lung cancer cases are related to tobacco smoking [34]. Other factors include radon, asbestos, occupational exposure to certain chemicals such as arsenic, air pollution, family history, lung disease, etc. The number of daily smokers in northern Saskatchewan is significantly higher compared to the provincial average [25, 26]. Additionally, the proportion of Saskatchewan residents who reported daily or occasional smoking was significantly higher than Canada [35]. In Canada, exposure to indoor radon is the second leading cause of lung cancer [36]. The CNSC uses this population health data along with exposure data to determine if health outcomes may be associated with radiation exposure and warrant future research.

The Saskatchewan Uranium Miners Cohort Study Part 1 which followed up with workers employed at the mines from 1932 to 1980, concluded that the overall health of workers was similar to the general public except for lung cancer death and incidence, which increased linearly with increasing RDP exposure. Part 2, which was a feasibility study to assess whether it was possible to detect excess lung cancers due to low RDP exposures in modern mines, determined that it would not be feasible to do so as exposure was so low and would be difficult to correct for effects of smoking and residential radon.

Based on exposure and health data, CNSC staff have not observed and do not expect any adverse health outcomes due to the presence of the Cluff Lake Project.

6 CONCLUSION

The EPR conducted for the Cluff Lake Project Decommissioning Licence Renewal concludes that Orano has taken adequate provisions for the health of persons and the protection of the environment and will continue to do so in the future. Through ongoing licensing and compliance reviews, as well as independent verification through consideration of IEMP results and regional health studies, CNSC staff continues to confirm and ensure that the environment and health of persons is protected at, and around, the Cluff Lake Project site.

The information provided in this EPR Report supports the recommendation by CNSC staff to the Commission to renew the licence UMDL-MINEMILL-CLUFF.01/2019 with a standardized licence condition handbook for a period of five years expiring July 31, 2024.

As stated in CMD 19-H3, CNSC staff have requested that Orano [20]:

- 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
- submit the updated Hydrogeology and Groundwater Modelling TID, expected in 2019, with more information regarding the effectiveness of the soil covers and the re-vegetation works on the CWRP
- submit the updated Hydrogeology and Groundwater Modelling TID, expected in 2019, 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 has confirmed with CNSC staff that the adoption of the CCME guidelines will be included in future iterations of the DPDP. The updated Hydrogeology and Groundwater Modeling, environmental performance and ERA TIDs will be submitted in 2019 and will further reduce uncertainty related to the modeling of long-term predictions set out by the CSR [13, 19]. CNSC staff will update the Commission on its confidence with the long-term predictions of contaminants in surface water and that the aquatic environment will remain protected at the licence renewal in 2024 or earlier if Orano applies to transfer the remaining parcels into the ICP.

7 Acronyms

ALARA	As low as reasonably achievable
Bq/g	Becquerel per gram
Bq/L	Becquerel per litre
Bq/kg	Becquerel per kilogram
Bq/m ³	Becquerel per metre cubed
Bq/mg	Becquerel per milligram
CANUWS	Canadian Uranium Workers Study
CCME	Canadian Council of Ministers of the Environment
CNSC	Canadian Nuclear Safety Commission
COPC	Contaminants of potential concern
CSR	Comprehensive Study Report
CWRP	Claude Waste Rock Pile
DJ	Dominique-Janine
DJX	Dominique-Janine extension
DPDP	Detailed Post-Decommissioning Plan
DSQO	Decommissioning Sediment Quality Objectives
DSWQO	Decommissioning Surface Water Quality Objectives
EA	Environmental Assessments
EPR	Environmental Protection Reviews
ERA	Environmental Risk Assessment
ICP	Institutional Control Program
IEMP	Independent Environmental Monitoring Program
LEL	Lowest effect levels
LLRD	Long-lived radioactive dust
mSv	Millisievert
NITHA	Northern Inter-Tribal Health Authority

Environmental Protection Review Report

NSCA	<i>Nuclear Safety and Control Act</i>
RDP	Radon decay products
SARA	<i>Species at Risk Act</i>
SRC	Saskatchewan Research Council
SUMC	Saskatchewan Uranium Miners' Cohort
TDI	Tolerable daily intake
TID	Technical Information Document
TMA	Tailings management area
U ₃ O ₈	Uranium concentrate
µg/L	Micrograms per litre

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Appendix A: CNSC Staff's Assessment of the Moose Gathered Near the Cluff Lake Project Site

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 was gathered near the Cluff Lake decommissioned site. The chemistry results were provided by SRC Analytical Laboratories. The following summarizes CNSC staff's assessment of the chemistry results of the moose.

CNSC staff concluded that concentrations of contaminants in this specific moose, shown in table 4, 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 [37]. This study analyzed tissues from two moose from Cluff Lake, 12 from other uranium mining sites in northern Saskatchewan, 20 moose and four 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 largely of 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 per year for the uranium mining area moose, versus 0.089 mSv per year for moose from southern Saskatchewan. For comparison, the dose from similar consumption rates for Wollaston caribou meat was 1.66 mSv per year, because of the accumulation of radionuclides in lichens via atmospheric absorption. As a result, CNSC staff conclude that the moose that was sampled was 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.

Table 4: 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

Note: Results are reported on a dry weight basis.

Appendix B: Summary of the Cluff Lake Project IEMP results for 2017

Table 5: Summary of the Cluff Lake IEMP 2017 results for water

Contaminant	Reference Location Saskatoon Lake	Exposure Location Sandy Lake	Exposure Location Cluff Lake	Guideline or CNSC screening level ¹
Water – Metals (µg/L)				
Arsenic	< 0.1	0.2	0.2	5
Copper	< 0.2	< 0.2	< 0.2	2
Lead	< 0.1	< 0.1	< 0.1	1
Molybdenum	< 0.1	0.5	0.2	73
Nickel	< 0.1	0.1	< 0.8	25
Selenium	< 0.1	< 0.1	< 0.1	1
Uranium	< 0.1	0.1	0.6	15
Zinc	< 0.5	0.8	< 0.5	30
pH	7.34	7.78	8.10	6.5-9.0
Water – Radionuclides (Bq/L)				
Lead-210	< 0.02	< 0.02	< 0.02	0.2
Polonium-210	< 0.005	< 0.005	< 0.005	0.1
Radium-226	< 0.005	0.009	< 0.005	0.5
Thorium-230	< 0.01	< 0.01	< 0.01	0.6

- (1) CNSC's screening levels for radionuclides represent the concentration required for a hypothetical person (most exposed member of a critical group) to receive an effective whole body dose of 0.1 mSv per year due to exposure to the given radionuclide. For metals, the guidelines are taken from Canadian Council of Ministers of the Environment (CCME) *Canadian Water Quality Guidelines for the Protection of Aquatic Life*
- (2) The < symbol indicates that a result is below the detection limit for laboratory analysis

Table 6: Summary of the Cluff Lake IEMP 2017 Results – Radionuclides in fish, blueberries, and Labrador tea

Contaminant	Reference location Saskatoon Lake	Exposure location Sandy Lake	Exposure location Cluff Lake	CNSC screening level ⁽¹⁾
Fish – Radionuclides (Bq/kg fresh weight)				
Lead-210	< 1 – 1	< 1	< 0.9 – < 1	0.7
Polonium-210	0.8 – 11	0.2 – 4.7	0.06 – 7.0	0.5
Radium-226	< 0.05 – 0.08	< 0.05 – 0.07	< 0.06 – 0.08	1.6
Thorium-230	< 0.1 – 0.2	< 0.1	< 0.1 – 0.5	5.2
Blueberries – Radionuclides (Bq/kg fresh weight)				
Lead-210	0.17 – 1.41	< 0.18 – 0.39	0.33 – 0.69	7.21
Polonium-210	0.20 – 0.74	0.07 – 0.30	0.16 – 0.28	5.27
Radium-226	0.13 – 0.21	0.18 – 0.40	0.38 – 3.23	17.1
Thorium-230	< 0.07 – < 0.10	< 0.09 – < 0.11	< 0.08 – < 0.10	57.1
Labrador tea – Radionuclides (Bq/kg fresh weight)				
Lead-210	1.82 – 12.17	4.63 – 12.34	5.03 – 9.56	132
Polonium-210	0.91 – 6.59	3.09 – 5.29	2.52 – 4.48	76
Radium-226	2.59 – 4.09	2.81 – 6.69	14.59 – 109.43	326
Thorium-230	< 0.26 – 0.46	< 0.25 – < 0.31	< 0.24 – 0.45	435

- (1) CNSC’s screening levels for radionuclides represent the concentration required for a hypothetical person (most exposed member of a critical group) to receive an effective whole body dose of 0.1 mSv per year due to exposure to the given radionuclide.
- (2) The < symbol indicates that a result is below the detection limit for laboratory analysis

Table 7: Summary of the Cluff Lake IEMP 2017 Results – Hazardous substances in fish, blueberries, and Labrador tea

Contaminant	Reference location Saskatoon Lake	Exposure location Sandy Lake	Exposure location Cluff Lake	CNSC screening level ¹
Fish – Metals (mg/kg fresh weight)				
Arsenic	< 0.01	0.02 – 0.06	< 0.01 – 0.02	0.06
Copper	0.07 – 0.18	0.08 – 0.21	0.10 – 0.37	4.52
Lead	< 0.002	< 0.002 – 0.004	< 0.002	0.06
Molybdenum	< 0.02	< 0.02	< 0.02	0.09
Nickel	< 0.01 – 0.05	< 0.01 – 0.03	< 0.01 – 0.06	0.36
Selenium	0.10 – 0.18	0.09 – 0.15	0.19 – 0.81	0.18
Uranium	< 0.001	< 0.001 – 0.002	< 0.001 – 0.004	0.02
Zinc	2.3 – 8.1	2.8 – 6.9	3.3 – 6.9	18.4
Blueberries – Metals (mg/kg fresh weight)				
Arsenic	< 0.009 – < 0.010	< 0.009 – < 0.011	< 0.009 – < 0.010	0.14
Copper	0.41 – 0.64	0.51 – 0.63	0.36 – 0.53	10.6
Lead	0.006 – 0.026	0.004 – 0.021	0.003 – 0.009	0.14
Molybdenum	< 0.017 – < 0.020	< 0.018 – < 0.021	< 0.016 – 0.040	0.17
Nickel	0.019 – 0.061	0.047 – 0.136	0.034 – 0.091	0.84
Selenium	< 0.009 – < 0.010	< 0.009 – < 0.010	< 0.008 – < 0.010	0.43
Uranium	0.0019 – 0.0070	< 0.0019 – 0.0084	< 0.0016 – < 0.0020	0.05
Zinc	0.70 – 0.77	0.79 – 1.48	0.87 – 1.03	36
Labrador tea – Metals (mg/kg fresh weight)				
Arsenic	< 0.023 – < 0.026	< 0.025 – < 0.026	< 0.024 – < 0.025	4.4
Copper	1.45 – 2.13	1.58 – 2.21	1.75 – 2.16	330
Lead	< 0.0045 – 0.0101	0.0049 – 0.0053	0.0049 – 0.0101	4.3
Molybdenum	< 0.045 – < 0.053	< 0.049 – < 0.053	< 0.049 – < 0.050	6.6
Nickel	0.077 – 0.380	0.079 – 0.163	0.126 – 0.333	26
Selenium	< 0.023 – < 0.026	< 0.025 – < 0.026	< 0.024 – < 0.025	13.5
Uranium	< 0.0045 – < 0.0053	< 0.0051 – 0.0198	0.0049 – 0.0150	1.4
Zinc	6.15 – 10.14	6.91 – 9.52	8.76 – 11.07	1350

- (1) the concentration required for a hypothetical representative person (most exposed member of a critical group) to receive a chemical dose of 10% the TDI due to exposure to the given contaminant from food ingestion.
- (2) the < symbol indicates that a result is below the detection limit for laboratory analysis

Table 8: Summary of the Cluff Lake IEMP 2017 results for radon in ambient air

Time Period	Reference location Saskatoon Lake	Exposure location Sandy Lake	Exposure location Cluff Lake	Background¹
Radon in ambient air (Bq/m³)				
August 2017 – February 2018	< 3	< 3	< 3	< 7.5 – 25 Bq/m ³
February 2018 – August 2018	< 3	< 4 – 4	5 – 7	< 7.5 – 25 Bq/m ³

- (1) Background concentrations obtained from a CanNorth report on the cumulative effects of uranium mining [38].
- (2) The < symbol indicates that a result is below the detection limit for laboratory analysis

PART TWO

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

1. any proposed changes to the conditions, licensing period, or formatting of an existing licence
2. the proposed licence
3. the proposed licence conditions handbook
4. the current licence

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PROPOSED LICENCE CHANGES

Overview

The original licence predates the formal adoption of the Canadian Nuclear Safety Commission's (CNSC) safety and control area (SCA) framework. The Cluff Lake site is currently unoccupied and is no longer an operating uranium mine or mill. The only activities proposed by the licensee are monitoring and maintenance. Therefore the number of licensed activities is being reduced from six to three: *possess, manage* and *store* nuclear substances that are associated with the Cluff Lake Project.

The previously licensed activities of *decommission; possess and use prescribed equipment and prescribed information; and modify* the facility, are no longer applicable and have been removed.

The "General" conditions in the proposed licence maintain existing regulatory requirements from the current licence:

- G.1 Licensing Basis for Licensed Activities (previously General 1.1, 1.2 and 1.3)
- G.2 Notification of Changes (previously Modifications 2.1)
- G.3 Financial Guarantee (previously General 1.4)
- G.4 Public Information and Disclosure (previously by reference in General 1.2).

The proposed licence has four conditions related to the safety and control areas which remain relevant at the post-decommissioned site:

- 1.1 Management System (previously 1.3, 5 and by reference 1.2)
- 2.1 Radiation Protection (previously 4)
- 3.1 Conventional Health and Safety
- 4.1 Environmental Protection (previously 3).

The remaining 10 SCAs are either not applicable to the post-decommissioning management of the site, or are very low risk considerations that can be managed under the broad umbrella of the management system SCA. For example, the requirements for record keeping and reporting have been incorporated into the management system which cites procedures for regulatory reporting on an annual basis. Under Orano's requirement, reporting would be to both the CNSC and the Province of Saskatchewan.

There is no longer a requirement for discharge limits to be included in the licence as there are no discharges from the site.

The proposed licence no longer requires a safeguards condition as there are no scenarios at site which would result in non-compliance with Canada's international obligations.

Licence Format

The existing licence, produced in 2009, is written in a different format than the current CNSC standard and LCH licences. The existing licence also predates the requirement to have an associated LCH. The proposed licence for the Cluff Lake Project continues to contain conditions that authorize changes that are within the licensing basis as defined in CNSC's information document INFO-0795, *Licensing Basis Objective and Definition*, and reflects the current licensing framework.

Licence Period

The licensee has requested a licensing period of five (5) years. During this time the only activities planned by Orano at the Cluff Lake site are monitoring and maintenance. Orano anticipates petitioning the Province of Saskatchewan to accept the transfer of the properties into the Saskatchewan Institutional Control Program (ICP) before the end of the proposed licensing term.

If the properties are accepted into the Saskatchewan ICP, CNSC staff would expect a request from Orano to revoke their CNSC licence for the Cluff Lake Project. The process for transferring responsibility for the properties to the Government of Saskatchewan under their ICP was provided to the Commission on October 3, 2018 in CMD 18-M38.

PROPOSED LICENCE

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**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 _____ day of _____, 2019.

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

APPENDIX A

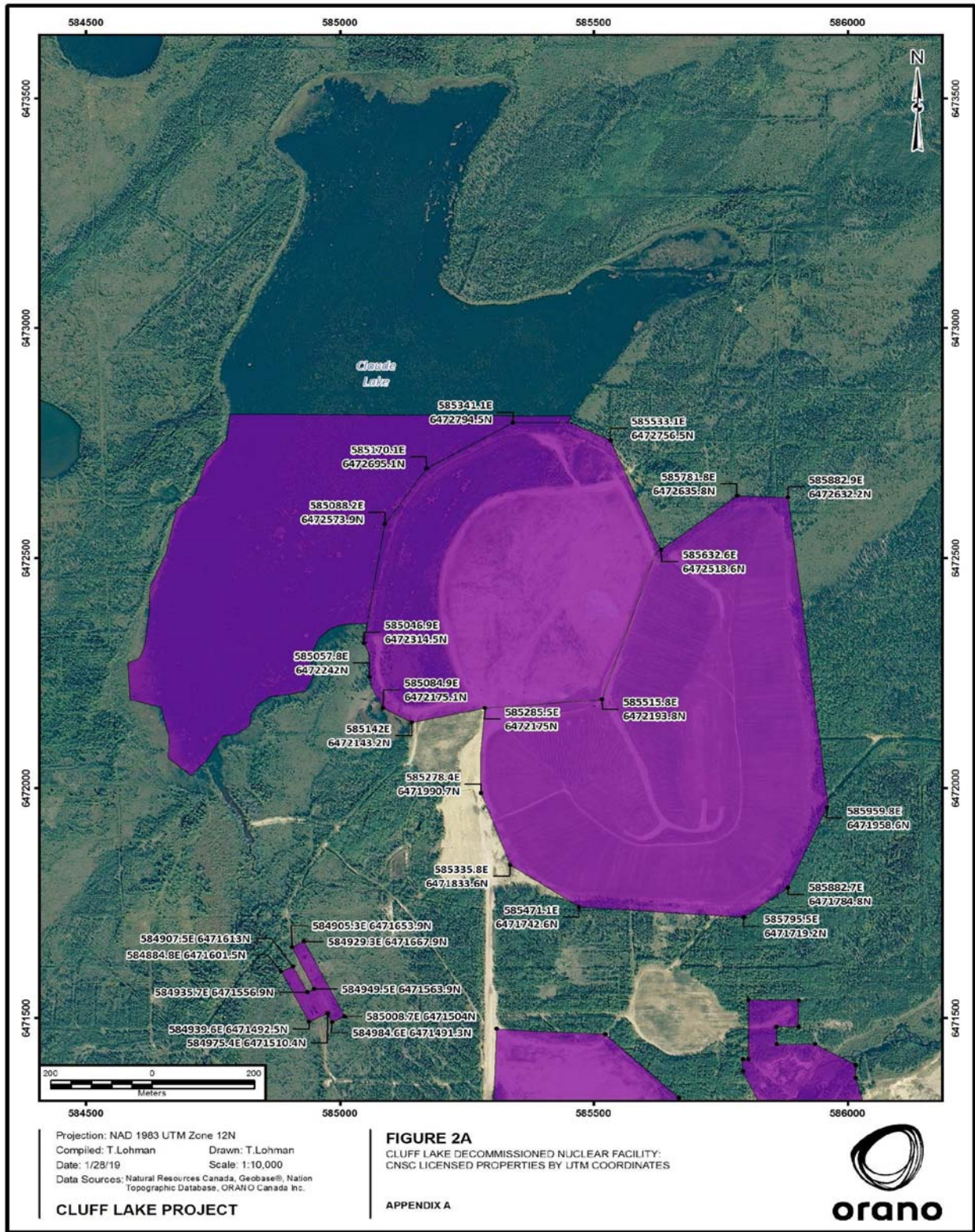
LOCATION AND SURFACE LEASE AREA OF THE CLUFF LAKE PROJECT

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.

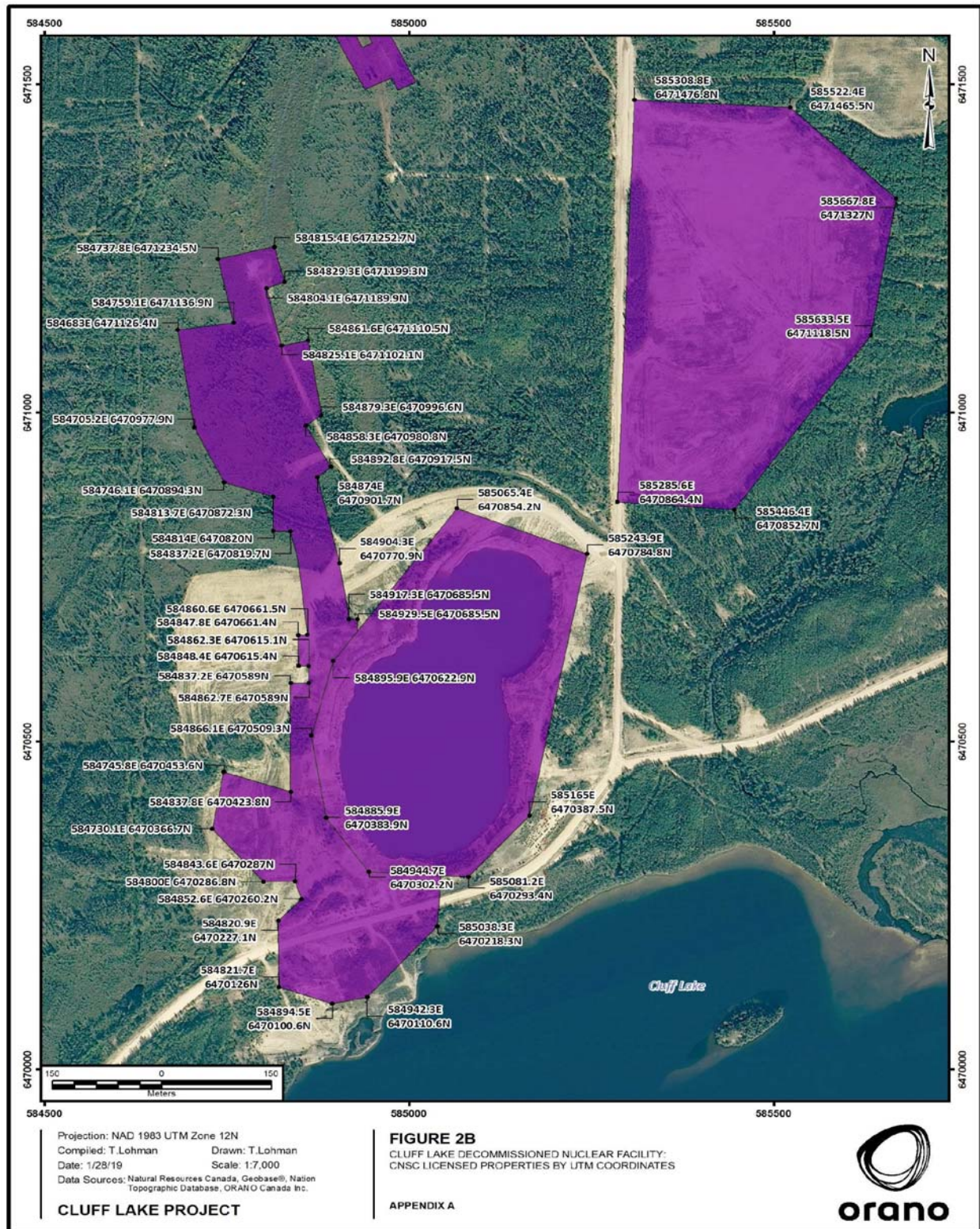
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Figure 2.A Cluff Lake – CNSC Licensed Properties by UTM Coordinates



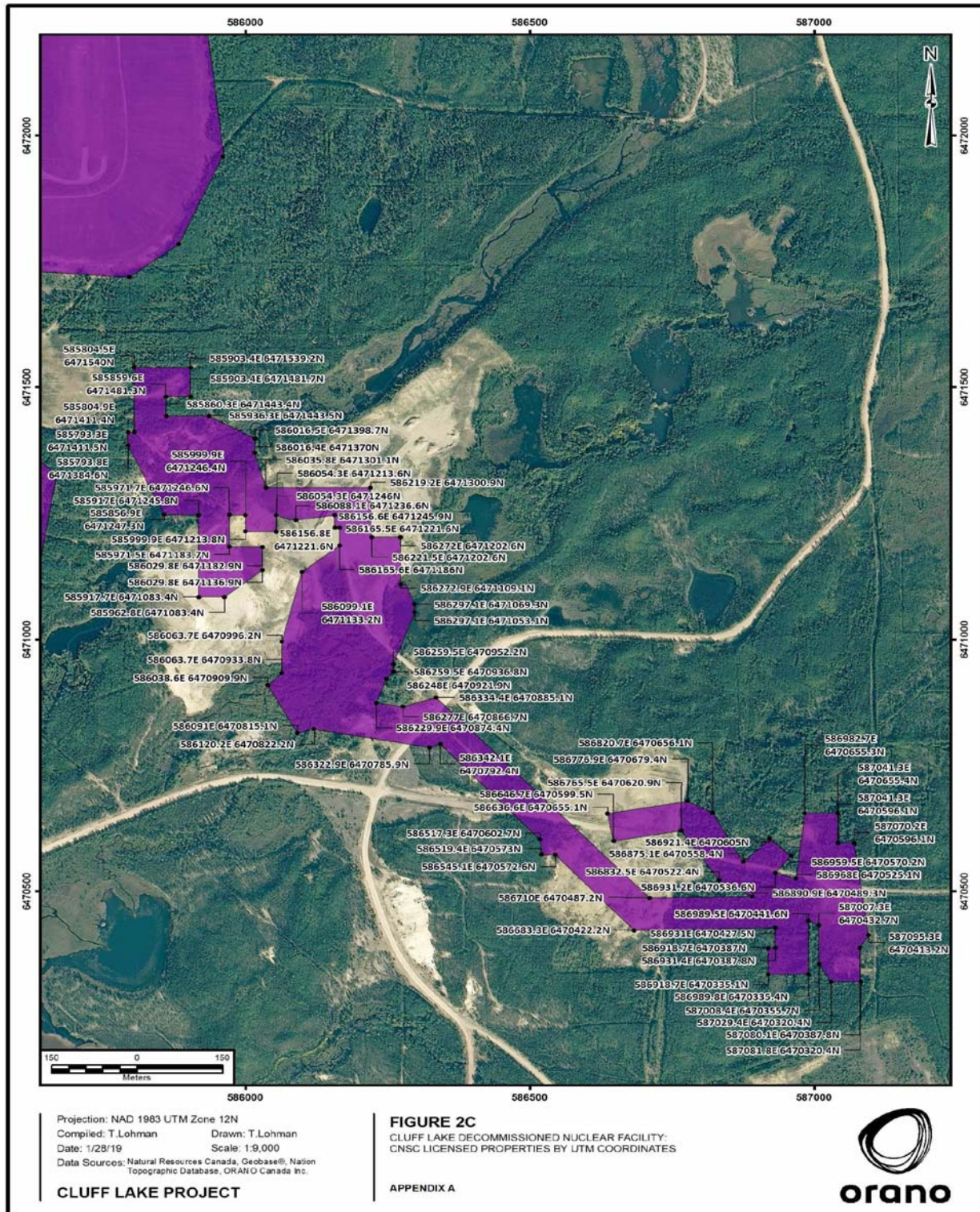
File: Q:\SHEQ\GIS\CLUFF_LAKE\2019\Cluff Lease\Maps\CNSC\Figure 2A - Cluff Lake Decommissioned Nuclear Facility - UTM Coord.mxd

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



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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

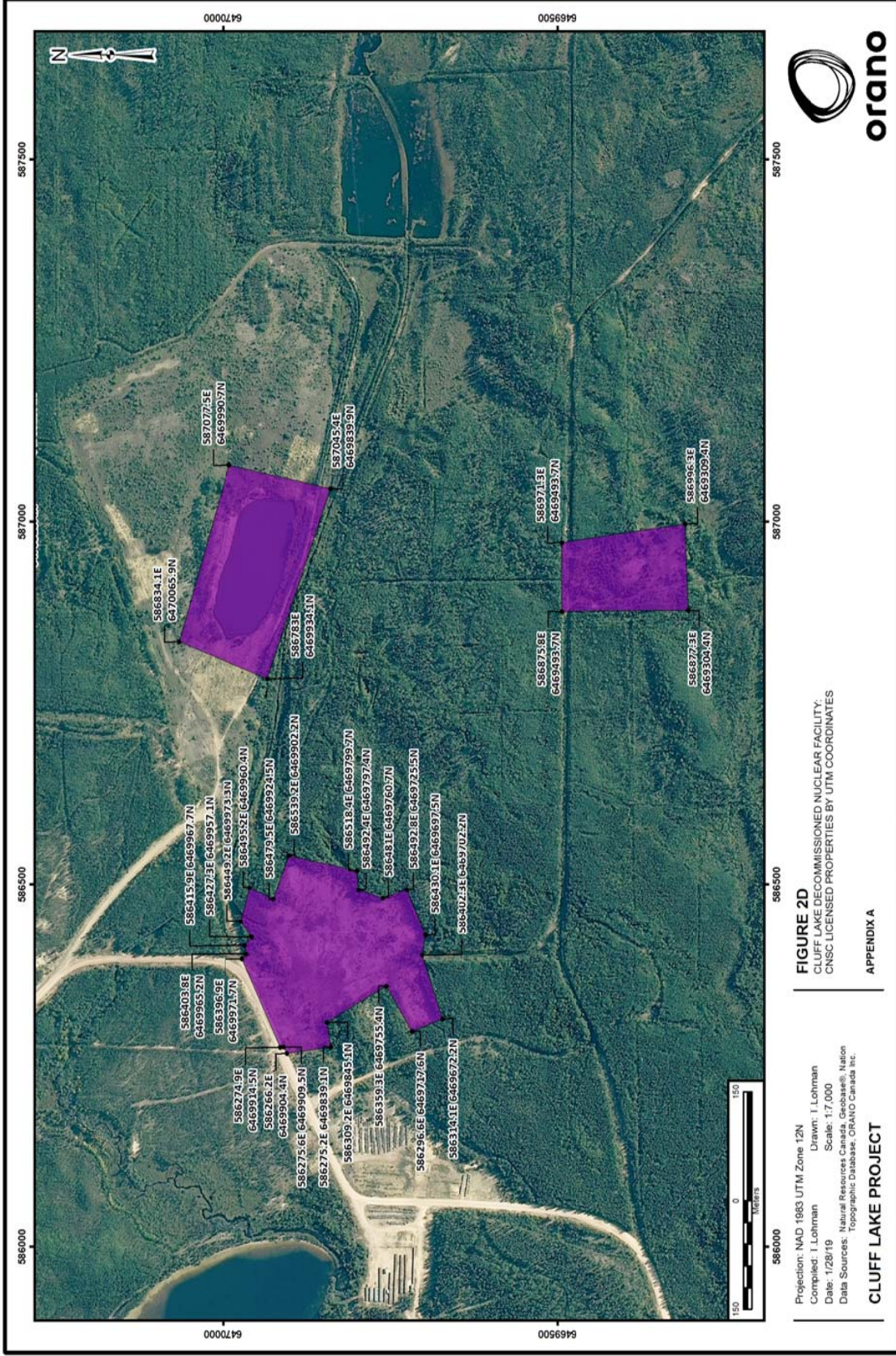


Figure 2.E Cluff Lake – CNSC Licensed Properties by UTM Coordinates

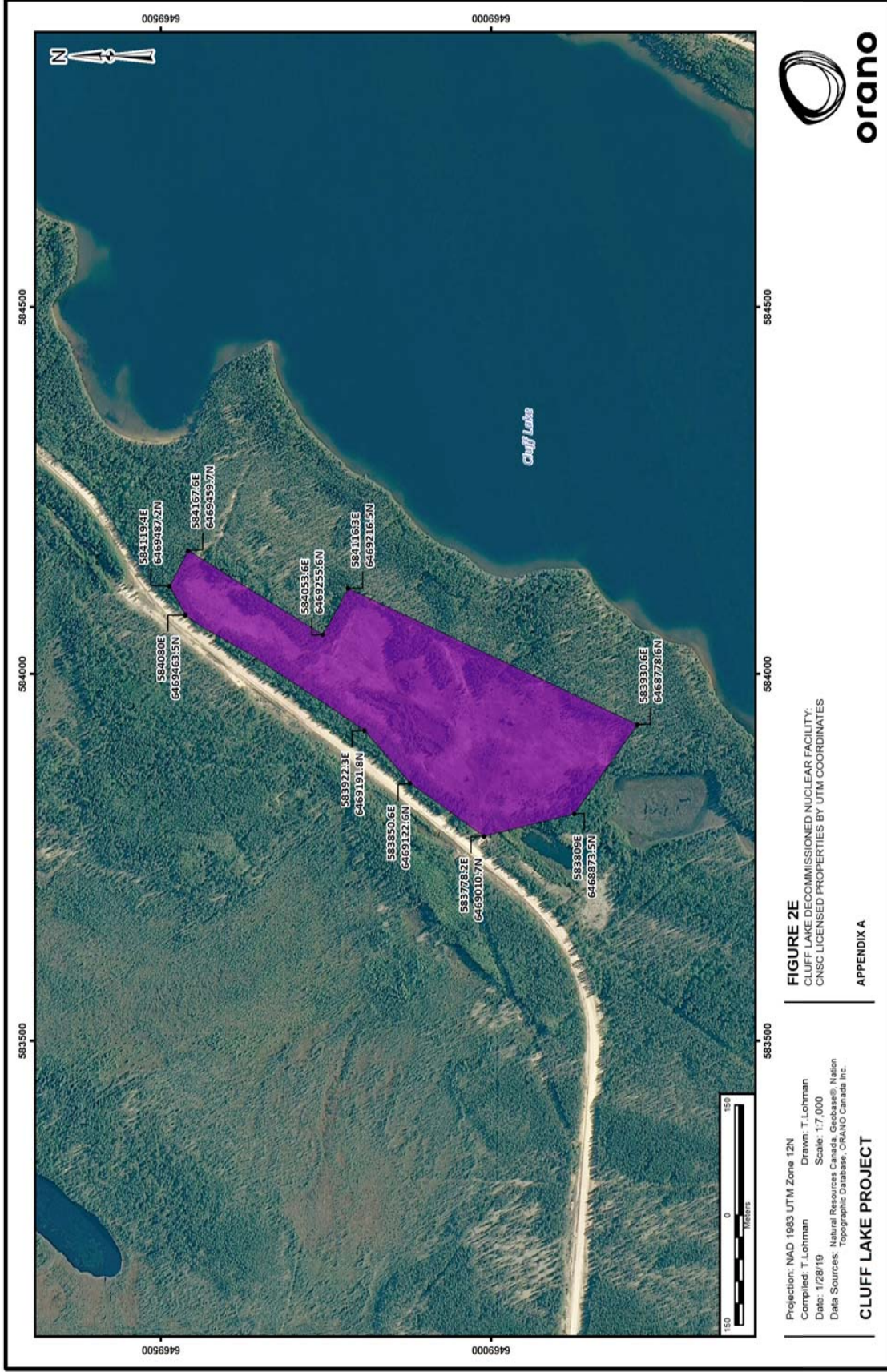
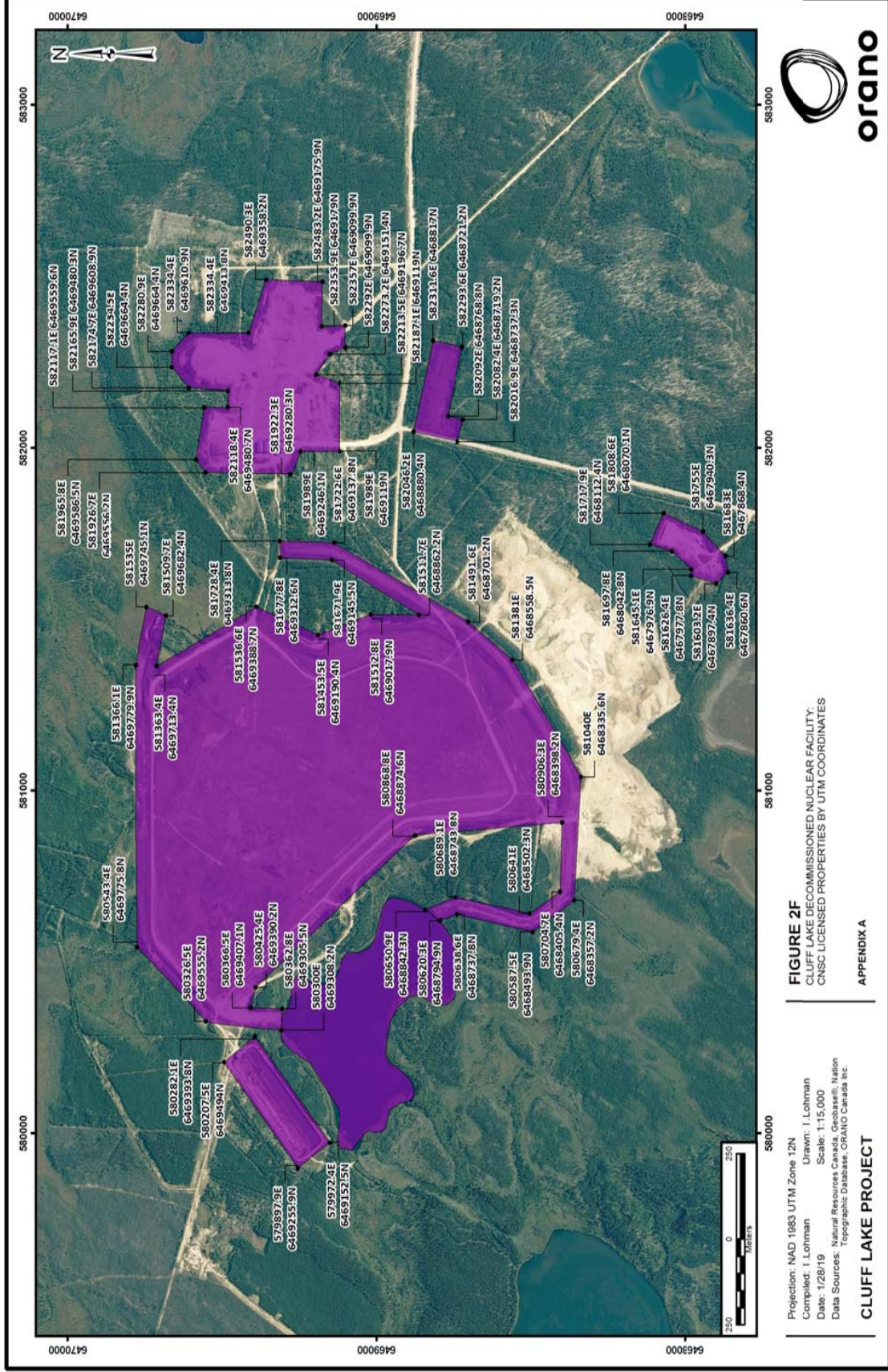


Figure 2.F Cluff Lake – CNSC Licensed Properties by UTM Coordinates



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DRAFT LICENCE CONDITIONS HANDBOOK

e-Doc # 5795671

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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



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Licence Conditions Handbook
LCH-MINEMILL-CLUFF.00/2024
Cluff Lake Project
Uranium Mine Licence
UML-MINEMILL-CLUFF.00/2024

Effective: August 1, 2019

SIGNED at OTTAWA this 1st day of August, 2019

Peter Fundarek, 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	Word/PDF e-Doc	Description of the Changes	DCR e-Doc
August 1, 2019	0	5725195 (Word) 5795671 (PDF)	Original document	N/A

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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 maintains facility operation in accordance with the licensing basis for the facility and the intent of the licence. The LCH should be read in conjunction with the licence.

The LCH typically has three parts under each LC: the Preamble, Compliance Verification Criteria (CVC), and Guidance. The Preamble explains, as needed, 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.

Interaction between the licensee and CNSC staff that is described in this LCH is governed by the prevailing communications protocol between the two, unless specified otherwise in the LCH.

This LCH has the following appendices:

- APPENDIX A, which describes the change control process applied to the LCH
- APPENDIX B, which lists licensee documents that require notification of change
- APPENDIX C, which lists documents used as guidance or criteria.

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G. GENERAL

G.1 Licensing Basis for Licensed Activities

The licensee shall conduct the activities described in Part IV of the 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

This LC is not intended to unduly inhibit the ongoing management and operation of the facility or the licensee’s ability to adapt to changing circumstances and continuously improve, in accordance with its management system. The licensing basis is further discussed in CNSC’s REGDOC–3.5.3, *Regulatory Fundamentals*.

Activities at the Cluff Lake Project to which CNSC staff provide oversight include:

- monitoring and maintenance of the decommissioned Cluff Lake Project site.

Orano Canada Inc. (Orano) is required to submit detailed monitoring reports to the CNSC so that it can be verified that the proposed activities meet CNSC requirements and remain within the licensing basis for the Cluff Lake Project.

Compliance Verification Criteria

Licensing Basis Documents

Source	Document Title	Document Number	Notification Requirements
Orano	Detailed Post-Decommissioning Plan, Post-Closure Monitoring and Maintenance	5726086	Acceptance
AREVA	Integrated Management System Manual	4385365	Acceptance
AREVA	Aboriginal and Public Information Program	4596454	Acceptance
AREVA	Environmental Monitoring Locations and Schedule	5066031	Acceptance

GENERAL

Part (i) of the licensing basis lists the applicable laws and regulations that are set out in several federal statutes and agreements, including the following:

- the *Nuclear Safety and Control Act*
- the *Canadian Environmental Assessment Act*
- the *Canadian Environmental Protection Act*
- the *Access to Information Act*

Part (iii) of the licensing basis consists of the safety and control measures described in the licence application and the documents needed to support that licence application. The safety and control measures include important aspects of analysis, design, operation, etc. They may be found in high-level, programmatic licensee documents but might also be found in lower-level, supporting documentation. They also include safety and control measures in licensing basis publications (e.g., CNSC REGDOCs or CSA Group standards) that are cited in the application or in the licensee's supporting documentation.

Licensing basis publications are listed in tables in this LCH 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.

LC G.1 requires the licensee to conform to, and/or implement, all the safety and control measures. Note, however, that not all details in referenced documents are necessarily considered to be safety and control measures:

- Details that are not directly relevant to safety and control measures for facilities or activities authorized by the licence are excluded from the licensing basis.
- Details that are relevant to a different safety and control area (i.e., not the one associated with the main document), are only part of the licensing basis to the extent they are consistent with the main requirements for both safety and control areas.

The licensing basis is established by the Commission at the time the licence is issued. Per LC G.1, operation during the licence period that is not in accordance with the licensing basis is only allowed based on the written approval of the Commission. Similarly, only the Commission can change the licensing basis during the licence period; this would also be expected to be recorded in writing.

In the event of any perceived or real conflict or inconsistency between two elements of the licensing basis, the licensee shall consult CNSC staff to determine the approach to resolve the issue.

For unapproved operation that is not in accordance with the licensing basis, the licensee shall take action as soon as practicable to return to a state consistent with the licensing basis, taking into account the risk significance of the situation.

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 CNSC related to licensee changes is discussed under LC G.2.

Guidance Publications

Source	Document Title	Document Number
CNSC	Regulatory Fundamentals	REGDOC-3.5.3

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

With the exception of security related documents, CNSC staff track version history of licensee documents that require notification of change (e-Doc 5726086). Tables under each LC in the LCH identify the documents (if any) requiring written notification of change.

Definition	Abbreviation	Description
Notification Required	Notification	Notification to the CNSC is required, but implementation by the licensee may be immediate.
Prior Notification Required	Advance	Prior notification of 30 days is required. Unless CNSC staff have comments, no formal acknowledgement of receipt will be given.
Prior Notification and Acceptance Required	Acceptance	Prior notification and CNSC acceptance is required before implementation. CNSC staff will formally acknowledge receipt of the submission and report acceptance of the submission before authorization to implement is granted.

Compliance Verification Criteria

Written notification is a physical or electronic communication from a person authorized to act on behalf of the licensee to a CNSC delegated authority or a CNSC staff member acting on behalf of a CNSC delegated authority.

In general, the changes for which the licensee shall notify the CNSC are captured as changes to specific licensee documents. The LCH identifies them under the most relevant LC. However, the licensee documents identified in the LCH only represent the minimum subset of documents that require notification of change. For any change that is not captured as a change to a document identified in the LCH, if it negatively impacts designs, operating conditions, policies, programs, methods, or other elements that are integral to the licensing basis, the licensee shall provide written notification of the change. For example, if a licensee document in the CVC refers to another document, including a third-party document, without citing the revision number of that document, if that document changes and the licensee uses the revised version, the licensee shall determine if it is necessary to notify the CNSC of the change.

The documents needed to support the licence application may include documents produced by third parties (e.g., reports prepared by third party contractors). Changes to these documents require written notification to the CNSC only if the new version continues to form part of the licensing basis. That is, if the licensee implements a new version of a document prepared by a third party, it shall inform the CNSC of the change(s), per LC G.2. However, if a third party has updated a certain document, but the licensee has not adopted the new version as part of its safety and control measures, the licensee is not required to inform the CNSC that the third party has changed the document.

Changes that are not clearly in the safe direction require further assessment of impact to determine if Commission approval is required in accordance with LC G.1.

The licensee shall notify the CNSC in writing when it plans to implement a new licensing basis publication, including the date by which implementation of the publication will be complete. The notice shall indicate the corresponding changes to licensee documents listed in the CVC of the LCH.

Guidance

For proposed changes that would not be in accordance with the licensing basis, the Guidance for LC G.1 applies.

G.3 Financial Guarantee

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

Preamble

Paragraph 3(1)(l) of the *General Nuclear Safety and Control Regulations* requires that an application for a licence contain a description of any proposed financial guarantee relating to the activity for which a licence application is submitted.

A financial guarantee is a tangible commitment by the licensee that there will be sufficient resources to safely terminate licensed activities.

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 (Source: Record of Decision, e-Doc xxxxxx). [To be inserted after hearing if accepted by the Commission]

Compliance Verification Criteria

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	Document Number	Notification Requirements
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Acceptance

GENERAL

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Financial Guarantees for the Decommissioning 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
CNSC	Public and Aboriginal Engagement, Aboriginal Engagement	REGDOC-3.2.2

Licensee Documents that Require Notification of Change

Source	Document Title	Document Number	Notification Requirements
AREVA	Aboriginal and Public Information Program	4596454	Acceptance
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Acceptance

Guidance

There is no guidance provided for this licence condition.

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, fosters a healthy safety culture, and conforms to applicable regulatory requirements.

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	Document Number	Notification Requirements
AREVA	Integrated Management System Manual	4385365	Acceptance

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:

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

MANAGEMENT SYSTEM

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, and maintained as low as reasonably achievable (ALARA).

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	Document Number	Notification Requirements
AREVA	Integrated Management System Manual (pertinent information from Code of Practice – Radiation Protection incorporated into document)	4385365	Acceptance
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Acceptance

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

- 2.1.1 Workers, supervisors and contractors will have the qualifications (knowledge, skills, experience) needed to effectively perform RP practices for any work activity with a projected exposure ≥ 0.1 mSv.
- 2.1.2 Radiological conditions are monitored at least annually, as required under the Detailed Post-Decommissioning Plan, to demonstrate that post-decommissioning radiological conditions are stable, and to confirm that ambient levels of airborne contaminants are at background levels.
- 2.1.3 RP instrumentation and equipment are calibrated, maintained prior to use so that radiation levels are accurately determined.
- 2.1.4 Personal dosimetry will be used for individuals 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

RADIATION PROTECTION

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.

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 Occupational Health and Safety Act, 1993* (Chapter O-1.1 of the Statutes of Saskatchewan, 1993) and regulations (including *The Mines Regulations, 2003* Chapter 0-1.1 Reg. 2).

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.

Licencee Documents that Require Notification of Change

Source	Document Title	Document Number	Notification Requirements
AREVA	Integrated Management System Manual (pertinent information from Code of Practice – Radiation Protection incorporated into document)	4385365	Acceptance

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.

CONVENTIONAL HEALTH AND SAFETY

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 licenced 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
CSA Group	Groundwater protection programs at Class I nuclear facilities and uranium mines and mills	N288.7

ENVIRONMENTAL PROTECTION

Licensee Documents that Require Notification of Change

Source	Document Title	Document Number	Notification Requirements
Orano	Environmental Monitoring Program – Environmental Monitoring Locations and Schedules	5616834	Acceptance
Orano	Technical Information Document Environmental Performance, Volume 2 of 2 – Environmental Risk Assessment	4829832	Acceptance
AREVA	Integrated Management System Manual	4385365	Acceptance
Orano	Detailed Post-Decommissioning Plan Post-Closure Monitoring and Maintenance	5726086	Acceptance

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
- changes are conducted in accordance with CNSC regulatory policy P-299, *Regulatory Fundamentals*
- 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 CEAA, 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 onsite 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 site status reports to the Commission.

APPENDIX B LICENSEE DOCUMENTS THAT REQUIRE NOTIFICATION OF CHANGE

Document Title	Effective Date	e-DOC	L.C.	Notification Requirements
Detailed Post-Decommissioning Plan, Post-Closure Monitoring and Maintenance	August 1, 2019	5726086	All	Acceptance
Integrated Management System Manual	February 2016	4385365	All	Acceptance
Aboriginal and Public Information Program	October 2014	4596454	G.1, G4	Acceptance
Environmental Monitoring Locations and Schedule	February 2014	5066031	G.1	Acceptance
Environmental Monitoring Locations and Schedule	March 2018	5616834	G.1, 4.1	Acceptance
Technical Information Document Environmental Performance, Volume 2 of 2 – Environmental Risk Assessment	September 2015	4829832	4.1	Acceptance

APPENDIX B

APPENDIX C LIST OF DOCUMENTS USED AS GUIDANCE OR CRITERIA

C.1 CSA Group documents referenced in the LCH

Source	Document Title	Document Number	L.C.
CSA Group	Decommissioning of facilities containing nuclear substances	N294-09	G.3
CSA Group	Management system requirements for nuclear facilities	N286-12	1.1
CSA Group	Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills	N288.4	4.1
CSA Group	Environmental risk assessments at Class I nuclear facilities and uranium mines and mills	N288.6-12	4.1
CSA Group	Groundwater protection programs at Class I nuclear facilities and uranium mines and mills	N288.7	4.1
CSA Group	Environmental management systems – Requirements with guidance for use	ISO 14001:2015	4.1

C.2 CNSC documents referenced in the LCH

Document	Document Title	Version	L.C.	e-DOC
INFO-0795	Licensing Basis, Objective and Definition	January 2010	G.1	N/A
G-206	Financial Guarantees for the Decommissioning of Licensed Activities	June 2000	G.3	N/A
REGDOC 3.2.1	Public Information and Disclosure	March 2012	G.4	N/A
REGDOC-3.2.2	Public and Aboriginal Engagement, Aboriginal Engagement	February 2016	G.4	N/A
REGDOC-3.1.2	Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills	January 2018	1.1	N/A
CNSC/SK	CNSC – Saskatchewan Harmonized Annual Reporting Requirements	August 2010	1.2	3678482
G-91	Ascertaining and Recording Radiation Doses to Individuals	June 2003	2.1	N/A
REGDOC-2.9.1	Environmental Protection: Environmental Principles, Assessments and Protection Measures	December 2016	4.1	N/A
REGDOC 2.11.1	Assessing the Long Term Safety of Radioactive Waste Management	May 2018 2006	4.1	N/A
P-299	Regulatory Fundamentals	April 2005	App. A	N/A

APPENDIX C

CURRENT LICENCE

e-Doc # 5477898

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URANIUM MINE DECOMMISSIONING LICENCE
Orano Canada Inc.
Cluff Lake Project

- I) LICENCE NUMBER:** UMDL-MINEMILL-CLUFF.01/2019
- II) LICENSEE:** Pursuant to section 24 of the *Nuclear Safety and Control Act* (hereinafter “the Act”), this licence is issued to:
- Orano Canada Inc.**
817 – 45th Street West
Saskatoon, SK S7L 5X2
- III) LICENCE PERIOD:** This licence is valid from August 1, 2009 to July 31, 2019 unless otherwise suspended, amended, revoked, or replaced.

IV) LICENSED ACTIVITIES:

This licence authorizes the licensee to:

- a) decommission a nuclear facility (hereinafter “the facility”). The facility consists of two underground mines, four open-pit mines, a mill, waste management systems, and associated site facilities, all in the Cluff Lake area of northern Saskatchewan, and more particularly described in Appendix A to this licence;
- b) possess, manage and store nuclear substances that are required for, associated with or arise from the activities described in a); and
- c) possess and use prescribed equipment and prescribed information that are required for, associated with or arise from the activities described in a) and b); and
- d) modify the facility subject to condition 2.1

V) CONDITIONS:

The licensee shall comply with the following conditions, established pursuant to subsection 24(5) of the *Nuclear Safety and Control Act*.

1. GENERAL

- 1.1 The appendices attached to this licence form part of this licence;
- 1.2 Subject to any other condition of this licence, the activities at the facility shall be carried out in accordance with the policies, programs, and methods and for the purposes described in the documents listed in Appendix B to this licence;
- 1.3 The licensee shall ensure that every contractor working at the facility complies with the applicable conditions of this licence including those relating to the licensee's policies, programs, and procedures with respect to the protection of health, safety, environment, and, to maintenance of security; and
- 1.4 The licensee shall maintain a financial guarantee for decommissioning acceptable to the Commission or a person authorized by the Commission.

2. MODIFICATIONS

- 2.1 No significant modifications to, or deviations from, the design decommissioning conditions, policies, programs, and/or methods referred to in the document in Appendix B may be made without the prior written approval of the Commission or a person authorized by the Commission.

3. ENVIRONMENTAL PROTECTION

- 3.1 The licensee shall:
 - a) where the effluent concentration reaches or exceeds the discharge limits specified in Appendix C to this licence:
 - i) report to the Commission or a person authorized by the Commission within 24 hours the fact that the discharge limit has been reached or exceeded; and
 - ii) immediately investigate and take corrective action to ensure that effluent concentrations are maintained below the discharge limits;
- 3.2 The licensee shall, within 24 hours of becoming aware that an action level specified in the environmental protection Code of Practice has been reached, notify the Commission or a person authorized by the Commission;

3.3 The licensee shall, within 24 hours of becoming aware of a release of a hazardous substance into the environment, not authorized by the licence, report to the Commission or a person authorized by the Commission the location and circumstances of the situation, and any action that the licensee has taken or proposes to take with respect to it.

4. **RADIATION PROTECTION**

4.1 The licensee shall, within 24 hours of becoming aware that the radiation protection action level specified in the Code of Practice has been reached, notify the Commission or a person authorized by the Commission that an action level specified in the Code of Practice has been reached.

5. **RECORDS/REPORTING**

5.1 The licensee shall issue the records required by subsection 5(1) of the *Radiation Protection Regulations* to:

- a) each person referred to in subsection 27(a) of the Act,
- b) the Commission or a person authorized by the Commission, and
- c) the National Dose Registry by March 31st of each year;

5.2 The licensee shall submit to the Commission or a person authorized by the Commission by March 31st of each year, a written Annual Report for the facility covering the previous calendar year;

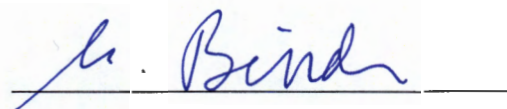
5.3 The licensee shall submit the results of the environmental monitoring and Follow-up Program at a frequency and in a form acceptable to the Commission or a person authorized by the Commission; and

5.4 The licensee shall submit the results of the radiation monitoring program at a frequency and in a form acceptable to the Commission or a person authorized by the Commission.

6. **SAFEGUARDS**

6.1 The licensee shall comply with the safeguards conditions contained in Appendix D to this licence.

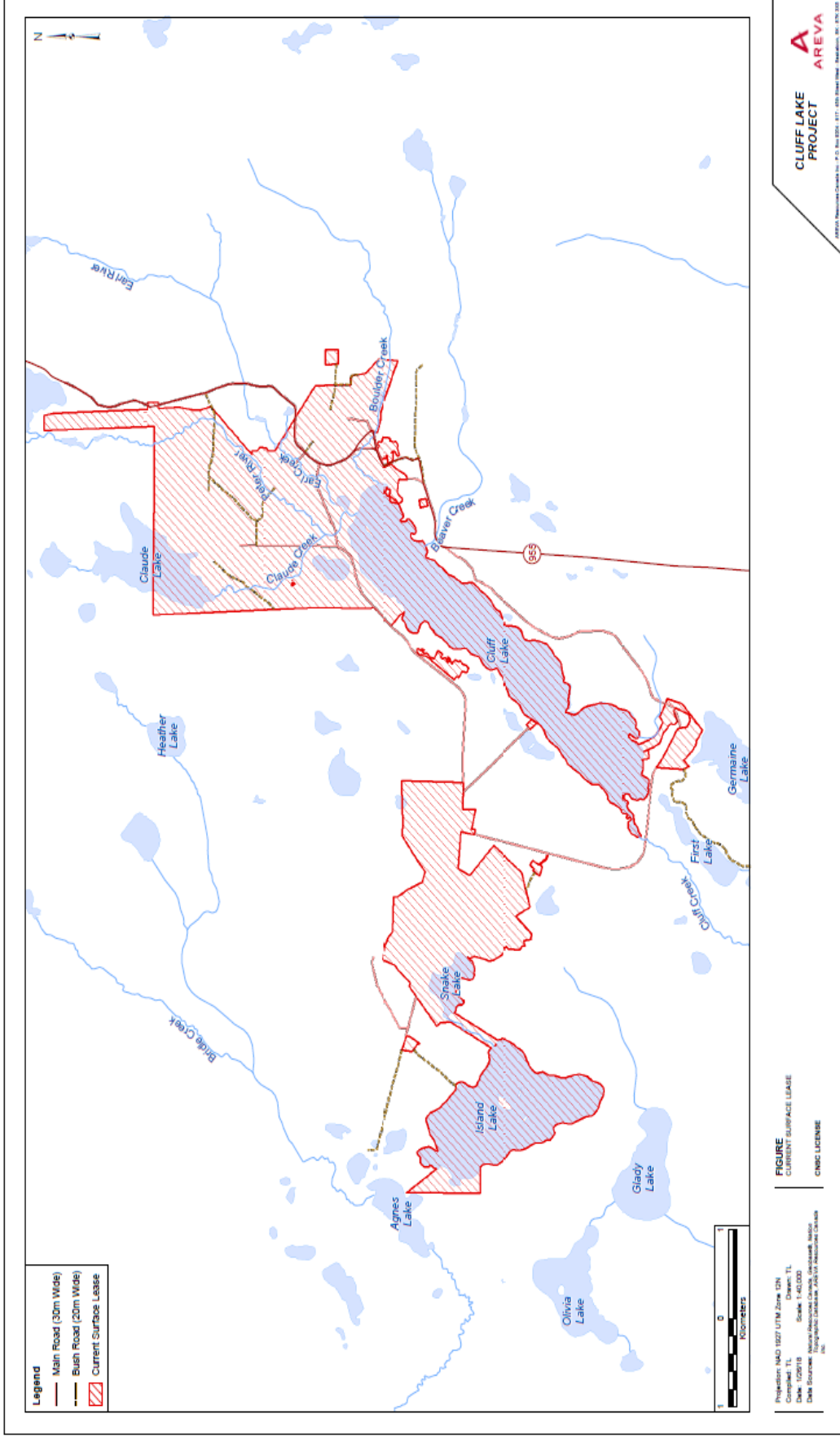
DATED at OTTAWA, this 2nd day of August 2018.



Michael Binder, President
on behalf of the Canadian Nuclear Safety Commission

APPENDIX A

Orano Canada Inc. – Cluff Lake Project Surface Lease Area, January 2018



APPENDIX B

REFERENCE DOCUMENTS

Cluff Lake Project, Detailed Decommissioning Plan, Version 3, December 2014

APPENDIX C

AUTHORIZED EFFLUENT DISCHARGE LIMITS

Deleterious Substance	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration In a Composite Sample	Maximum Authorized Concentration In a Grab Sample
Arsenic (mg/L)	0.50	0.75	1.00
Copper (mg/L)	0.30	0.45	0.60
Lead (mg/L)	0.20	0.30	0.40
Nickel (mg/L)	0.50	0.75	1.00
Zinc (mg/L)	0.50	0.75	1.00
Total Suspended Solids (mg/L)	15.00	22.50	30.00
Radium-226 (Bq/L)	0.37	0.74	1.11

Acid balance (as H ₃ O ⁺) reported as pH	In a range of 6.0 to 9.5
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Acutely Lethal Effluent	0 %
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Notes:

1. Definition of Units: mg/L = milligrams per litre
 Bq/L = Becquerels per litre
2. All concentrations and activities are total values.
3. The above limits shall apply to all effluent discharged from the Secondary Treatment Pond A2 outlet.
4. "Monthly Mean Concentration" means the average value of the concentrations measured in all composite or grab samples collected from the final discharge point during each month when liquid effluent is released.
5. "Composite Sample" means:
 - i) a quantity of effluent consisting of not less than three equal volumes or three volumes proportionate to flow that have been collected at approximately equal time intervals over a period of not less than seven hours and not more than 24 hours; or
 - ii) a quantity of effluent collected continuously at a constant rate or at a rate proportionate to the rate of flow of the effluent over a sampling period of not less than seven hours and not more than 24 hours.
6. "Grab Sample" means a quantity of undiluted effluent collected at any given time.
7. "Acutely Lethal Effluent" means an effluent at 100% concentration that kills more than 50% of the rainbow trout subjected to it over a 96-hour period when tested in accordance with the acute lethality test.

APPENDIX D

SAFEGUARDS LICENCE CONDITIONS

1. The licensee shall take all necessary measures to facilitate Canada's compliance with any applicable safeguards agreement.
2. The licensee shall provide the International Atomic Energy Agency, an International Atomic Energy Agency inspector, or a person acting on behalf of the International Atomic Energy Agency, with such reasonable services and assistance as are required to enable the International Atomic Energy Agency to carry out its duties and functions pursuant to a safeguards agreement.
3. The licensee shall grant prompt access at all reasonable times to all locations at the facility to an International Atomic Energy Agency inspector, or to a person acting on behalf of the International Atomic Energy Agency, where such access is required for the purposes of carrying on an activity pursuant to a safeguards agreement. In granting access, the licensee shall provide health and safety services and escorts as required in order to facilitate activities pursuant to a safeguards agreement.
4. The licensee shall disclose to the Commission or a person authorized by the Commission, to the International Atomic Energy Agency or to an International Atomic Energy Agency inspector any records that are required to be kept or any reports that are required to be made under a safeguards agreement.
5. The licensee shall provide such reasonable assistance to an International Atomic Energy Agency inspector, or to a person acting on behalf of the International Atomic Energy Agency, as is required to enable sampling and removal or shipment of samples required pursuant to a safeguards agreement.
6. The licensee shall provide such reasonable assistance to an International Atomic Energy Agency inspector, or to a person acting on behalf of the International Atomic Energy Agency, as is required to enable measurements, tests and removal or shipment of equipment required pursuant to a safeguards agreement.
7. The licensee shall not interfere with, alter, deface or break a safeguards seal, except pursuant to a safeguards agreement.
8. The licensee shall implement measures to prevent damage to, or the theft, loss or sabotage of samples collected pursuant to a safeguards agreement or the illegal use, possession or removal of such samples.
9. The licensee shall make such reports and provide such information to the Commission or a person authorized by the Commission as are required to facilitate Canada's compliance with any applicable safeguards agreement.