Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

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CMD: 21-H6

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A Licence Amendment

Orano Canada Inc.

McClean Lake Operation

Licence Amendment for the JEB TMF Expansion

Commission Public Hearing

Scheduled for:

September 29 and 30, 2021

Submitted by:

CNSC Staff

Une modification de permis

Orano Canada Inc.

Établissement minier de McClean Lake

Modification de permis pour l'agrandissement de l'IGR JEB

Audience publique de la Commission

Prévue pour :

Les 29 et 30 septembre 2021

Soumise par :

Le personnel de la CCSN

e-Doc 6495064 (WORD)
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Summary

This CMD presents information about the following matter of regulatory interest with respect to Orano Canada Inc.'s (Orano) McClean Lake Operation:

- Application to amend their uranium mine operating licence UMOL-MINEMILL-McCLEAN.01/2027 for the JEB Tailings Management Facility expansion
- Revision of the financial guarantee.

CNSC staff recommend the Commission take the following actions:

- Amend the McClean Lake Licence UMOL-MINEMILL-McCLEAN.01/2027 as put forward in this CMD
- Accept the proposed revised financial guarantee amount for Orano's McClean Lake Operation for decommissioning.

The following items are attached:

- Current licence UMOL-MINEMILL-McCLEAN.01/2027
- Proposed licence amendment
- Proposed licence UML-MINEMILL-McCLEAN.02/2027
- Draft Licence Conditions Handbook, Revision 5
- Environmental Protection Review Report.

Résumé

Le présent CMD présente de l'information sur une question d'ordre réglementaire concernant l'établissement minier de McClean Lake appartenant à Orano Canada Inc. (Orano) :

- Demande de modification de son permis d'exploitation d'une mine d'uranium, UMOL-MINEMILL-McCLEAN.01/2027, pour autoriser l'agrandissement de l'installation de gestion des résidus JEB
- Révision de la garantie financière.

La Commission pourrait considérer prendre les mesures suivantes:

- Modifier le permis pour McClean Lake, UMOL-MINEMILL-McCLEAN.01/2027 tel que présenté dans ce CMD
- Accepter le montant proposé de la garantie financière révisée pour le déclassement de l'établissement de McClean Lake d'Orano.

Les pièces suivantes sont jointes :

- Le permis actuel UMOL-MINEMILL-McCLEAN.01/2027
- La modification proposée au permis
- Le permis proposé UML-MINEMILL-McCLEAN.02/2027
- L'ébauche du Manuel des conditions de permis, révision 5
- Le Rapport d'examen de la protection de l'environnement.

Signed/signé le

11 June 2021

Kavita Murthy

Director General / Director General

Directorate of Nuclear Cycle and Facilities Regulation

Directrice générale de la

Direction de la réglementation du cycle et des installations nucléaires

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EXECUTIVE SUMMARY

Orano Canada Inc. (Orano) submitted an application to the Canadian Nuclear Safety Commission (CNSC) to amend its uranium mine operating licence for the expansion of the JEB Tailings Management Facility (TMF) at the McClean Lake Operation (MLO) [1]. Orano is the operator of the MLO, which is located in the Athabasca Basin of northern Saskatchewan.

This Commission Member Document (CMD) presents CNSC staff's assessment, conclusions and recommendations in respect of Orano's licence amendment application for the JEB TMF expansion. CNSC staff have evaluated Orano's application and supporting documentation and determined that the tailings preparation process and the JEB TMF will continue to perform as expected and continue to meet regulatory requirements with respect to the protection of the receiving environment. CNSC staff have evaluated the licensee's compliance with the requirements of the *Nuclear Safety and Control Act*, the *General Nuclear Safety and Control Regulations*, the *Uranium Mines and Mills Regulations* and other applicable Regulations.

The current CNSC licence issued in 2017 authorizes Orano to operate the MLO for a 10-year term (July 1, 2017 to June 30, 2027) [2]. The licence was renewed following a public hearing held in La Ronge, Saskatchewan. In July 2018, the Commission approved the licensee's name change from AREVA Resources Canada Inc. to Orano Canada Inc., and issued the amended licence UMOL-MINEMILL-McCLEAN.01/2027 [3].

Orano has been licensed to operate the MLO for over two decades by the Atomic Energy Control Board (predecessor) and the CNSC. The MLO is currently in good standing; rated "Satisfactory" in all safety and control areas and other areas of regulatory interest (Indigenous engagement, cost recovery, financial guarantee, public information and disclosure). The JEB TMF has been the subject of several environmental assessments and is continuously studied under the Tailings Optimization and Validation Program (TOVP). The TOVP is on a five-year submission cycle that validates predicted JEB TMF performance. The results of the current TOVP provided assurances and reduced uncertainty in understanding the long-term environmental performance of the JEB TMF.

CNSC staff conclude that the design and operation of the JEB TMF expansion will continue to achieve the operational and post-closure objectives to ensure safety and protection of the environment. The licensee has committed to carry out additional monitoring and modelling for the contaminants of potential concerns, if the Commission approves Orano's licence amendment. This is discussed in detail in subsection 3.4.1 (assessment and monitoring; long-term assessment under normal design conditions).

In November 2020, Orano submitted an updated draft preliminary decommissioning plan (PDP) and financial guarantee. The PDP was submitted in accordance with CNSC licence conditions 11.2 and G.3 requiring the MLO to maintain a PDP and financial guarantee, respectively, for decommissioning of the facility. CNSC staff reviewed Orano's PDP and financial guarantee in accordance with CSA standard N294-09, *Decommissioning of Facilities Containing Nuclear Substances*, and CNSC Regulatory Guides G-219, *Decommissioning Planning for Licensed Activities*, and G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*. CNSC staff concluded that the updated draft PDP and financial guarantee meet CNSC regulatory requirements.

CNSC staff recommend that the Commission take the following actions:

- Amend McClean Lake Licence UMOL-MINEMILL-McCLEAN.01/2027 as put forward in this CMD.
- Accept the proposed revised financial guarantee amount for Orano's McClean Lake Operation for decommissioning.

PLAIN LANGUAGE SUMMARY

Orano Canada Inc. (Orano) submitted an application to the Canadian Nuclear Safety Commission (CNSC) to amend the uranium mine operating licence for the expansion of the JEB Tailings Management Facility (TMF) at the McClean Lake Operation (MLO). The proposed expansion will increase the height of the JEB TMF by 10.5 metres in elevation and the consolidated tailings by 14 metres in elevation. The continued construction of an engineered embankment and placement of special clay material mixed with crushed waste rock liner will prevent the seepage of the pond water over the long term.

Orano also submitted a revised preliminary decommissioning plan (PDP) and cost estimate for the MLO following the five-year cycle requirement in the CNSC licence. This Commission Member Document (CMD) presents CNSC staff's assessment, conclusions and recommendations for Orano's licence amendment application for the JEB TMF expansion and for the financial guarantee. This CMD will focus on the following SCAs related to Orano's licence amendment application for the JEB TMF expansion:

- Operating Performance
- Safety Analysis
- Physical Design
- Environmental Protection
- Waste Management

The amendment of the CNSC licence, as requested by Orano, does not change any other operations at the McClean Lake site and there is no impact on other parts of the facility. Orano maintains satisfactory performance in all SCAs for this site. However, the impact of the proposed licence amendment on all 14 SCAs was evaluated.

Operating Performance

Orano has operated the JEB TMF facility in compliance with the CNSC's regulatory requirements. CNSC staff concluded that the tailings preparation process and the expanded JEB TMF will continue to perform as expected and meet CNSC's expectations with respect to the protection of the receiving environment.

Safety Analysis

CNSC staff conducted an assessment of Orano's hazard analysis, safety analysis of containment structure, and severe accident analysis for the JEB TMF expansion. CNSC staff concluded that Orano's proposed 10.5-metre JEB TMF vertical expansion can be constructed, operated, and decommissioned safely, taking into account environmental design features and mitigation measures.

Physical Design

Site characterization was conducted at the JEB TMF site to provide appropriate foundation soil conditions and material properties for the embankment, liner, preliminary cover and landform designs. CNSC staff's technical assessment of Orano's application for the JEB TMF expansion concluded that the embankment and the liner designs are appropriate to provide expected embankment stability, and safe containment of tailings and pond water during operation. Orano is required to provide a detailed design of final cover and landform at the time of decommissioning to ensure the long-term safety and the environmental performance of the decommissioned JEB TMF.

Environmental Protection

Orano maintains a robust and comprehensive environmental protection program in alignment with CNSC's REGDOC 2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures* (2020). As part of their program, Orano conducts routine environmental monitoring through a robust environmental monitoring program (EMP). The current MLO EMP requires very little change in order to effectively monitor potential risks from the JEB TMF expansion project. However, Orano will continue to evaluate the adequacy of the EMP and make adjustments where required during the construction, operation and decommissioning phases. In addition, a groundwater monitoring plan has been developed to demonstrate that hydraulic containment is maintained throughout the operation of the expanded TMF and contaminants do not move into ground water.

Based on CNSC staff's review of Orano's licence amendment application for the JEB TMF expansion and associated documents including the project description, CNSC staff concluded that Orano's airborne emissions and waterborne effluent released to the environment are not expected to impact the environment. The modelling results also demonstrated that surface water quality in Fox Lake and Pat Lake is expected to remain below surface water quality guidelines after the site is decommissioned; therefore, impacts to the aquatic environment are expected to be negligible. The predicted exposure to radiation for people using the site after decommissioning will be the same as exposure to natural background radiation in the area. Overall, the risk to the environment and to people from the proposed expansion is predicted to be negligible.

Waste Management

In November 2020, Orano revised and submitted the PDP and cost estimate for their MLO following a five-year cycle requirement. CNSC staff reviewed the proposed revisions and concluded that the revised preliminary decommissioning plan, including cost estimates and financial guarantee, meet CNSC regulatory requirements. Orano proposed a revised financial guarantee of **C$102,098,000**, which was reviewed by CNSC staff.

Indigenous and Community Engagement

As an agent of the Government of Canada, the CNSC recognizes and understands the importance of building relationships with Indigenous peoples in Canada. The CNSC's goal is to build partnerships and trust with Indigenous communities through collaborative ongoing engagement activities related to CNSC-regulated facilities and activities of interest within their traditional and/or treaty territories.

In September 2019, as a result of recommendations from the Commission [4], CNSC staff took an initiative to meet with Indigenous groups and communities to provide information and seek opportunity for improvement on CNSC's 2018 regulatory oversight report for uranium mines and mills. Again, in September 2020, due to the COVID-19 pandemic restrictions, a virtual Zoom meeting with northern community leadership was also conducted in which the CNSC staff provided information on Orano's application to expand the JEB TMF expansion as well as the 2019 regulatory oversight report.

CNSC staff conclude that the proposed JEB TMF expansion will be carried out within the existing footprint of the McClean Lake site and is unlikely to cause any new impacts on Indigenous and/or treaty rights in relation to Orano's licence amendment application.

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

PART ONE

Part One includes:

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

PART TWO

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

1. proposed changes to the licence
2. proposed licence, UML-MINEMILL-McCLEAN.02/2027
3. draft licence conditions handbook
4. current licence, UMOL-MINEMILL-McCLEAN.01/2027.

1. OVERVIEW

1.1 Background

Orano Canada Inc. (Orano) is the operator of the McClean Lake Operation (MLO). Ownership of the MLO is comprised of Orano (77.5%), and Denison Mines Inc. (22.5%). Orano has been issued a licence for the MLO by the Canadian Nuclear Safety Commission (CNSC) under section 24 of the *Nuclear Safety and Control Act* (NSCA) and is authorized to conduct licensed activities, including:

- processing of Cameco Corporation's Cigar Lake mine high-grade ore slurry
- operation and modification of a nuclear facility for the mining of uranium ore
- production of uranium concentrate
- operation of the JEB Tailings Management Facility (TMF).

Construction of the MLO began in 1994. In 1996, an operating licence was first issued to Orano (formerly COGEMA Resources Inc., and then AREVA Resources Canada) for the MLO by the Atomic Energy Control Board (AECB), predecessor of the CNSC. Since then, the CNSC licence issued to Orano has been renewed several times. Mining and milling of uranium ore from five open-pit mines has been completed and conventional mining has not been carried out at the MLO since 2008. The current operating licence, UMOL-MINEMILL-McCLEAN.00/2027, was renewed by the Commission on July 1, 2017 for a 10-year term with an expiry date of June 30, 2027. The licence was renewed following a public hearing held on June 7 and 8, 2017 in La Ronge, Saskatchewan, authorizing Orano to continue operations at their McClean Lake facility.

Mill tailings have been deposited in the JEB TMF, which was engineered from the mined out JEB open pit. The MLO was designed and constructed with radiation protection features (e.g. lead shielding, concrete enclosures and lined leach tanks) for processing of undiluted high grade ore slurry averaging from 20 percent uranium to as high as 30 percent uranium.

In December 2020, CNSC staff reported on Orano's continued satisfactory performance from 2017 to 2019 through CNSC staff's annual regulatory oversight report presented to the Commission [5]. The results of the annual CNSC regulatory oversight report provides additional confirmation of the effectiveness of CNSC's continuous regulatory oversight.

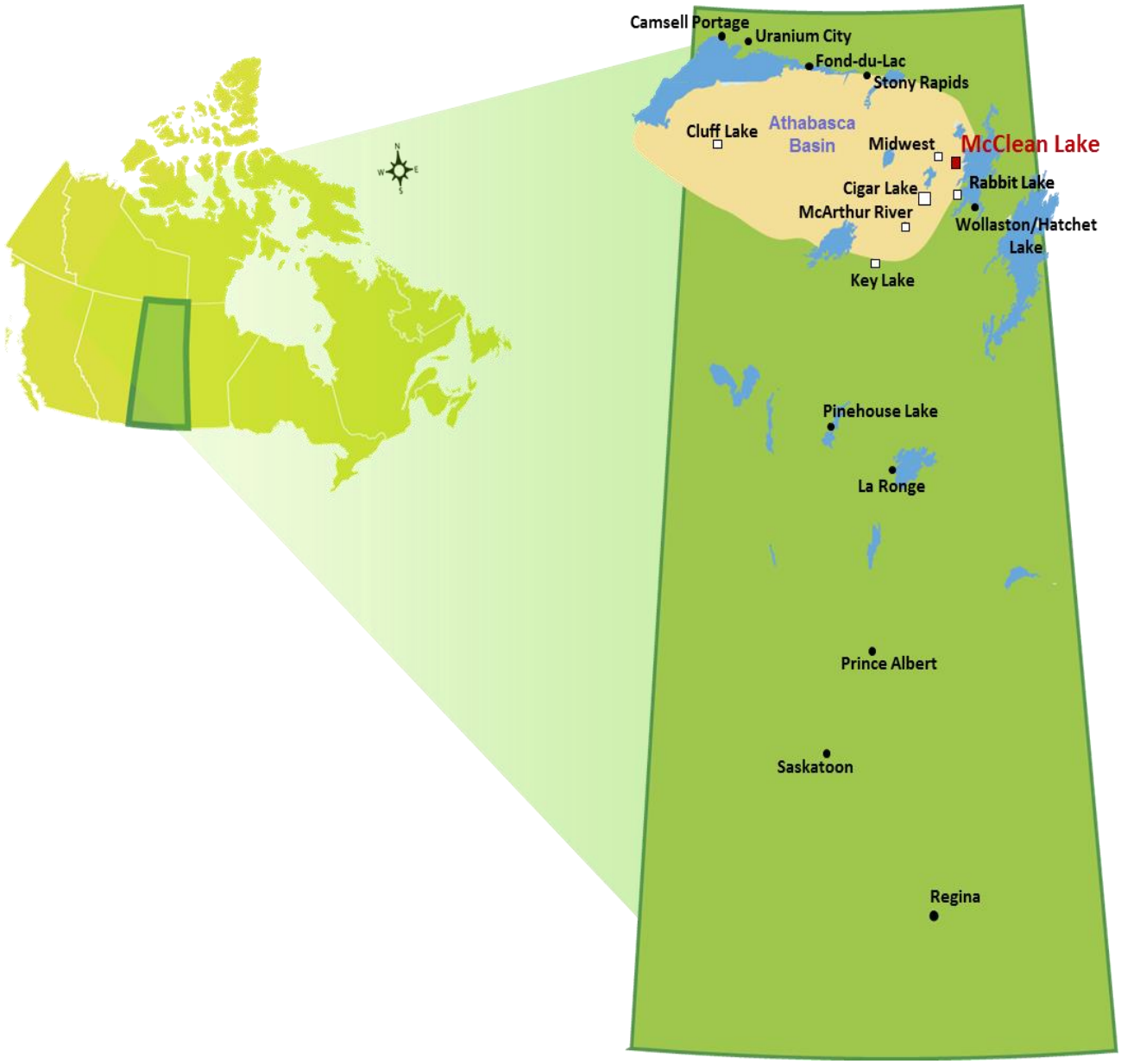
1.1.1 McClean Lake location and layout

The MLO is a uranium mine and mill facility located approximately 750 kilometres north of Saskatoon in the Athabasca Basin area of northern Saskatchewan. The MLO includes the JEB milling area, Sue mining area, JEB TMF and the undeveloped McClean, Midwest and Caribou ore deposits. Access to the site is by an all-weather road that connects with the provincial highway system

(Highway 905) with an access road to the combined Sue and JEB sites and a dedicated access road to the Midwest Project site. Workers commute to and from the site by aircraft landing at Points North, a private airstrip, and continue by bus to the MLO. The nearest permanent communities are Wollaston Post and the Wollaston Lake Indian Reserve (Hatchet Lake Indian Band), located approximately 50 kilometres by air from the mine to the southeast on the far shore of Wollaston Lake.

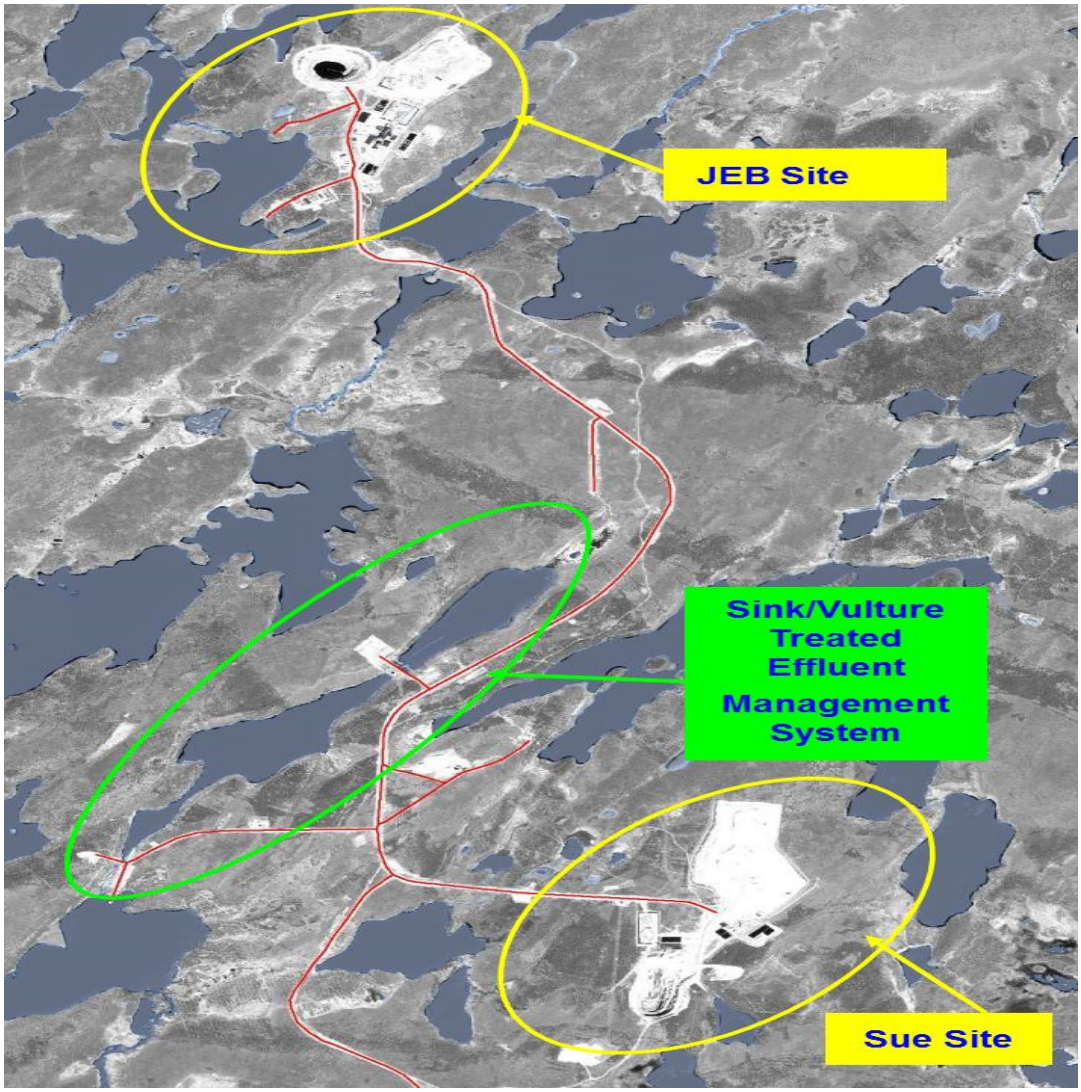
A map displaying the MLO along with the nearest communities is shown in figure 1.1.

Figure 1.1: McClean Lake – Location and nearest communities



An aerial view of the JEB site (milling area) and the Sue site at the MLO is shown in figure 1.2.

Figure 1.2: McClean Lake – Aerial view of the JEB and Sue sites



Source: Orano

1.1.2 Amendments during current licence period (July 2017 to May 2021)

On February 15, 2018, the CNSC received notification that, under section 178 of the *Canada Business Corporations Act*, AREVA Resources Canada Inc. amended their corporate name to Orano Canada Inc. The official name change became effective February 7, 2018 [6]. AREVA provided copies of the Certificate of Amendment confirming the corporation number had not changed; that it was only a name change [7]. In July 2018, the Commission approved the change of the licensee name from AREVA Resources Canada Inc. (AREVA) to Orano Canada Inc., and issued the amended licence UMOL-MINEMILL-McCLEAN.01/2027.

1.2 Highlights

Preliminary Decommissioning Plan and Financial Guarantee

In November 2020, Orano submitted a revised preliminary decommissioning plan (PDP) and cost estimate for the MLO following the five-year cycle requirement [8]. CNSC staff have assessed the proposed revisions and concluded the revised PDP, including cost estimates for the financial guarantee, meets the criteria of CNSC's regulatory guides G-219, *Decommissioning Planning for Licensed Activities*[1], G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*, and CSA standard N294-09, *Decommissioning of Facilities Containing Nuclear Substances*. CNSC staff recommend that the Commission accept Orano's proposed financial guarantee in the amount of **C$102,098,000** for the MLO. The Saskatchewan Ministry of Environment, beneficiary of the financial guarantee, is solely responsible for any associated work and has accepted this proposed amount [9]. The decommissioning plans and financial guarantee are discussed in detail in subsections 3.5.1 and 5.4, respectively.

Orano's MLO licence amendment application for the JEB TMF expansion

On June 16, 2020, Orano submitted an application to the CNSC to amend their Uranium Mine Operating Licence UMOL-MINEMILL-McCLEAN.01/2027 for the expansion of the JEB TMF at the MLO [1]. This was an update of an earlier submission made by Orano on November 1, 2019 [10]. The current approved elevation of the JEB TMF is 457.5 metres above sea level (mASL) and the consolidated tailings elevation is 448 mASL. The proposed expansion of the JEB TMF will be achieved through the continued construction of an engineered embankment and placement of a bentonite amended crushed waste rock liner. This proposed expansion will increase the height of the JEB TMF to 468 mASL elevation and the consolidated tailings to 462 mASL elevation.

CNSC staff assessment of Orano's application

Orano has operated the JEB TMF since 1999 and is currently authorized for disposal of tailings in the JEB TMF up to a consolidated tailings elevation of 448 mASL. As per existing design, the current approved elevation of 457.5 mASL will provide an additional 1.7 million cubic metres (MCM) during the current licence period until 2027. Based on current mining and milling projections, Orano expects to generate approximately 3.0 MCM of additional tailings over the next 15 years. Based on the configuration proposed for the vertical expansion to 468 mASL, approximately 2.3 MCM of additional tailings can be placed within the expanded JEB TMF, while maintaining a minimum of a 1-metre water cover over the tailings mass.

[1] CNSC Regulatory Guides G-219 and G-206 have been superseded by CNSC Regulatory Documents 2.11.2 and 3.3.1, respectively; the requirements have not fundamentally changed.

CNSC staff have conducted a thorough technical assessment of Orano's JEB TMF expansion proposal and concluded that the expanded JEB TMF will continue to:

- employ acceptable tailings preparation and deposition methods as informed by the Tailings Optimization and Validation Program (TOVP)
- limit flux of TMF pond water into the overburden during the operating period through the placement of a low permeability liner
- manage storm water effectively
- maintain hydraulic containment of the tailings through the operating period
- limit infiltration through the tailings during the post-closure period through acceptable cover and landform design and construction
- validate the geochemical and geotechnical aspects of the tailings.

CNSC staff requested Orano provide clarity and additional information related to the project alternatives such as: decommissioning approach, slope stability, till collapse potential, groundwater flow and solute transport, soil liner design, radiological assessment, and a hypothetical beyond-design basis erosion event that could result in partial erosion of the cover. CNSC staff evaluated Orano's responses and determined that these are acceptable and meeting regulatory requirements to protect health and safety of people and the environment. The detailed technical review of Orano's submission including supporting documents is now complete.

As discussed in the Environmental Protection Review Report (appendix E), disposal of tailings has been assessed and CNSC staff concluded that the design and operation of the JEB TMF expansion will continue to achieve the operational and post-closure objectives to ensure safety and protection of the environment. Orano provided a tentative schedule indicating that construction activities will start in 2025 and will be completed by 2030. Orano will provide construction details prior to initiating any construction activities for CNSC staff review and acceptance.

CNSC staff, as part of its compliance activities, will carry out the following activities to ensure safety and protection of the environment:

- verify, on an annual basis, that hydraulic containment of the JEB TMF is being maintained
- review tailings optimization and validation programs which are on a five-year cycle
- confirm the timely implementation of any mitigation measures necessary to ensure that the aquatic ecosystem in nearby Fox and Pat Lakes are protected.

Proposed licence amendment

Based on the discussion above, CNSC staff recommend to the Commission to amend section IV) *Licensed Activities* of the current licence to add a licensed activity as described below:

b) modify the outer perimeter of the JEB Tailings Management Facility for the vertical expansion up to 468 metres above sea level (mASL) and to accommodate disposal of tailings up to a consolidated tailings elevation of 462 mASL.

1.3 Overall Conclusions

CNSC staff reviewed Orano's licence amendment application and supporting documents and concluded that Orano meets CNSC's regulatory requirements.

1.4 Overall Recommendations

CNSC staff recommend that the Commission:

1. Conclude that Orano, pursuant to subsection 24(4) of the *Nuclear Safety and Control Act*, is qualified to carry out the activities authorized by the uranium mine and mill operating licence.
2. Amend the McClean Lake Licence UMOL-MINEMILL-McCLEAN.01/2027 as put forward in this CMD.
3. Accept the proposed revised financial guarantee amount for Orano's McClean Lake Operation for decommissioning.

2. MATTERS FOR CONSIDERATION

2.1 Environmental Assessment

CNSC staff reviewed Orano's licence amendment application and supporting documents in the context of the *Impact Assessment Act*. CNSC staff determined that the *Impact Assessment Act* does not apply because the activities proposed in the application are not captured in its associated *Physical Activities Regulations*.

CNSC staff conduct environmental protection reviews (EPRs) for all licence applications with potential environmental interactions, in accordance with its mandate under the *Nuclear Safety and Control Act* and associated regulations. For this licence amendment application, CNSC staff conducted an EPR to ensure the protection of the environment and the health of persons. CNSC staff's assessment included a review of Orano's licence amendment application, supporting documents (e.g., Tailings Management Technical Information Document [TMTID] and annual compliance monitoring reports), and past environmental performance. The EPR Report, which contains the results of this assessment for the MLO, can be found in appendix E of this CMD.

Based on the EPR, CNSC staff have concluded that the environment (terrestrial, aquatic and air) around the MLO is adequately protected. Orano has, and will, continue to implement and maintain an effective environmental protection program to adequately protect the environment and the health and safety of persons. Through ongoing licensing, compliance activities and reviews, CNSC staff will continue to verify and ensure that the environment and the health and safety of persons are, and will continue to be, protected.

2.2 Relevant Safety and Control Areas

Regulatory oversight is performed in accordance with a standard set of safety and control areas (SCAs). SCAs are technical topics used across all CNSC regulated facilities and activities to assess, evaluate, review, verify and report on licensee regulatory requirements and performance. Each SCA is comprised of "specific areas" of regulatory interest; however, the specific areas associated with each SCA vary between facility types. Further information about SCAs is provided in appendix D of this CMD.

In CNSC's regulatory oversight report presented to the Commission in December 2020, staff reported on Orano's satisfactory performance in all 14 SCAs for the 2017 to 2019 period. As Orano's application is for an amendment to their uranium mine operating licence for the MLO JEB TMF expansion, and not for a licence renewal, this CMD will focus on the following five relevant SCAs:

- Operating Performance
- Safety Analysis
- Physical Design
- Environmental Protection
- Waste Management

However, an evaluation of the remaining nine SCAs is also presented and provides a summary of CNSC staff's review for the operation of the MLO.

Risk ranking and rating levels

In the following table, the "risk ranking" column indicates the overall level of risk associated with each SCA and the rating level indicates the overall compliance with regulatory requirements for implementation at the MLO. Table 2.1 shows there is no change in the risk ranking for the SCAs, as reported during the last licence renewal in June 2017 (CMD 17-H9) [11]. Appendix A provides additional information related to "Risk Ranking" and appendix B further defines the "Rating Levels".

Table 2.1: McClean Lake – Safety and control areas

Functional area	Safety and control area	Risk ranking	Overall rating level[1]
Management	Management system	H	SA
	Human performance management	M	SA
	Operating performance[2]	**M**	**SA**
Facility and Equipment	**Safety analysis**[2]	**L**	**SA**
	Physical design[2]	**L**	**SA**
	Fitness for service	L	SA
Core Control Processes	Radiation protection	H	SA
	Conventional health and safety	H	SA
	Environmental protection[2]	**H**	**SA**
	Emergency management and fire protection	M	SA
	Waste management[2]	**M**	**SA**
	Security	L	SA
	Safeguards and non-proliferation	L	SA
	Packaging and transport	L	SA

H = High M = Moderate L = Low SA = Satisfactory

1. Overall rating level for the current licence period (July 2017 to May 2021).
2. Relevant SCAs focused and discussed within this CMD.

The rating level column represents an overall rating level for the current licence period as reported since the July 2017 licence renewal (CMD 17-H9).

2.3 Other Matters of Regulatory Interest

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

Table 2.2: McClean Lake - Other matters of regulatory interest

Area	Relevant to this CMD?
Indigenous consultation	Yes
Other consultation	Yes
Cost recovery	Yes
Financial guarantees	Yes
Public information and disclosure	Yes
Licence conditions handbook	No
Delegation of authority	No

These "other matters of regulatory interest" are further discussed in section 5 of this CMD.

2.4 Regulatory and Technical Basis

The regulatory and technical basis for the matters discussed in this CMD arise directly from the *Uranium Mines and Mills Regulations* and the *General Nuclear Safety and Control Regulations* as well as other regulatory requirements associated with the *Nuclear Safety and Control Act*. Further information regarding the regulatory and technical basis for the matters discussed in this CMD are provided in appendix C of this document.

3. GENERAL ASSESSMENT OF RELEVANT SCAS

The CNSC implements a risk-informed approach in the regulation of nuclear facilities and activities. The depth of regulatory reviews of relevant SCAs for this licence amendment and the baseline frequency of regulatory compliance activities are established by the risk ranking of that SCA (section 2.2, table 2.1). The specific areas that comprise the SCAs for this facility or activity type are identified in section D.2 (appendix D) of this CMD.

In this CMD, general assessment of relevant SCAs are discussed in detail in relation to the JEB TMF expansion proposal and operation.

3.1 Operating Performance

The operating performance SCA includes an overall review of the conduct of the licensed activities and other activities that enable effective performance. The specific areas that comprise this SCA are not addressed individually in this document.

3.1.1 Discussion

The following provides discussions on tailings preparation, the JEB TMF, tailings delivery and deposition, JEB TMF expansion project history, application for licence amendment and tailings management.

Tailings preparation

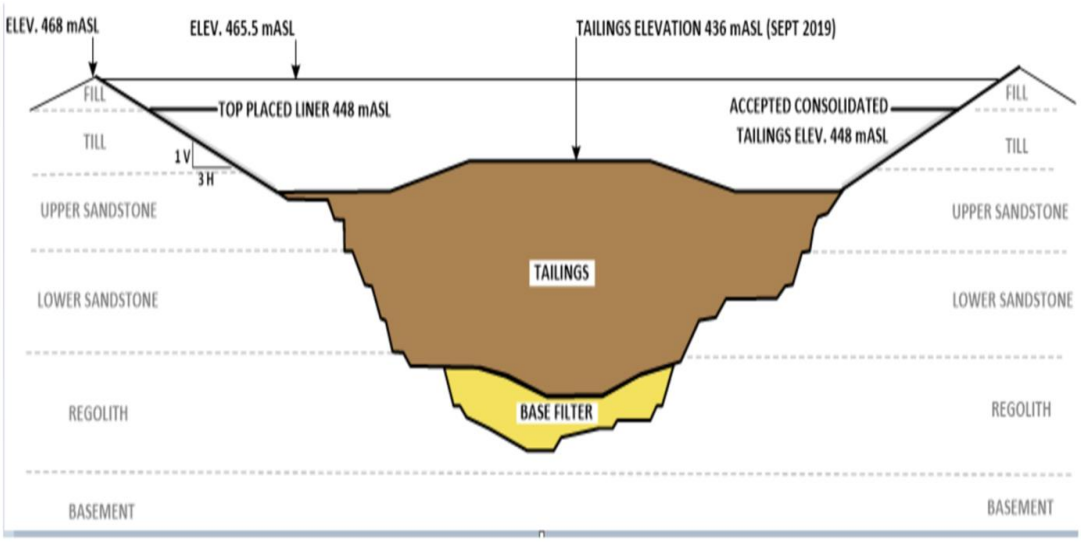
The tailings preparation circuit treats leach residue and various other waste streams, which cannot be returned to the mill process. The purpose is to neutralize acid waste solutions, to precipitate contaminants out of the solution and to prepare the tailings for disposal. In the neutralization process, which takes place in tailings neutralization tanks, sulphuric acid, hydrogen peroxide, barium chloride and ferric sulphate are added to promote the precipitation and/or adsorption of radium, arsenic and various other contaminants of concern. Slaked lime is also added to tailings neutralization tanks to incrementally raise the pH and to promote additional contaminant precipitation before discharge.

The neutralized tailings are then pumped to the tailings thickener. The thickener is a large diameter tank with a rake mechanism to scrape the settled tailings to the underflow extraction line. Flocculent is added to aid in settling the solids. The thickener overflow liquid is collected in an overflow tank, which is then pumped to the surface of the JEB TMF with eventual treatment in the JEB water treatment plant (WTP). The thickener underflow solids slurry is pumped down to the JEB TMF for disposal.

JEB tailings management facility

The JEB TMF is an in-pit tailings disposal facility designed to provide long-term hydraulic containment of tailings. The existing natural ground elevation of the top of the JEB TMF perimeter ranges from 448 mASL on the low side to 462 mASL on the high side. A conceptual cross-section of the JEB TMF with the current and proposed elevations as they correspond to the consolidated tailings is shown below in figure 3.1.

Figure 3.1: McClean Lake – Conceptual cross-section showing the JEB TMF



Source: Orano

Table 3.1 shows the different components of the JEB TMF and consolidated tailings with the current and proposed embankment elevations. The designation of "1V:3H" shown in figure 3.1 is a representation of the proposed upstream slopes of both the embankment and the wall; this is normally read as "3H:1V", or three units horizontal for each unit vertical.

Table 3.1: McClean Lake - Current and proposed JEB TMF consolidated tailings and embankment elevation

Component	Accepted embankment to 457.5 mASL	Proposed embankment to 468 mASL
Top of embankment	457.5 mASL	468 mASL
Top of placed tailings	452 mASL	465.5 mASL
Top of consolidated tailings	448 mASL	462 mASL
Created additional tailings capacity	1.5 MCM	2.3 MCM
Total volume of tailings capacity	4.6 MCM	6.9 MCM
Toe distance to high water mark of Fox Lake	58 m	10 m

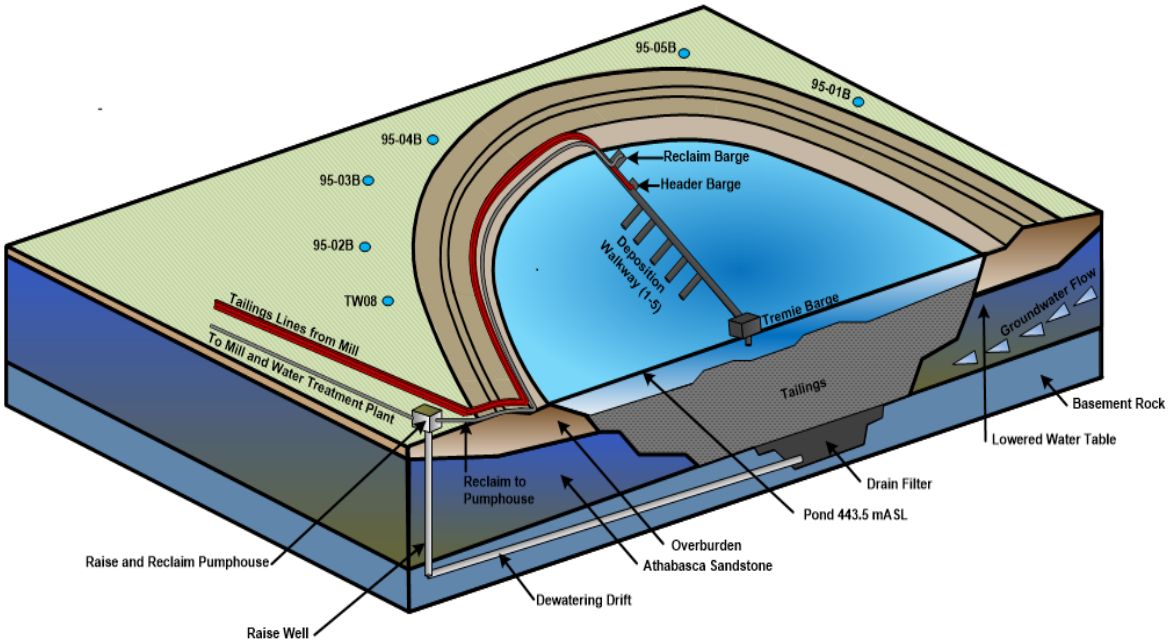
Note: Top of existing JEB TMF perimeter is 448 mASL to 462 mASL.

The JEB TMF consists of:

- tailings preparation circuit inside the mill
- JEB dewatering system
- tailings delivery system (pumps, piping and barge)
- reclaim water system (pumps, piping and barge)
- JEB filter, underdrain, drift, raise wells
- observational monitoring wells.

The following figure displays a schematic of the tailings disposal system at the JEB TMF.

Figure 3.2: McClean Lake – Tailings disposal system at the JEB TMF



Source: Orano

The drift and raise system consists of sand and gravel filters, a drain rock under the tailings that is penetrated by a rock-filled drift, and three raised wells that penetrate the drift outside the JEB TMF. The system pulls tailings pore water and surrounding groundwater through the filter, pumps it through the leaching circuit heat exchanger and onto the process water tank for use throughout the mill. Any excess water not used for mill processes is directed to the JEB WTP. As shown in figure 3.2, the TW08 well is used for monitoring head differential and water quality. The 95 series wells are for monitoring water quality.

Tailings delivery and deposition

The flows from the tailings thickener are pumped through one independent 5-inch diameter and/or two independent, 3-inch diameter high-density polyethylene pipelines. A dual containment system is used from the mill to the pit and a single pipe is used from the pit edge to the placement barge. The barge contains a steel-clad building to protect equipment and provide shelter for workers performing periodic inspections and maintenance. A floating walkway connects the barge to the "shore" of the TMF. The walkway carries the tailings lines, electrical cable and provides a means for workers to access the barge. The barge is moved in the TMF by adding or removing sections of the walkway, or by moving the entire walkway (and barge) to a different anchor point on the "shore". The tailings are deposited in the pit through 6-inch vertical deposition pipes that penetrate the pit water cover (subaqueous deposition) and approximately the top 2 metres of tailings. The length of the deposition pipe is adjusted manually to ensure tailings are deposited at the desired depth.

The following figure displays the JEB TMF as well as the floating barge at Orano's MLO.

Figure 3.3: McClean Lake - JEB TMF and floating barge

Source: Orano

JEB TMF expansion – project history

August 2011 to November 2014

Originally, Orano was allowed to dispose of tailings in the JEB TMF up to a consolidated tailings elevation of 434 mASL. On August 26, 2011, Orano submitted a project description with an application to amend their CNSC operating licence for the vertical expansion of the JEB TMF, increasing to a total elevation of 468 mASL. The CNSC determined that a federal screening level environmental assessment (EA) under *Canadian Environmental Assessment Act* (CEAA, 1992) was required for the project, with the EA process overseen by the CNSC. During CNSC staff's review of Orano's licence amendment application, the *Canadian Environmental Assessment Act, 2012* (S.C. 2012, c.19, s. 52) came into force. CNSC notified Orano that an EA would no longer be required and that the project would continue to the licensing process under the *Nuclear Safety and Control Act*. The project description advanced through a technical review with CNSC staff, as Orano continued to conduct engagement with stakeholders.

In 2014, Orano revised their forecasted mine development plans which resulted in a reduction of the forecasted tailings volume. This reduction was significant enough that Orano revisited the alternative assessment for the long-term management of tailings. The subsequent alternative assessment confirmed that expanding the JEB TMF remained the preferred option, although with a reduced scope in design. Construction of an embankment was still required, however, to a lower elevation. Therefore, Orano withdrew their 2011 application for a licence amendment for the JEB TMF expansion to 468 mASL, indicating the licensee would re-evaluate alternatives.

June 2016 to April 2017

On June 10, 2016, Orano provided a reduced scope for the vertical expansion of the JEB TMF to a total elevation of 457.5 mASL. Based on the submission and additional information provided, CNSC staff concluded that the reduced proposed vertical expansion of the JEB TMF remained within the licensing basis and would continue to be effective in protecting the environment. Therefore, the CNSC staff approved the project in April 2017 and reported to the Commission in CMD 17-H9 during the CNSC public hearing in June 2017 [11].

Orano's current JEB TMF expansion application for licence amendment

Orano started processing Cameco's Cigar Lake ore in September 2014. Orano stated that milling of Cigar Lake ore produced more tailings per tonne of ore processed than initially expected. Current mining and milling plans indicate that the JEB TMF will reach its full storage capacity approximately during the year of 2027. In order for Orano to secure future mining and milling plans, sufficient tailings capacity must be available to prevent production disruptions. Therefore, in November 2019, Orano provided an updated project description to the CNSC [10], describing the need for a further expansion to the JEB TMF.

In May 2020, after conducting a thorough technical assessment of Orano's submission, CNSC staff noted this vertical expansion would result in an above ground tailings management facility on top of an in-pit facility requiring reliance on above ground structures. CNSC staff determined that this proposal is outside the licensing basis and therefore requires a decision by the Commission [12]. Furthermore, CNSC staff advised Orano to submit an application to the Commission Secretariat for a licence amendment. Accordingly, on June 16, 2020, Orano submitted an application to the CNSC requesting a licence amendment to the MLO [1].

Tailings management

Orano reports every five years on the operational performance of the JEB TMF through the Tailings Optimization and Validation Program (TOVP), which is a provincial licensing requirement to operate the MLO (Saskatchewan Ministry of Environment Approval to Operate PO17-186). The TOVP is an ongoing sampling, monitoring, and research program focused on the performance of the JEB TMF. In 2015, the TOVP was integrated into the Tailings Management Technical Information Document (TMTID). The TMTID provides documentation of the design, operation, and expected future decommissioning of the TMF at the MLO and presents predicted operational and long-term environmental effects and mitigating measures related to tailings management. In May 2020, Orano submitted the TMTID [13], which constitutes the seventh report on *in situ* sampling campaign results and the fourth five-year review of the TOVP to optimize and validate long-term tailings performance. It is the first time the TMTID contained information on the characteristics and performance of Cigar Lake tailings placed in the JEB TMF. CNSC staff assessed Orano's TMTID and concluded that the design and operation of the tailings preparation process and the JEB TMF are performing as expected with respect to the protection of the receiving environment.

3.1.2 Summary

A summary of Orano's past performance, regulatory focus and proposed improvements at the MLO are presented in the following subsections.

3.1.2.1 Past Performance

In support of the licence amendment and based on a comprehensive assessment of Orano's JEB TMF expansion documentation including the TMTID, CNSC staff conclude that Orano's tailings preparation process and the JEB TMF operation are meeting regulatory requirements. Based on its compliance monitoring activities, CNSC staff are satisfied that Orano takes timely and appropriate corrective actions necessary to resolve any non-compliances that stem from inspections and document reviews.

3.1.2.2 Regulatory Focus

CNSC staff will continue to monitor Orano's performance in this area through regulatory oversight activities including compliance inspections and desktop reviews of MLO's compliance reporting, and revisions to relevant program documentation pertaining to this SCA.

3.1.2.3 Proposed Improvements

Orano has applied to modify the JEB TMF to increase tailings storage capacity. CNSC staff will carry out its regulatory oversight to confirm that Orano completes the project safely and the environment is protected. Orano is required to verify hydraulic containment of the JEB TMF and report to the CNSC through the annual compliance report.

Improvements to operation, facility equipment and processes are identified on an ongoing basis and implemented as part of continuous improvement.

3.1.3 Conclusion

During the current licence period, CNSC staff verified that Orano has operated the JEB TMF facility in compliance with the CNSC's regulatory requirements.

Based on the above assessment, CNSC staff concluded that the tailings preparation process and the expanded JEB TMF will continue to perform as expected and meet CNSC expectations with respect to the protection of the receiving environment.

3.1.4 Recommendation

CNSC staff recommend the three licence conditions associated with this SCA be retained without change. The first condition states that the licensee shall implement and maintain an operating program, which includes a set of operating limits. The second condition states that the licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission. The third condition states that the licensee shall implement and maintain a program for nuclear substances and radiation devices.

3.2 Safety Analysis

The safety analysis SCA supports the 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 preventive measures and strategies in reducing the effects of such hazards.

3.2.1 Discussion

As a licensing requirement, Orano must implement and maintain an ongoing process to identify and assess hazards and risks at the MLO. In conformity with these licensing requirements, Orano has implemented a safety analysis program to evaluate the potential hazards associated with the conduct of the proposed JEB TMF expansion and to consider the effectiveness of preventative measures and strategies in reducing the effects of such hazards. Based on CNSC staff's assessment, focused highlights are provided for the following specific areas in relation to this licence amendment for the JEB TMF expansion:

- hazard analysis
- safety analysis of containment structure
- severe accident analysis.

Hazard analysis

Hazard analysis provides an opportunity to identify and mitigate potential hazards to workers health and safety, and to the environment, to an acceptable level or as low as reasonably achievable (ALARA). The primary activity associated with the JEB TMF expansion is to modify/expand the outer perimeter to accommodate the disposal of tailings to a consolidated elevation of 462 mASL, which is the approximate ground elevation on the high side of the pit. The JEB TMF expansion will be achieved through the continued construction of an engineered embankment and placement of a bentonite-amended liner from the currently approved elevation of 457.5 mASL up to an elevation of 468 mASL.

The primary hazards associated with the JEB TMF expansion include the increase of the embankment height up to 10.5 metres, the extra loading resulting from the expanded embankment, and an increase of the consolidated tailings elevation up to 14 metres above the ground elevation on the low side of the JEB TMF. The increased embankment height and its resulting extra loading could pose a risk to the stability of the embankment structure and its foundation. Containment of the consolidated tailings above the existing ground elevation over the long-term will rely on engineered structures, which in turn creates a potential long-term risk to the environment and human health. CNSC staff assessed the impact of the identified hazards on the safety of the facility through the review of Orano's slope stability analysis of the proposed embankment structure, the foundation collapse potential analysis, and the severe accidental failure of the embankment structure. The potential environmental and human health effects of the JEB TMF expansion are assessed in section 3.2 of the EPR Report (appendix E) of this CMD.

Safety analysis of containment structure

The safety of the proposed embankment structure was assessed with both the deterministic and the probabilistic analysis of the embankment slope stability, as well as the till collapse potential analysis.

The deterministic stability analysis used soil parameters, such as unit weight, effective friction angle and effective cohesion, which have a single unique value. The deterministic stability analysis was performed with the limit equilibrium method at representative cross sections. The analysis result is a single factor of safety for each analysis slip surface. The *Dam Safety Guidelines* (2007, revised 2013) [14] of the Canadian Dam Association (CDA) recommends a minimum factor of safety for the slope stability analysis at different conditions as shown in table 3.2.

Table 3.2: McClean Lake - Factor of safety for slope stability*

Loading condition	Minimum factor of safety	Slope
End of construction before reservoir (TMF) filling	1.3	Upstream and downstream
Long-term (steady-state seepage, normal reservoir level)	1.5	Downstream
Pseudo-static (for seismic loading)	1.0	Upstream and downstream

* CDA, 2007, revised 2013.

A probabilistic slope stability analysis was also performed to demonstrate the stability of the proposed embankment structure by considering the variability of input parameters. Based on a literature review of recent research, it is recommended that a reliability index of at least 2.5 is required for the JEB TMF expansion embankment slope. A probability of unsatisfactory performance that corresponds to the reliability index of 2.5 is approximately 0.006 [15] indicating a probability of embankment slope failure of 6×10^{-3}.

The analysis results show that an embankment with a Horizontal to Vertical ratio, 2H:1V, or flatter upstream slope and a 2H:1V or flatter downstream slope would meet the CDA recommended minimum factor of safety criteria and achieve a minimum reliability index of 3.89. The probability of embankment slope failure that corresponds to the reliability index of 3.89 is approximately 3×10^{-5}.

The JEB TMF is located within the tectonically stable interior of the Canadian Shield. Historical records verify seismicity in this area has been very low; no natural earthquake event with a magnitude of M3 or larger has been recorded in the JEB area. An evaluation of embankment stability for seismic loading was conducted using a pseudo-static analysis approach. This evaluation was conducted in accordance with the guidelines and procedures provided by the CDA [14]. A conservatively estimated mean peak ground acceleration of 0.143 g for annual probability of 1/10,000 was used for the assessment of the JEB TMF embankment stability. The calculated factors of safety for seismic loading conditions for the proposed embankment meet the CDA recommended minimum factor of safety criteria.

During the review of Orano's application for the JEB TMF expansion, CNSC staff requested the licensee to further assess:

- the impact of the perched water table in the till on the upstream till slope stability
- the slope stability of the embankment with a groundwater level derived from the sensitivity analysis of groundwater seepage through the embankment with a hydraulic conductivity of 10^{-6} and 10^{-8} metres/second (m/s) for the embankment fill material, which is one order of magnitude higher or lower than the value (10^{-7} m/s) used for groundwater seepage analysis
- how the variability of the liner strength parameters is considered in the embankment stability analysis.

In response, Orano conducted the assessments and provided the requested information in a timely and satisfactory manner. CNSC staff reviewed the information and concluded that the embankment slope stability analysis is acceptable and the expansion embankment can be designed, constructed, and operated safely.

With the expansion of the JEB TMF to 468 mASL, the embankment surrounding the TMF will have a height between 6 metres (on the high side of the natural ground) and 20 metres (on the low side of the natural ground). This will result in a maximum pressure between 400 kilopascals (kPa) and 500 kPa on the till (the low natural ground side), which may cause potential collapse of the till due to wetting and thus, the impact on the embankment stability.

In response to CNSC staff's concern, Orano evaluated the collapse potential of the till due to wetting. The evaluation was based on the:

- regional geology along the eastern margin of the Athabasca Basin in northern Saskatchewan
- recent geotechnical data available for the JEB TMF site and the nearby mill site
- recent research findings associated with wetting collapse phenomenon
- laboratory oedometer test results of the till.

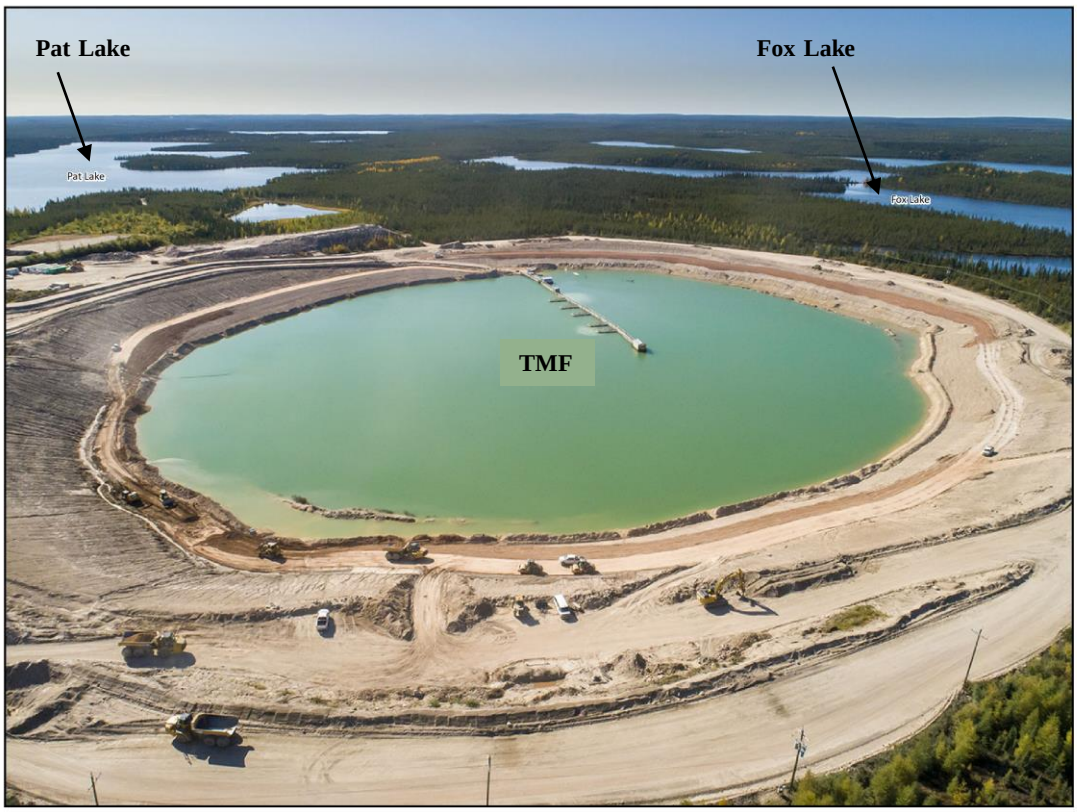
The evaluation concluded that if the till is at a dense to very dense condition, the collapse potential of the till due to wetting would be negligible or very small. Since the dry density of the till at the JEB TMF was estimated to be more than 1,950 kg/m^3, the collapse potential for the till foundation at the JEB TMF would be less than 0.2 percent. Therefore, the instability of the embankment slope due to wetting collapse of the foundation till is not a concern. CNSC staff reviewed Orano's evaluation of the till collapse potential and found it to be adequate.

As required by CNSC staff, Orano will verify the till density during footprint preparation with nuclear densometer testing to gain further confidence in the JEB TMF *in situ* till condition. Orano will provide the test data to the CNSC staff for review and confirmation prior to starting construction of the embankment. If the test data are not in agreement with the prediction, further assessments will be conducted to confirm the till collapse potential would not affect the foundation stability. The project will not proceed unless CNSC staff are satisfied that the assessment results are within the parameters of the licensing basis, as approved by the Commission.

Severe accident analysis

The JEB TMF expansion to 468 mASL will result in a total embankment height of 20 metres from low natural ground and includes the currently approved embankment to 457.5 mASL. As a result, the 468 mASL embankment height would be an additional 10.5 metres on one side and 6 metres on the other. Although the probability of an embankment failure at the JEB TMF is very low, if a failure occurred, the releases could impact Fox Lake (closest water body to the TMF), Pat Lake, and possibly downstream receiving waters. The following figure provides an aerial view of the JEB TMF and its proximity to Fox Lake and Pat Lake.

Figure 3.4: McClean Lake - Aerial view of the JEB TMF, Fox Lake and Pat Lake



Source: Orano

A screening level evaluation of the potential environmental consequences to Fox Lake, Pat Lake and downstream water bodies in the Collins Creek watershed resulting from the hypothetical accidental failure of the expanded 468 mASL embankment during operations was conducted under two scenarios:

- release of pond water to the environment when the pond is at maximum capacity
- release of pond water and tailings solids to the environment when the JEB TMF is at the maximum capacity.

Orano's analysis assumed that such a hypothetical worst-case scenario would only occur during operation and the failure would be remediated immediately after the event. CNSC staff expectation is that Orano will prevent any such severe accidents from occurring through its management of the activity. Orano will implement a JEB TMF embankment structure monitoring program. This program will include the requirement of visual observation of the embankment and measurements with field instrumentation including piezometers, slope inclinometers and ground monitoring points. Orano will report on the monitoring results through their annual compliance report to the CNSC.

This monitoring program plus preventative maintenance is expected to help maintain the stability and integrity of the embankment and liner system. CNSC staff will monitor performance in this regard through its regulatory oversight of Orano's embankment structure monitoring program.

Fox Lake, the closest water body to the JEB TMF, is completely within the licensed site and is not used for fishing during operation. The analysis concludes that the low-probability of an accidental embankment failure at the expanded JEB TMF during operation would not have significant effects on the Collins Creek watershed downstream of the facility. While water and sediment quality and the health of aquatic biota in Fox Lake would be affected, the recovery of Fox Lake, following the low-probability embankment failure event, could take many months or years. However, it is not expected that aquatic life in water bodies downstream of Fox Lake would be negatively impacted over the short or long term. Orano stated that if such a failure was to occur, further assessments would be completed to determine the extent of the failure and associated impacts, as well as the remediation actions needed and the end state of the remediated environment. Risk assessments, clean-up and determining remediation targets would be completed at the time of an accident or malfunction of this nature. Further details on the effects of such a hypothetical severe accident on the environment and human health are provided in section 3.3 of the EPR Report (appendix E).

The embankment will be transitioned from a dam to a slope of a waste disposal facility after tailings consolidation is completed. The embankment slopes will be flattened during decommissioning, which will improve the long-term slope stability. The failure of the embankment is unlikely to occur after decommissioning but would be of lesser consequence than one occurring during operations. After decommissioning, there would no longer be a tailings water cover releasing to Fox Lake; the tailings would be consolidated rather than free flowing, resulting in a significantly lesser volume of tailings reaching Fox Lake.

CNSC staff reviewed Orano's analysis of this unlikely severe accident scenario and agree that the water bodies downstream of Pat Lake would likely remain protected. Orano has an emergency preparedness program ready to deal with any unexpected severe accidents and can immediately mitigate and remediate any potential events that arise during operation. CNSC staff will continue to provide effective regulatory oversight through compliance activities.

3.2.2 Summary

A summary of Orano's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.2.2.1 Past Performance

Through CNSC staff's review of Orano's safety analysis for the JEB TMF expansion, CNSC staff concluded that it meets regulatory requirements. Orano's MLO continues promoting a positive safety culture and assessing ongoing work procedures and potential hazards to ensure safety of workers and protection of the environment.

3.2.2.2 Regulatory Focus

CNSC staff will continue to monitor performance in this area through regulatory oversight activities including inspections and desktop reviews of MLO's compliance reporting and revisions to relevant program documentation pertaining to this SCA. Orano is required to provide the construction quality control and quality assurance (QC/QA) details prior to initiating any construction activities at the MLO, including a safe work plan for the JEB TMF expansion, for CNSC staff review and acceptance.

3.2.2.3 Proposed Improvements

Improvements to operation, facility equipment and processes are identified on a continual basis and implemented as part of continuous improvement. Orano has applied to modify the JEB TMF to increase tailings storage capacity. CNSC staff will confirm through compliance verification activities that the project is completed safely.

3.2.3 Conclusion

Based on the above assessment, CNSC staff determined that the JEB TMF expansion to 468 mASL can be constructed, operated, and decommissioned safely, taking into account environmental design features and mitigation measures. CNSC staff concluded that Orano is meeting the regulatory requirements of the safety analysis SCA and CNSC staff's expectations to protect the workers and the environment at the MLO as it relates to the development and maintenance of the safety analysis for the facility.

3.2.4 Recommendation

One condition in the proposed licence is associated with the safety analysis SCA. This condition states that the licensee shall implement and maintain a safety analysis program. CNSC staff recommend the licence condition remain.

3.3 Physical Design

The physical design SCA relates to activities that impact the ability of structures, systems and components to meet and maintain their design basis given new information or activities arising over time and taking changes in the external environment into account.

3.3.1 Discussion

The CNSC expects licensees to implement and maintain a design control process to ensure that design outputs are verified against design inputs and performance expectations. The physical design of the original TMF is described and documented in Orano's MLO Facility Description Manual (FDM) [16]. The FDM provides details including physical description, technical specifications and capacities. Orano uses facility change control and design control processes to ensure that any physical changes are reviewed and approved by site management before implementation.

Based on CNSC staff's assessment of Orano's licence amendment application and supporting documents for the JEB TMF expansion, focused highlights are provided for the following specific areas:

- site characterization
- structure design
- component design.

Site characterization

The JEB TMF site was characterized with several geological and geotechnical investigation and material characterization programs during historical developments of the JEB open pit mining and the JEB TMF. The general stratigraphy encountered in the JEB TMF area, in descending order, includes the organics or organic soils, till, upper sandstone, lower sandstone, basement regolith, and intact basement rock. The organics or organic soils occur sporadically on site with a thickness between 0 metres and 4 metres.

The thickness of the till around the perimeter of the JEB TMF ranges between 10 metres and 28 metres.

The till stratigraphy of the JEB TMF area has been characterized into three stratigraphic units. The three units identified, in ascending order, are named units 1, 2 and 3, which are considered to represent three separate and distinct glaciations. The till units are differentiated on the basis of texture, resistance logs, neutron logs, weathered zones and stratigraphic position. The sandstone unit is approximately 60 metres to 200 metres thick with fractures occurring on both the local and regional scales. The basement regolith is a layer of paleo-weathered basement rock with a thickness from a few metres to approximately 50 metres. The basement rock includes a variety of crystalline rocks.

A laboratory testing program was performed previously by Orano to characterize material properties for design consideration. This program was completed to confirm that the materials meet the geotechnical requirements as determined by pit and embankment slope stability analyses and the requirements for the pond containment system. Laboratory tests completed on samples include:

- the original samples collected during the drilling and test pitting programs
- composite till materials
- crushed sandstone waste rock (processed in the laboratory)
- bentonite-amended till and bentonite-amended crushed sandstone.

The test results indicate that without any amendment, neither screened till nor crushed sandstone would provide a hydraulic conductivity that would effectively contain pond water within the JEB TMF. The test results also confirmed that either bentonite-amended crushed sandstone or bentonite-amended till can be used as a liner material for the JEB TMF expansion.

The site investigation and material characterization conducted to date by Orano shows that there are no weak clay layers in the till other than some organics or organic soils observed locally on the site surface. The organics or organic soils will be excavated together with any onsite till fill prior to construction of the TMF expansion embankment. The till is characterized as over-consolidated and is from compact to very dense conditions. The site characterization has verified appropriate site soil condition for the expansion design and the safety analysis. Orano has agreed to verify the *in situ* soil condition through an infill-drilling program along the proposed embankment axis and density measurements of the upper till prior to construction of the TMF expansion embankment, which will gain further confidence in the site soil condition.

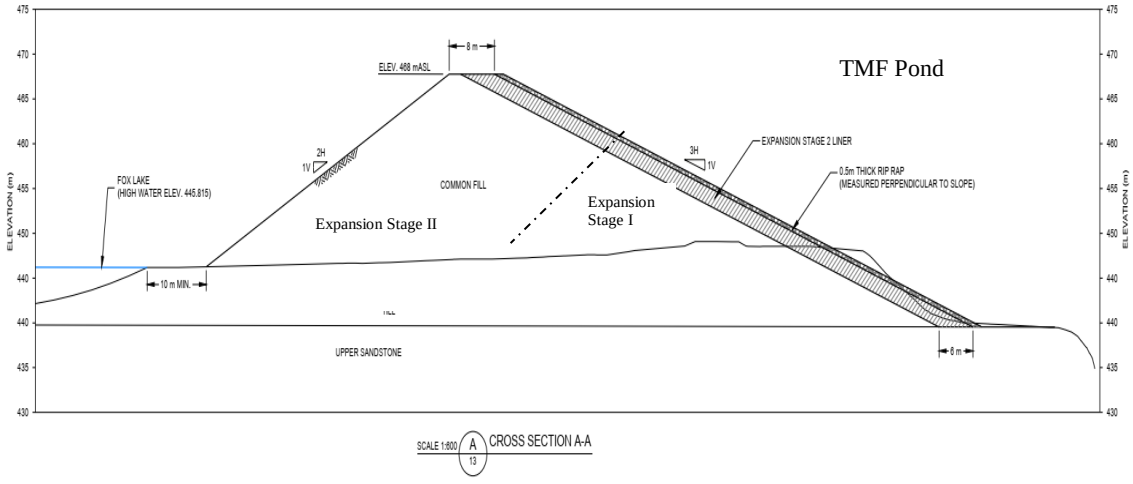
Structure design

Embankment design

The design of the expanded embankment was based upon work completed as part of the previous JEB TMF expansion approval to 457.5 mASL, and existing information of site topography, foundation conditions, soil properties, and groundwater conditions. The embankment is designed with rock fill and a bentonite-amended crushed sandstone liner on the upstream slope. The primary considerations in the design of the JEB TMF embankment are slope stability (including foundation) and pond water containment throughout operations. Slope stability analyses are performed on the preliminary embankment design and the processed bentonite-amended liner for the determination of the final geometry of the embankment.

With the support of the slope stability analysis, the designed embankment is illustrated in a typical cross-section in figure 3.5.

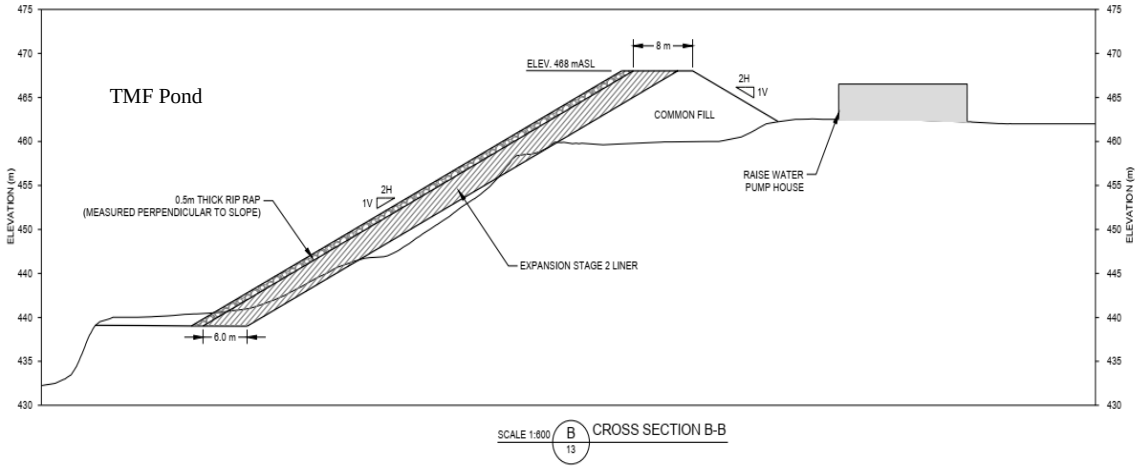
Figure 3.5: McClean Lake - Illustration of the designed embankment and liner system



Source: Orano

The designed embankment has an upstream slope of 3H:1V and a downstream slope of 2H:1V with a crest width of 8 metres. The section near the raise water pump house is designed with 2H:1V upstream slope (figure 3.6) to avoid impacting the raise water pump house and a section on the north side of the TMF is designed at 3.5H:1V to smooth the curve of the embankment crest. The toe of the downstream slope is 10 metres to the high water level at Fox Lake. The main body of the embankment will be constructed with compacted rock fill. A processed bentonite-amended crushed sandstone liner of 6 metres (measured horizontally) will be constructed on the upstream slope, which will be protected by a 0.5 metre (measured perpendicular to slope) thick riprap. As discussed in section 3.2.1, the calculated factor of safety (for deterministic analysis) and the reliability index (for probabilistic analysis) for the designed embankment meet the criteria for embankment slope stability.

Figure 3.6: McClean Lake - Designed embankment and liner system for the section near the raise water pump house



Source: Orano

The embankment design includes maintaining a minimum 1 metre water cover over the tailings mass, a 1 metre freeboard to the embankment crest, and a 0.5 metre allowance to manage storm water for a probable maximum precipitation event during the operation period.

CNSC staff determined that Orano's proposed embankment design is appropriate to ensure a sufficient factor of safety in the construction and operation of the facility, and meets the CDA recommended minimum factor of safety criteria for the embankment slope stability. An embankment monitoring program will be implemented during construction and operation to monitor the embankment stability and integrity. During the decommissioning of the TMF, the downstream slopes would be flattened to mitigate erosion potential of the slopes, which will further improve the long-term stability of the slopes. The footprint of the decommissioned slope will be 10 metres from Fox Lake to avoid potential impact to and from Fox Lake. Orano has agreed to construct an embankment fill test pad prior to construction of the embankment to determine the compaction effort and the gradation of the embankment fill and assess the requirements for a transitional granular filter layer between the soil-bentonite liner and the embankment fill.

Lessons learned from the Mount Polley tailings dam breach event have been taken into account during the design and safety analyses of the proposed embankment. These include, but are not limited to the:

- understanding of dam failure modes applicable to the proposed embankment
- confirmation of no weaker foundation materials, such as glaciolacustrine layers
- understanding of foundation soils behavior under the increased embankment loads

- adequate geometry of the embankment, (e.g., no slopes steeper than a gradient of 2H:1V to ensure the required factor of safety)
- understanding of the role of groundwater and tailings water
- need for "Engineer of Record" for the expansion project
- adequate construction QC/QA to ensure the embankment to be constructed as designed
- proper instrumentation and monitoring plan to ensure the embankment structure integrity during construction and operation
- understanding of potential consequence of unlikely accidental embankment failures.

CNSC staff will conduct regulatory oversight activities including inspections during construction and operation of the embankment and desktop reviews of the MLO's compliance reporting to verify that the proposed embankment is constructed, operated, and decommissioned safely and the environment is protected.

Landform design

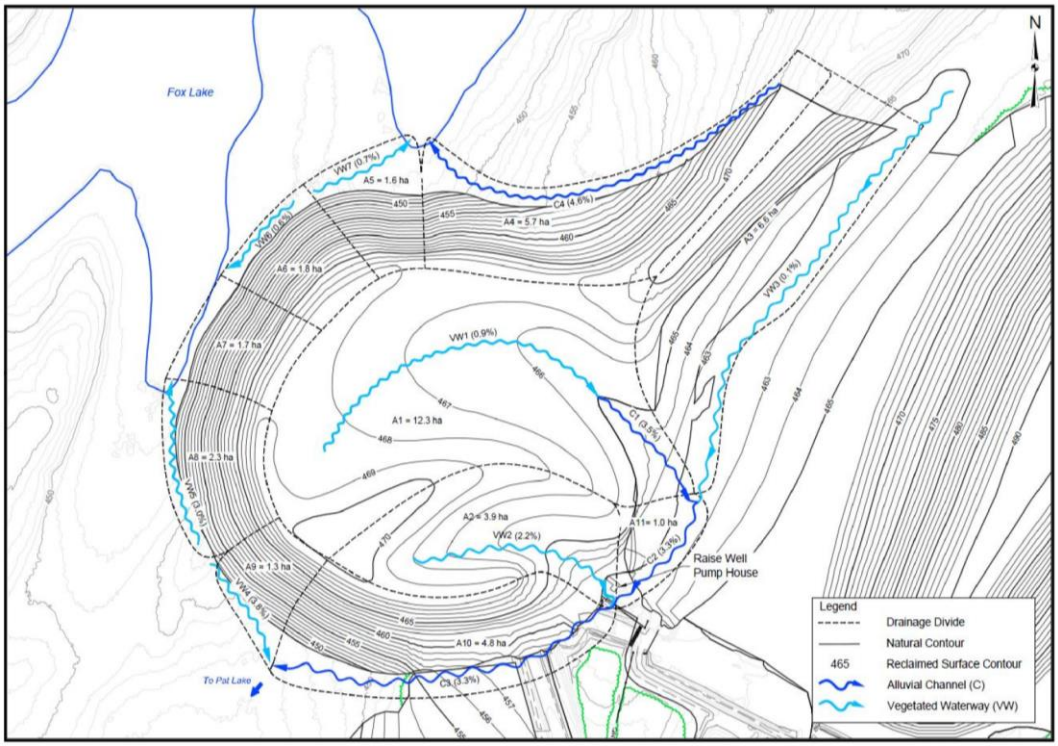
Based on the current mineral reserves, Orano indicated that the MLO could continue to operate until approximately 2050, with decommissioning activities starting thereafter. The primary objective of the landform design is to provide a sustainable landform configuration and drainage system for the decommissioned JEB TMF. The physical characteristics of the decommissioned JEB TMF landform is developed using a geomorphic approach, which involves the design of a passive system with built-in redundancy and is based on observing and replicating key features of common landforms in the area. The sustainable drainage and landform configuration for the JEB TMF was developed using geomorphic criteria developed from local natural analogue landforms (i.e. drumlins in proximity to the TMF), which include the analyses of the regional and local climate, geology, hydrogeology and natural landforms near the JEB TMF. Geomorphic analyses of these local natural analogue landforms included:

- the length, width and height of natural landforms
- the maximum overland flow path length and maximum valley slope
- the overland flow path length and upland slope
- the drainage area and average channel slope.

Characteristics of the drainage system of the landform would be expected to be similar to natural drainage systems in terms of dynamic stability, robustness, longevity and self-healing mechanisms. The structural approach was also used to design the drainage channel by considering the difference between the JEB TMF landform and the natural landform to account for the increased runoff expected over the TMF landform because of the low permeable barrier, and define the specification of riprap size used to reinforce the channel.

Figure 3.7 presents a preliminary landform design for the decommissioned JEB TMF based on the physical characteristics of natural landforms and hydrologic simulations of the flow conveyances in the drainage channels and waterways. During the assessment, CNSC staff were concerned regarding Orano's use of a flood event resulting from 1:100 year rainfall in consideration for the drainage channel and waterway design. This assessment cannot guarantee that no major erosion would occur on the decommissioned TMF landform over the long term. CNSC staff were also concerned regarding the proposed decommissioned embankment slopes of 4H:1V as no sufficient evidence was provided to demonstrate that a 4H:1V slope would have enough erosion resistance to ensure no major erosion would occur over the long term. In response, Orano has agreed to use the probable maximum flood event for the detailed design of the drainage channel and cover in addition to consideration of potential climate change effect on the design. Orano has also agreed that the detailed design of the cover will further assess erosion on embankment slopes and assess the need for refinement. This refinement could include flattening surface gradients and/or drainage distances of the decommissioned TMF slopes to meet the design criterion of "permanent walk-away closure", taking into consideration that the decommissioned JEB TMF is a tailings disposal facility and not a natural drumlin feature.

Figure 3.7: McClean Lake - Illustration of proposed landform for decommissioned JEB TMF



Source: Orano

CNSC staff concurred with the approach used for landform design and have accepted the preliminary landform design. The licensee will provide the final detailed closure landform design prior to the decommissioning of the JEB TMF. CNSC staff will review the landform design and provide recommendations to the Commission for approval as part of an overall licensing decision by the Commission, which is required before Orano can begin decommissioning activities. This design will incorporate the final cover design, climatologic and hydrologic conditions, environmental features of the site, and best science available at the time of decommissioning. This final landform design would ensure the long-term integrity and the environmental performance of the decommissioned JEB TMF.

Component design

Liner design

The pond water containment for the expanded JEB TMF during operation will be provided by the bentonite-amended liner system; the same as successfully constructed during the JEB TMF optimization and the previously approved JEB TMF expansion to 457.5 mASL. The design objective of the liner is that the constructed liner shall have a hydraulic conductivity of 1.0×10^{-9} m/s. The laboratory test results indicate that either bentonite-amended crushed sandstone or bentonite-amended screened till can be used as a liner material for the JEB TMF expansion.

The liner design is supported with numerical finite element analyses that were carried out to evaluate the hydraulic performance of the potential liner with varying thicknesses. Two performance factors considered for the analyses are the location of a wetting front in the liner during operation and the flux of tailings water through the liner during operation. The analysis indicates that the targeted value of hydraulic conductivity for the liner is 1.0×10^{-9} m/s or less and requires bentonite amendment to achieve this value. The calculated flux through the liner is most sensitive to the liner width (or thickness) and hydraulic conductivity of the liner. There was not a significant decrease in flux through the liner for a liner crest width equal to or larger than 4 metres. A liner width of 6 metres is then considered a minimum for constructability on a 3H:1V slope. An addition of up to 5 percent bentonite to the till or crushed sandstone will have a minor effect on the shear strength of either material; both meet the shear strength requirement for a liner material placed on a 3H:1V slope. Therefore, a 6-metre wide liner made with 5 percent bentonite addition to either till materials or crushed sandstone will then be constructed on the upstream slope for pond containment. The liner design was accepted by CNSC staff for the previously approved JEB TMF expansion to 457.5 mASL. Results of laboratory and *in situ* testing of the liner constructed to date, submitted as part of the application, has validated that the design objective (e.g., hydraulic conductivity) is being met or exceeded.

A pond wave analysis was conducted to calculate the freeboard requirement and determine the size and thickness of a riprap layer required to protect the liner slope from wave action. As such, a 1 metre freeboard would be sufficient to meet the freeboard requirement and a 0.5 metre (measured perpendicular to slope) thick riprap will protect the liner from wave action, as shown in figure 3.5.

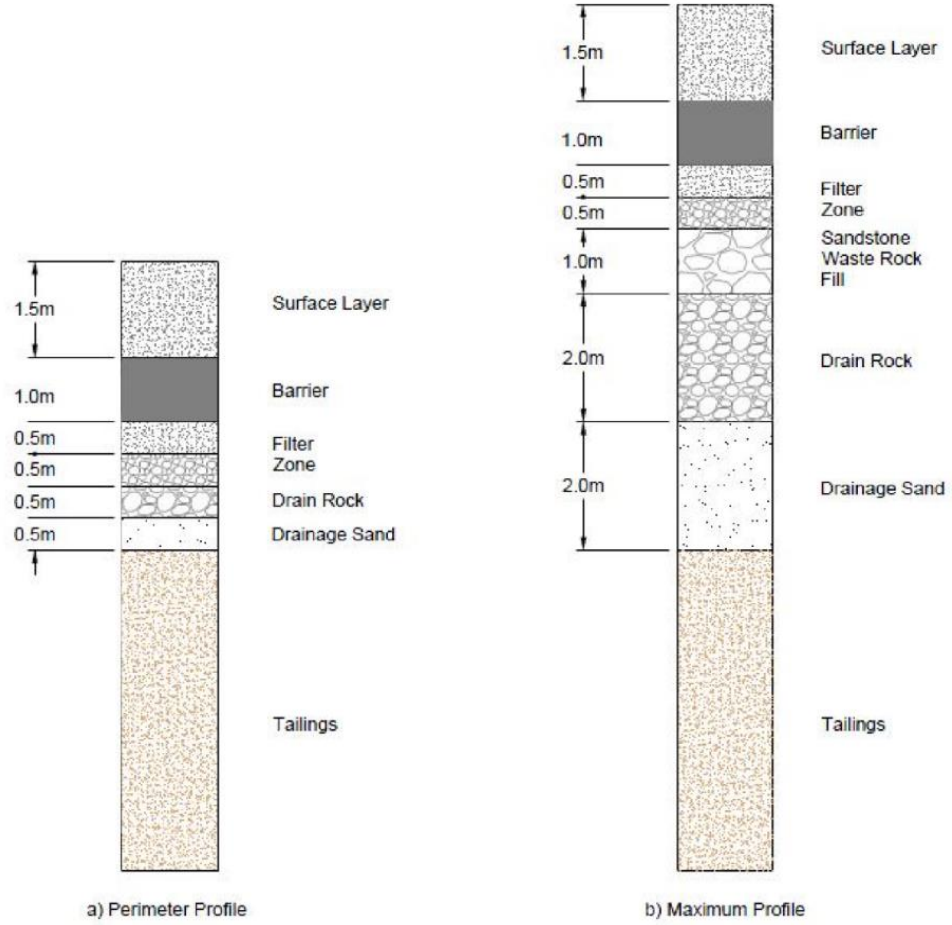
TMF cover design

The expanded JEB TMF will be capped with a low hydraulic conductivity soil cover system. The geometry and soil properties for the conceptual model of the cover were selected based on the results of preliminary modelling, laboratory testing results, the proposed closure landform and other practical considerations which comprise of three layers, as follows:

- The surface layer, elevated at a sufficient grade to promote runoff, consists of crushed sandstone and is dressed with an appropriate medium growth to promote vegetation growth. The surface layer should be at least 1.5 metres thick to protect the barrier layer against penetration from vegetation.
- The barrier layer is designed as a mixture of crushed sandstone and bentonite. The barrier layer will have a minimum of a 1 metre thickness with a hydraulic conductivity of 1.0×10^{-9} m/s or less.
- The filter layer consists of crushed sandstone waste rock with different grain sizes or sands and gravels. The function of the filter layer is to stop the internal erosion of bentonite from the barrier layer and promote the development of a capillary break that could further reduce the percolation of water into the tailings.

As shown in figure 3.8, the current soil cover design is preliminary and intended to demonstrate the feasibility of the construction of a soil cover to limit net percolation (NP) to the values, if required, to ensure the overall performance of the decommissioned TMF. The cover design requirements will be refined through the detailed design process considering the results of a field cover test plot program and the analysis of overall JEB TMF performance through the TOVP. CNSC staff accepted the preliminary cover design for the purpose of demonstrating the feasibility of the construction of a soil cover to limit NP to the values that can ensure the overall performance of the decommissioned JEB TMF. CNSC staff expect that the detailed final cover design be completed prior to decommissioning of the JEB TMF to ensure the long-term cover integrity and minimize the reliance on active institutional controls post closure. Orano has agreed to develop a detailed soil cover performance monitoring program prior to decommissioning of the JEB TMF, including performance indicators, to monitor the soil cover performance post decommissioning to confirm/verify that the cover is performing as designed.

Figure 3.8: McClean Lake - Preliminary design of the TMF soil cover



Source: Orano

3.3.2 Summary

A summary of Orano's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.3.2.1 Past Performance

During the current licence period, CNSC staff confirmed that Orano demonstrated the ability to follow the design control process when a modification or addition to facilities was required. The design control process is also being followed for this JEB TMF expansion.

Inspections were conducted to ensure implementation and verify physical design SCA compliance verification criteria. Orano's MLO continues to implement and follow the design control process as per CNSC regulatory requirements.

3.3.2.2 Regulatory Focus

CNSC staff will continue to monitor performance in this area through regulatory oversight activities including inspections and desktop reviews of MLO's compliance reporting and revisions to relevant program documentation pertaining to this SCA. The regulatory focus includes verification of embankment foundation soil conditions, construction details including construction drawings and technical specifications, proposed field testing programs such as the embankment fill test pad and the field cover test plot, as well as construction quality control and quality assurance. This will provide further confidence in the foundation competency and ensure that the relevant structures and components of the expansion are constructed safely and as designed.

3.3.2.3 Proposed Improvements

Improvements to operation of the facility are identified on an ongoing basis and implemented as part of continuous improvement.

During the licensing term, Orano will update the surface water management plan for management of probable maximum precipitation event runoff by modifying the waste rock runoff pond and the storm water storage pond, and constructing a new mill site runoff pond. CNSC staff will verify that the project is completed safely and the environment is protected.

3.3.3 Conclusion

Based on CNSC staff assessments of Orano's application, project description and design, and other supporting documents, CNSC staff conclude that Orano continues to implement and maintain effective design programs at the MLO in accordance with regulatory requirements. The site characterization has provided appropriate foundation soil conditions and material properties for embankment and liner designs, and for the preliminary cover and landform designs. The embankment structure and the liner are designed with expected performance of stability and pond water containment, which are supported with the analysis results.

Orano has agreed to provide a detailed cover design and a detailed landform design prior to decommissioning of the JEB TMF. The detailed designs will be supported with further analyses and arguments to ensure their long-term integrity and the expected environmental performance.

3.3.4 Recommendation

One condition in the proposed licence is associated with the physical design SCA. This condition states that the licensee shall implement and maintain a design program. CNSC staff recommend the licence condition remain.

3.4 Environmental Protection

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

3.4.1 Discussion

Under the *Uranium Mines and Mills Regulations*, Orano is required to develop and implement environmental protection policies, programs and associated procedures that comply with all applicable federal and provincial regulatory requirements, in order to control the release of radioactive and hazardous substances into the environment, and to protect the environment and human health.

This section focuses on potential project-environment interactions as a result of the proposed JEB TMF expansion (including releases to the environment), and an assessment of their associated impacts.

Effluent and emissions control (releases)

Orano identified some potential project-environment interactions to air and water during the construction, operation and decommissioning phases of the proposed JEB TMF expansion project.

Potential interactions to the atmosphere include emissions generated from construction activities and road dust. In addition, there is potential of releases of radioactive dust, radon, and gamma emissions from the JEB TMF. To reduce the potential emissions, air quality is expected to be maintained through use of the existing TMF water cover. Orano will also implement dust mitigation measures such as using water to control dust from construction activities. During post-closure, the engineered cover will prevent these contaminants from migrating from the JEB TMF to the atmosphere. The engineered cover will be of a suitable depth and material to prevent vegetative roots from penetrating the tailings, creating a preferential pathway for release.

For controlled waterborne releases from the JEB WTP, Orano has determined that this WTP has the capacity to treat the reclaimed water from the proposed JEB TMF expansion. The treated effluent from the JEB WTP is not expected to change as a result of the expansion. Orano will continue to monitor the effluent and ensure that it meets licensed release limits prior to discharge.

Based on CNSC staff's assessment of Orano's licence amendment application for the JEB TMF expansion and associated documents including project description, CNSC staff conclude that Orano's airborne emissions and waterborne effluent released to the environment as a result of the proposed JEB TMF expansion project will have no expected impact to the environment.

Please refer to section 3.1 of the EPR Report (appendix E) for more information about potential releases to the environment as a result of the JEB TMF expansion.

Assessment and monitoring

Orano maintains a robust and comprehensive environmental monitoring program (EMP) in alignment with CSA standard N288.4, *Environmental monitoring programs at nuclear facilities and uranium mines and mills*. The current McClean Lake Operation EMP requires very little change in order to effectively monitor any potential risks from the JEB TMF expansion project as the EMP was originally designed to monitor the existing JEB TMF. However, Orano will continue to evaluate the adequacy of the EMP and make adjustments where required during the construction, operation and decommissioning phases. In the JEB TMF expansion project description, Orano also committed to implementing a post-decommissioning EMP, which will focus on the surrounding and downstream receiving environments from the JEB TMF (section 6.1.3.1 [10]).

Orano implemented an ongoing groundwater monitoring program which includes groundwater level and chemistry monitoring. Groundwater monitoring will be updated to reflect monitoring wells affected by the construction of the project and replaced with new monitoring wells. In addition, a groundwater monitoring plan has been developed to demonstrate that hydraulic containment is maintained throughout the operation of the expanded TMF. This monitoring plan will be incorporated into the existing groundwater monitoring program. Orano has agreed to monitor groundwater quality at wells close to the JEB TMF, if the Commission approves Orano's licence amendment. This monitoring will provide early performance indicators of the post-decommissioning rate of movement and long-term concentrations of groundwater contaminants of potential concern (COPC) and the long-term COPC concentration predictions in Fox Lake and Pat Lake. If the revised COPCs predictions in Fox Lake and Pat Lake water are above the current long-term assessment predictions, Orano will assess risks to the receiving environment and if necessary, implement mitigation measures [17].

Protection of people

The potential impact to human health for the currently approved JEB TMF was assessed in Orano's 2016 Environmental Risk Assessment (ERA) and found to be negligible [18]. The releases of hazardous contaminants to the air, soil and surface water during construction, operation and decommissioning for the proposed JEB TMF expansion are expected to be similar to the existing accepted and approved JEB TMF and will not result in impacts to human health.

Orano conducted an evaluation of the post-closure radiation exposure conditions for the expanded JEB TMF, considered potential exposure of traditional land users to gamma radiation, radon, and long-lived radioactive dusts. Orano concluded that the anticipated radiation exposure post-decommissioning will be indistinguishable from natural background radiation in the area and that environmental risk to the health of the general public is predicted to be negligible.

Successful closure and decommissioning of the JEB TMF will ensure containment of the tailings material within the TMF, while the engineered cover acts as a barrier to contain and isolate the waste. For additional information on the radiological assessment of the JEB TMF expansion for the protection of people, please refer to section 3.2.4 of the EPR Report (appendix E).

Environmental risk assessment

In support of this licence amendment for the JEB TMF expansion at the MLO, Orano assessed the impact of expanding the JEB TMF elevation level to 468 mASL on the surrounding environment during the construction, operation, decommissioning and post-closure phase.

Long-term assessment under normal design conditions

After decommissioning and closure, the engineered cover will significantly limit the infiltration of precipitation into the tailings mass; however, over time, some precipitation will infiltrate. Infiltrated precipitation will migrate through the tailings and into the surrounding sandstone and base drain, resulting in a slow discharge of contaminants into groundwater and subsequently into Fox and Pat Lakes.

In order to assess the potential environmental impacts, Orano conducted an assessment of the predicted long-term contaminant loading to the surface water from this pathway. In doing so, Orano took into consideration the performance of the engineered cover to limit infiltration, the anticipated groundwater flows over time, and the solute concentrations of contaminants in tailings pore water. In addition, for hazardous contaminants, a conservative approach was used by assuming the JEB TMF acted as a non-depleting source. For radiological contaminants, attenuation due to sorption, which allows time for radioactive decay to occur, was considered.

The assessment was conducted for a base case scenario (i.e., likely scenario), as well as for a conservative upper bound scenario, which assumes the maximum probable values for the cover infiltration rate and for the tailings pore water source concentrations. In both cases, the modelling results demonstrated that for several contaminants (including uranium and molybdenum), long-term surface water concentrations in Fox Lake and Pat Lake will be notably above the current baseline conditions. However, all contaminants are expected to remain below *Saskatchewan Surface Water Quality Objectives* or the *Canadian Council of Ministers of the Environment Water Quality Guidelines* or within background levels (e.g., cadmium and lead) at all times in the future; therefore, aquatic life will remain protected. As a result, impacts to the aquatic environment are expected to be negligible. For additional information on the assessment of impacts to the aquatic environment, please refer to section 3.2 of the EPR Report presented in appendix E.

During CNSC staff's review of Orano's assessment, it was noted that a long-term assessment of predicted contaminant concentrations in sediments in Fox Lake and Pat Lake had not been provided. While Orano's modelled predictions confirm contaminant concentrations in surface water will remain below surface water quality objectives and guidelines, the breakthrough of contaminants into the receiving environment of Fox and Pat Lakes is predicted to occur in 200 to 4,000 years. As a result, it is expected that there will be an accumulation of contaminants in sediments over time. Orano has committed to conduct a long-term assessment of the base case scenario and upper bound scenario to predict concentrations of COPCs in Fox Lake and Pat Lake sediments and assess the risk to aquatic receptors due to sediment COPC predictions, if the Commission approves Orano's licence amendment. In the event that the sediment concentration predictions will result in an unreasonable risk to aquatic receptors over the long term, Orano must consider additional mitigation measures to prevent these from occurring [17]. Orano will integrate the assessment of COPC concentrations in Fox and Pat Lake sediments into future submissions of TOVP's and Environmental Performance Technical Information Documents during the operation of the expanded JEB TMF, to support decommissioning planning and long-term predictions.

Disruptive event – cover erosion scenario

In addition to the predicted long-term assessment described above, at the request of the CNSC, Orano considered a hypothetical case of a discrete, beyond design basis disruptive event scenario resulting in significant cover erosion. Although an unlikely scenario, it provided a bounding assessment of the potential long-term impacts to the environment if a portion of the cover was eroded resulting in increased infiltration into the TMF and higher contaminant migration into Fox and Pat Lakes via groundwater. The results of this scenario demonstrated that even under this unlikely event, it would not result in additional risks to aquatic receptors beyond those that have already been evaluated by Orano. CNSC staff accepted this as a reasonable assessment of a disruptive event or beyond design basis failure of the cover [19]. At the request of CNSC staff, Orano committed to submitting a revision to the cover erosion scenario during the detailed decommissioning planning and/or detailed design stages. The revised cover erosion design will justify the 6 metre wide by 3 metre deep gully selected as the bounding case in the 2021 cover erosion scenario, and to confirm that erosion beyond the barrier layer and exposure of the tailings is unlikely [20]. For additional information on the disruptive event scenario, please refer to section 3.3 of the EPR Report.

3.4.2 Summary

A summary of Orano's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.4.2.1 Past Performance

Orano has developed, implemented and maintained an effective environmental protection program at the MLO that protects the environment and the people in accordance with regulatory requirements outlined in CNSC's REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures*. During the current licensing period, the JEB TMF continued to perform as expected, meeting CNSC expectations. CNSC staff will continue to monitor implementation of the environmental protection program through compliance verification activities.

3.4.2.2 Regulatory Focus

CNSC staff will continue to monitor performance in this area through regulatory oversight activities including inspections and desktop reviews of the MLO's compliance reporting and revisions to relevant program documentation pertaining to this SCA. The regulatory focus includes that verification of the hydraulic containment is maintained throughout the operation of the JEB TMF.

3.4.2.3 Proposed Improvements

Improvements to operation of the facility are identified on an ongoing basis and implemented as part of continuous improvement. As required by CNSC staff, Orano has agreed to carry out additional monitoring and modelling for the COPCs, if the Commission approves licence amendment. CNSC staff will verify that the project is completed safely and the environment is protected.

3.4.3 Conclusion

Orano's MLO has implemented and maintained an environmental protection program that adequately protects the environment and the people in accordance with regulatory requirements. No adverse effects are expected on human health during operation of the expanded JEB TMF.

As documented in the EPR Report (appendix E), CNSC staff concluded that the potential risks to human health and the environment from radiological and hazardous releases to the atmospheric, terrestrial, hydrogeological and aquatic environments from the proposed JEB expansion are low to negligible.

3.4.4 Recommendation

Two conditions in the proposed licence are associated with the environmental protection SCA. The first condition states that the licensee shall implement and maintain an environmental protection program which includes a set of action levels. When the licensee becomes aware than an action level has been reached, the licensee shall notify the Commission within 24 hours. The second condition states that the licensee shall, where the effluent concentration reaches or exceeds the discharge limits specified in the *Metal and Diamond Mining Effluent Regulations*, as amended from time to time, immediately investigate and take corrective action to ensure that the effluent concentration is maintained below the discharge limits. CNSC staff recommend that the licence conditions remain.

3.5 Waste Management

The waste management SCA covers internal waste-related programs that 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. This area also covers the planning for decommissioning.

3.5.1 Discussion

Licensees of uranium mines and mills are expected to have a waste management program in place for collecting, transporting, receiving, treating, processing, storing or disposing of the wastes that are produced as a result of licensed activities. Licensees are also required to have a decommissioning plan and financial guarantees. Orano is expected to take all reasonable precautions to protect workers and the environment and to control releases of nuclear and hazardous substances.

Decommissioning plans

In accordance with paragraph 3(a)(viii) of the *Uranium Mines and Mills Regulations* and the CNSC's Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*, Orano is required to maintain decommissioning plans throughout the lifecycle of the MLO. The Saskatchewan Ministry of Environment (SMOE) and CNSC staff work closely in aligning and coordinating requirements. A memorandum of understanding (MOU) with the province of Saskatchewan guides the nature of the cooperation between the parties [21].

Orano's preliminary decommissioning plan (PDP) and financial assurance [8] sets out the strategy and the preliminary plan by which the MLO will be decommissioned in the future. The PDP must be kept current to reflect any changes in the facility or operations, and meet the requirements of CSA standard N294-09, *Decommissioning of Facilities Containing Nuclear Substances,* and CNSC's Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*. The licensee's submitted plan is reviewed and assessed by CNSC staff in accordance with these documents.

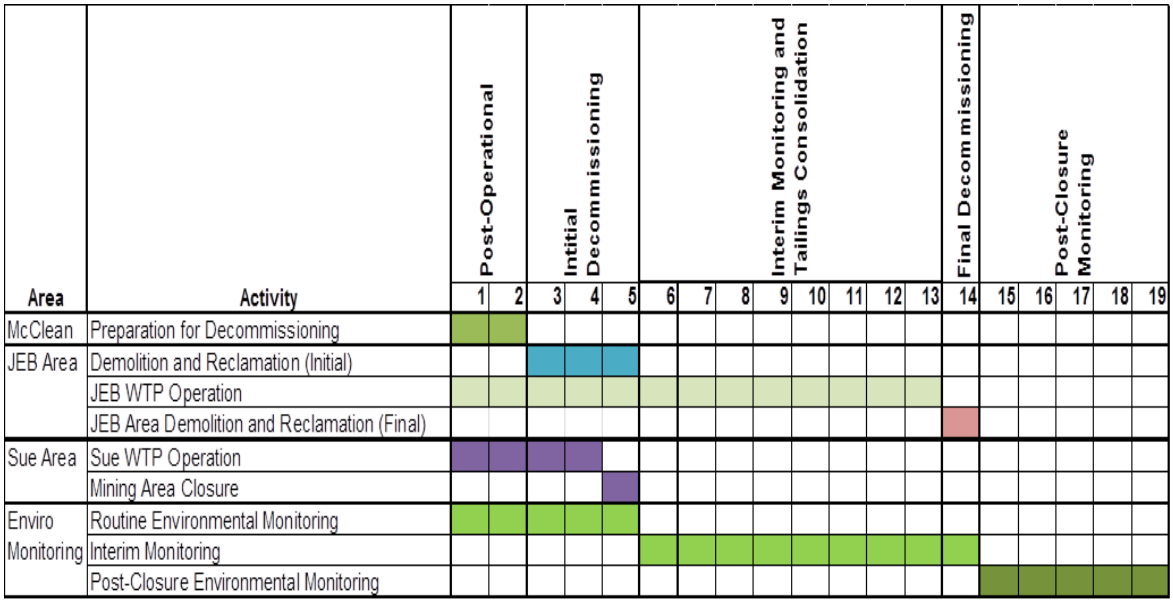
In 2020, Orano revised and submitted the PDP and cost estimate for their MLO following a five-year cycle requirement. The revised PDP includes the decommissioning of additional facilities associated with the optimization of the JEB TMF to increase tailings storage capacity. Orano's PDP states that the proposed end-state following decommissioning is to return the site to a natural, vegetated state as far as is reasonably achievable. The end-state objectives for key landforms that will remain on site include:

- placement of a cover on the JEB TMF followed by re-vegetation
- re-contouring of waste rock stockpiles to long-term stable slopes
- re-vegetation and flooding of the mined-out Sue pits with an acceptable long-term water quality.

For the purpose of the cost estimate, a "decommission tomorrow" scenario will be applied with consideration of planned activities within a five-year period to the end of 2025 and cover all decommissioning costs resulting from past and expected future activities. Orano proposed to revise the financial guarantee to the amount of **C$102,098,000**.

Based on current mineral reserves, Orano has indicated that the MLO could continue until approximately 2050 and has provided timeline estimates for the completion of each of the major decommissioning activities planned. The decommissioning of the facility is expected to occur over a period of approximately 19 years, post operation, as indicated in the following figure.

Figure 3.9: McClean Lake - Preliminary schedule of the proposed decommissioning phases



Source: Orano

Note: The numbers heading the columns represent the number of years post-operation.

CNSC staff reviewed the proposed revisions and concluded that the revised preliminary decommissioning plan, including cost estimates and financial guarantee, meet CNSC regulatory requirements. The SMOE has also reviewed and approved the revised PDP and associated cost estimates (refer to section 5.4 for further details on the financial guarantee). This approval was conveyed by official correspondence to Orano and copied to the CNSC [9].

3.5.2 Summary

A summary of Orano's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.5.2.1 Past Performance

For the current licence period, CNSC staff rated Orano's overall performance for the waste management SCA as satisfactory.

3.5.2.2 Regulatory Focus

CNSC staff will continue to monitor performance in this area through regulatory oversight activities including inspections and desktop reviews of Orano's compliance reporting and revisions to relevant program documentation pertaining to this SCA.

3.5.2.3 Proposed Improvements

Orano has submitted plans to expand the current JEB TMF to increase tailings storage capacity at the MLO. CNSC staff will verify that the project is completed safely and the environment is protected.

3.5.3 Conclusion

Based on desktop reviews and inspections, CNSC staff have concluded that Orano's overall performance for this SCA is satisfactory.

3.5.4 Recommendation

Two conditions in the proposed licence are associated with the waste management SCA. The first condition states that the licensee shall implement and maintain a waste management program. The second condition states that the licensee shall implement and maintain a decommissioning strategy. CNSC staff recommend that the existing licence conditions remain.

4. GENERAL ASSESSMENT OF OTHER SCAS

In CNSC staff's evaluation of the remaining nine SCAs, the following provides a summary of staff's review for the operation of the MLO.

4.1 Management System

The management system SCA covers the framework that establishes the processes and programs required to ensure an organization achieves its safety objectives, monitors its performance against these objectives and fosters a healthy safety culture. CSA standard N286-12, *Management System Requirements for Nuclear Facilities* contains the requirements for a management system for nuclear facilities and extends to all safety and control areas. While Orano has the required programs and processes to ensure an effective management system within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of CNSC staff's assessment of Orano's licence amendment application.

Orano's MLO has a mature management system, which continues to improve and meet evolving regulatory requirements. In October of 2016, CNSC staff accepted Orano's McClean Lake Integrated Quality Management System Document (Version 8), which met the requirements of CSA N286-12. In November 2019, as part of the continual improvement, Orano submitted an updated Integrated Management System (IMS) Manual (Version 9). CNSC staff performed a desktop review by comparing CNSC staff's previous review of IMS Version 8, focusing on the changes made from Version 8 to Version 9. The major changes between Versions 8 and 9 were found in the "Change Control" and "Design Control" sections. The "Design Control" section was removed from Version 9 of the McClean Lake IMS; however, information for the Design Control Process was added to the "Change Control" section. CNSC staff concluded that Orano's updated IMS Version 9 meets the requirements as outlined in CSA N286-12.

CNSC staff monitor implementation of the management system at the MLO through compliance verification activities, which includes desktop reviews and onsite inspections. In June 2020, a focused inspection was conducted remotely to verify implementation and effectiveness of Orano's management system at the MLO. CNSC staff developed inspection criteria to sample selected components of the management system and mitigation measures identified by Orano to manage risks to the operation. The inspection report outlined some low risk deficiencies that resulted in five non-compliances related to the documentation in the areas of commissioning, operating experience, change control and design control, self and independent assessment (e.g., missing signatures, incorrect form number). Orano provided an action plan to address these non-compliances. CNSC staff reviewed and confirmed that Orano addressed the non-compliances in a timely and satisfactory manner and have taken appropriate corrective actions; therefore, all five non-compliances were closed.

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

4.2 Human Performance Management

The human performance management SCA covers activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee personnel are in all relevant job areas and have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties. Orano includes program documentation for the human performance SCA as part of the overall management system and reports to the CNSC annually on improvements to its training programs and training delivered to the MLO workers. While Orano has a program to ensure effective human performance within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

CNSC staff review Orano's adherence to its training plan and maintenance of training records through periodic routine compliance inspections. In January 2021, a focused human performance (training) inspection was conducted remotely to evaluate and verify compliance regarding Orano's training program and its implementation. Because of this inspection, CNSC staff issued three non-compliances in the areas of positions and training analysis, change management, and evaluation. CNSC staff reviewed Orano's action plan to address these low risk non-compliances and verified that the proposed corrective actions were satisfactory. Therefore, all three non-compliances have been closed.

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

4.3 Fitness for Service

The fitness for service SCA covers activities that impact the physical condition of structures, systems and components to ensure that they remain effective over time. Orano's MLO has implemented and maintained programs to ensure structures and equipment remain effective and perform as designed over time. While Orano has a program to ensure fitness for service within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

CNSC staff's review of the maintenance management system at the MLO during regular inspections confirms that preventive maintenance activities are scheduled, completed and recorded. In July 2017, CNSC staff conducted a focused fitness for service inspection at the MLO. CNSC staff found two low risk items of non-compliance related to identifying critical monitoring equipment and assessing impacts of situations where deviations are found in monitoring equipment, which could impact past results and present performance. CNSC staff reviewed Orano's action plan to address these non-compliances and verified that the corrective actions were satisfactory. As a result, these two non-compliances were closed.

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

4.4 Radiation Protection

The radiation protection SCA covers the implementation of a radiation protection (RP) program in accordance with the *Radiation Protection Regulations*. The licensee has implemented a radiation protection program that meets regulatory requirements and protects the health and safety of workers. During the current licence period, no worker or member of the public received a radiation dose in excess of CNSC regulatory limits. While Orano has a program to ensure RP as part of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

In June 2020, a focused RP inspection was conducted remotely to evaluate and verify compliance regarding Orano's RP program and its implementation. CNSC staff found the licensee to be in compliance and therefore no non-compliances were raised as part of this inspection.

The *Uranium Mines and Mills Regulations* and the *Radiation Protection Regulations* require that a licensee report any radiation action level exceedances as defined in the Radiation Code of Practice (RCOP). The action levels for effective dose are 1 mSv per week and 5 mSv per quarter of a year. There was one RCOP action level exceedance in October 2020, which was attributed to the exposure during dust-generating cleaning activities within a vessel in the water treatment plant (WTP). The employee's personal alpha dosimeter (PAD) recorded a radon progeny exposure of 0.495 mSv and a long-lived radioactive dust exposure of 1.92 mSv for a combined PAD dose of 2.42 mSv, thus exceeding action levels for effective dose of 1 mSv per week. The corrective actions identified by Orano for interior cleaning of vessels within the WTP includes using:

- dust sampling pumps
- radiation work permits.

CNSC staff are satisfied with the actions taken by the MLO to address this action level exceedance and to prevent similar future occurrences.

CNSC staff are satisfied with the performance of Orano's RP program and its implementation at the MLO.

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

4.5 Conventional Health and Safety

The conventional health and safety SCA covers the implementation of a program to manage workplace safety hazards and to protect personnel and equipment. While Orano has a program to ensure conventional health and safety within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

Orano's MLO has an acceptable conventional health and safety program to identify and control risks. CNSC staff monitor implementation of this program to ensure protection of workers. Orano has been proactive in identifying and managing risks to improve health and safety performance.

CNSC staff observed and verified safety practices during compliance inspections. The conventional health and safety SCA is included as a component in most of the CNSC inspections. In November 2018, a focused inspection was conducted to verify implementation and effectiveness of Orano's health and safety program at the MLO. The inspection team found the licensee to be in compliance with the inspection criteria, and therefore no compliance actions or recommendations were raised as part of this inspection.

CNSC staff's compliance verification activities include inspections, reviews of compliance reports and health and safety events. In December 2020, Orano reported a dangerous occurrence of elevated hydrogen levels in a leach tank. CNSC staff presented an Event Initial Report (EIR) to the Commission, describing the event and its impact on people and environment [22]. CNSC staff reviewed Orano's initial incident report and the follow-up report and are satisfied with the corrective actions taken by the licensee to avoid similar events in the future.

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

4.6 Emergency Management and Fire Protection

The emergency management and fire protection SCA covers emergency plans and emergency preparedness programs that exist for emergencies and for non-routine conditions. While Orano maintains a program to ensure emergency management and fire protection within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

Emergency management program

Orano's MLO has an acceptable emergency preparedness and response program that meets CNSC regulatory and performance requirements. Orano's fire protection program is also in place to minimize both the probability of occurrence and the consequences of fire, therefore meeting CNSC regulatory requirements.

CNSC staff verified Orano's implementation of its emergency response program at the MLO in accordance with CNSC regulatory requirements through inspections and desktop reviews during the current licence period. In September 2019, a focused inspection was conducted to verify implementation and effectiveness of Orano's emergency management program at the MLO. The inspection report outlined one area of non-compliance requiring Orano to conduct a gap analysis of current practices with CSA standard N393-13, *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*.

Orano provided CNSC with the gap analysis, which also included an action plan with estimated timelines for completion. CNSC staff reviewed Orano's gap analysis and found the action plan and timelines provided to address the gaps satisfactory; therefore, the non-compliance was closed.

Fire protection

Orano's MLO has an acceptable fire protection program (FPP) in place. The contents of the FPP contain elements that would be expected for a mine/mill facility and comply with the requirements of the *National Fire Code of Canada 2015* and the *National Building Code of Canada 2015*. Orano conducts periodic fire hazard assessments (FHA) to demonstrate that a comprehensive assessment has been made of the potential fires and that its impacts on people, equipment, buildings and the environment are within acceptable limits. The most recent FHA was completed in September 2020 by a third party consultant for all existing JEB and Sue site buildings at the MLO along with a corrective action plan to address recommendations arising from the FHA [23]. The FHA and corrective action plan were reviewed by CNSC staff and found satisfactory and meeting expectations.

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

4.7 Security

The security SCA covers the programs required to implement and support the security requirements stipulated in the regulations, the licence, orders, or expectations for the facility or activity. While Orano has a program implemented to ensure security within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

Orano's MLO has implemented a security program that meets regulatory requirements under the *General Nuclear Safety and Control Regulations* to prevent the loss or unauthorized removal of nuclear substances, radioactive sources, prescribed equipment or information. The security risk at the MLO is considered low because of the remote location of the operation, the lack of incidents involving theft and sabotage to the operation, the percentage of long-term employees, and the lack of evidence of any threats to the operations.

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

4.8 Safeguards and Non-Proliferation

The scope of the non-proliferation program for Orano is limited to the tracking and reporting of foreign obligations and origins of nuclear material. This tracking and reporting assists the CNSC in the implementation of Canada's bilateral Nuclear Cooperation Agreements with other countries. While Orano has the required program to ensure compliance with safeguards and non-proliferation within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

Orano's MLO continues to implement and maintain an effective program for safeguards measures and nuclear non-proliferation commitments arising from Canada's international obligations under the *Treaty on the Non-Proliferation of Nuclear Weapons.*

In July 2019, CNSC received a request from the International Atomic Energy Agency (IAEA) for complementary access (CA) to conduct an inspection of Orano's MLO. Both the IAEA and CNSC staff were able to carry out all planned activities during the CA on August 21 and 22, 2019 at the MLO. As reflected in the IAEA conclusions pursuant to article 10.a of the Additional Protocol, IAEA staff were able to carry out all planned activities during the CA.

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

4.9 Packaging and Transport

The packaging and transport SCA covers programs for the safe packaging and transport of nuclear substances to and from the licensed facility. While Orano has a program to ensure compliance with packaging and transport within the framework of their overall operation of the MLO, this SCA was not evaluated in detail as part of the CNSC staff assessment of Orano's licence amendment application.

Orano's MLO has a packaging and transportation program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015*, and the *Transportation of Dangerous Goods Regulations*. CNSC staff monitor Orano's implementation of this program through compliance verification activities. The packaging and transport SCA is included as a component of the CNSC inspections. Inspections were conducted in February 2018 and again in June 2019 involving various components of the packaging and transport SCA. These inspections were conducted to verify the implementation and effectiveness of Orano's packaging and transport program at the MLO. The inspection team found the licensee to be in compliance with the inspection criteria, and therefore no compliance actions or recommendations were raised as part of these inspections.

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

5. OTHER MATTERS OF REGULATORY INTEREST

5.1 Indigenous Engagement

The common law duty to consult with Indigenous peoples 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 *Nuclear Safety and Control Act* 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

CNSC staff have identified the First Nation and Métis groups and organizations who may have an interest in the proposed licence amendment to expand the JEB TMF of Orano's MLO. These groups include: English River First Nation, Birch Narrows Dene Nation, Buffalo River Dene Nation, Hatchet Lake Denesuline First Nation, Black Lake Denesuline First Nation, Fond-du-Lac Denesuline First Nation, Lac La Ronge Indian Band, Métis Nation-Saskatchewan, Ya'thi Néné Lands and Resources Office, Prince Albert Grand Council, and Meadow Lake Tribal Council. These groups were identified because they all have previously expressed interest in being kept informed of CNSC licensed activities occurring in proximity to their traditional and/or treaty territories.

Since 2012, CNSC staff have been engaging with a number of the identified Indigenous groups concerning the MLO and the JEB TMF expansion. Previous consultation activities included letters of notification that were sent in February 2012 to a number of Indigenous groups identified within this report, to inform them that a screening level environmental assessment was required for the JEB TMF expansion. In July of 2012, updated notification letters were sent to Indigenous groups in light of CEAA 2012. The federal EA screening process for the JEB TMF expansion was transitioned to the licensing process and continued under the authority of the *Nuclear Safety and Control Act*. CNSC staff met in person with several Indigenous groups interested in the project on two northern community tours that were also attended by Orano staff in 2012 and 2013. CNSC staff participated in the McClean Lake JEB TMF workshop alongside Orano representatives where discussions and presentations were made to the Northern Saskatchewan Environmental Quality Committee in October of 2013.

In 2016, letters of notification were sent to the Indigenous groups to inform them about Orano's McClean Lake licence renewal application, the Commission hearing process, and the participant funding opportunities. This process was followed with an introductory information session to over 100 participants in the Wollaston Post/Hatchet Lake First Nation community in October 2016, including representatives from other northern Saskatchewan First Nation and Métis communities and organizations. This session provided an introduction to the

CNSC and the work it does to ensure that nuclear facilities in northern Saskatchewan and across Canada are safe and how the public can participate in the licensing process. In addition, the CNSC also hosted an introductory information session for the leadership and staff of the Prince Albert Grand Council and the Federation of Sovereign Indigenous Nations in Saskatoon, Saskatchewan on October 12, 2016.

In relation to Orano's current proposed licence amendment application for the JEB TMF expansion, CNSC staff sent letters of notification in February 2021 to all of the Indigenous groups identified above. The letters provided information regarding Orano's proposed licence amendment 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 proposed for September 29 and 30 of 2021. The identified First Nation and Métis groups and organizations have been encouraged to participate in the Commission's public hearing process in order to advise the Commission directly of any concerns they may have in relation to this decision.

CNSC staff conducted follow-up emails with the identified groups on March 2021 to ensure they had received the letters. Additional communication with identified Indigenous groups conveyed updated information pertaining to the specific hearing dates and information on the participant funding opportunity through the CNSC's Participant Funding Program (PFP). CNSC staff sent follow-up emails to the identified groups in May 2021 offering to set-up virtual meetings with interested Indigenous groups and answer any questions they may have with respect to Orano's licence amendment application.

To date, CNSC staff have not been made aware of any specific concerns about Orano's application for a licence amendment for the McClean Lake JEB TMF expansion on Indigenous peoples' potential or established Indigenous and/or treaty rights pursuant to section 35 of the Constitution. CNSC staff are committed to continuing to address concerns and provide information pertaining to the project. Follow-up activities will be conducted with Indigenous groups who express any remaining concerns about the facility following the Commission hearing, where necessary.

CNSC's REGDOC-3.2.2, *Indigenous Engagement*, Version 1.1, published in August 2019, sets out requirements and guidance for licensees whose proposed projects may raise the Crown's duty to consult. While the CNSC cannot delegate its obligation, it can delegate procedural aspects of the consultation process to licensees, where appropriate. The information collected and measures proposed by licensees to avoid, mitigate or offset adverse impacts from the proposed licence amendment, may be used by CNSC staff in meeting its consultation obligations.

Based on CNSC staff's review of Orano's licence amendment application for the JEB TMF expansion and associated documents including the project description, CNSC staff concluded that the risk to the environment and to people is predicted to be negligible. However, since the JEB TMF expansion could have a potential interaction with the rights and interests of Indigenous peoples, CNSC staff determined that CNSC's REGDOC-3.2.2 would apply to this licence amendment. In accordance with REGDOC-3.2.2, Orano prepared an Indigenous Engagement Report, which includes a list of Indigenous groups identified for engagement, a summary of any Indigenous engagement activities conducted to date, and a description of planned Indigenous engagement activities. Progress against this plan was and continues to be monitored by CNSC staff through meetings and information updates from Orano.

In addition, Orano is required to provide a final Indigenous Engagement Report as part of their CMD submission for the licence amendment to the Commission and the public. To date, CNSC staff are satisfied with Orano's approach to Indigenous engagement, which is in accordance with the requirements and guidance of CNSC's REGDOC 3.2.2. CNSC staff encourage Orano staff to continue working with the identified Indigenous groups throughout the proposed licensing term to ensure that they continue to build relationships, provide regular updates on their activities, and address concerns on an ongoing basis.

5.1.2 Conclusion

The CNSC ensures that all of its licensing decisions under the *Nuclear Safety and Control Act* uphold the honour of the Crown and consider the broader interests of Indigenous peoples who exercise Indigenous and/or treaty rights in proximity to CNSC-regulated activities or facilities. Since the proposed JEB TMF expansion will be carried out within the existing footprint of the McClean Lake site, CNSC staff are confident that the risk of potential impacts on the environment are unlikely to cause new impacts to Indigenous and/or treaty rights in relation to this licence amendment.

CNSC staff conducted engagement activities with the identified Indigenous groups to ensure their full participation in the regulatory process and to ensure their concerns are heard and addressed by CNSC staff and the Commission in a meaningful way. CNSC staff are committed to ongoing consultation with the identified Indigenous groups and work to address any concerns they may have with regards to the licence amendment application and hearing process.

Orano has met the requirements set out in CNSC's REGDOC-3.2.2 pertaining to Indigenous engagement. Orano has engaged with the identified Indigenous groups and is working towards addressing questions or concerns as appropriate. CNSC staff encourage Orano to continue to engage with interested Indigenous communities on the JEB TMF expansion project and other ongoing activities of interest to the groups.

Based on the information reviewed to date, CNSC staff conclude that the proposed licence amendment for the MLO is unlikely to cause any new impacts on Indigenous and/or treaty rights.

5.2 Other Consultation

As per normal public notification process for Commission proceedings, CNSC staff informed the public via the CNSC's website, email subscription list, social media channels, radio and print advertisements in local communities in northern Saskatchewan of the public Commission hearing and availability of participant funding.

5.2.1 Discussion

In September 2019, as a result of recommendations from the Commission, CNSC staff took initiative and met with Indigenous groups and communities to provide information and seek opportunities for improvement on the CNSC's regulatory oversight report (figure 5.1). Due to COVID-19 pandemic restrictions, a virtual Zoom meeting with northern community leadership was also conducted on September 28, 2020, in which the CNSC staff provided information on the application by Orano to expand the JEB TMF expansion and the 2019 regulatory oversight report. These information sessions were conducted prior to the presentation of the *Regulatory Oversight Report for Uranium Mines and Mills in Canada: 2019* [5] to the Commission at the December 10, 2020 CNSC public meeting.

Figure 5.1: CNSC outreach session – September, 2019

Source: CNSC

During public engagement activities, the CNSC often staffs an information booth to provide important information on its regulatory role and mandate, as well as to answer any questions that community members may have. The CNSC is committed to keeping interested communities informed of regulatory activities occurring at the uranium mines and mills and will continue to look for ways to enhance the involvement of interested groups.

Participant Funding

The CNSC made funding available through its PFP to assist Indigenous peoples, members of the public, and stakeholders in participating in the regulatory process for Orano's proposed licence amendment for the McClean Lake JEB TMF expansion and to provide value-added information to the Commission through informed and topic-specific interventions. This funding opportunity was offered to review Orano's application and associated documents and to prepare for and participate in the Commission's public hearing in September of 2021.

The deadline for applications was April 1, 2021. A Funding Review Committee (FRC), independent from CNSC staff, reviewed the applications received and made recommendations on the allocation of funding to eligible recipients. Based on the recommendations from the FRC, the CNSC awarded a total of C$105,680 in funding to the following recipients:

- Ya'thi Néné Lands and Resources Office
- English River First Nation
- Métis Nation-Saskatchewan

5.2.2 Conclusion

CNSC staff continued to inform the public of its regulatory activities through regular website updates, publicly webcast Commission proceedings, social media and regular face-to-face discussion with key audiences in Northern Saskatchewan.

CNSC staff encourage the public to participate in the Commission's public hearing. The CNSC offered assistance to interested members of the public, Indigenous groups, and other stakeholders, through the PFP, to prepare for and participate in the Commission's public hearing.

5.3 Cost Recovery

It is a requirement of the *Nuclear Safety and Control Act* under paragraph 24(2)(*c*), that the licence application is accompanied by the prescribed fee. The *CNSC Cost Recovery Fees Regulations* (CNSC CRFR) set out the specific requirements based on the activities to be licensed. A licensee for a uranium mines and mills licence is subject to "Part 2" of the CNSC CRFR, which is based on "Regulatory Activity Plan Fees".

5.3.1 Discussion

Orano is in good standing with respect to the CNSC CRFR requirements for their MLO. Orano's licence amendment application is not an initial application, and as such, the applicant is not required to submit the initial fee of C$25,000 as described in paragraph 7(1)(a) of the CNSC CRFR, which is only for initial applicants. In this case, Orano is subject to subsection 5(2) of the CNSC CRFR, which relates to quarterly invoices sent to licensees.

5.3.2 Conclusion

After assessing CNSC records, CNSC staff conclude that Orano is in good standing with respect to MLO meeting CNSC CRFR requirements.

No licence condition is required for this matter.

5.4 Financial Guarantees

Under subsection 24(5) of the *Nuclear Safety and Control Act*, Orano is required to provide a financial guarantee in a form that is acceptable to the Commission. *General Nuclear Safety and Control Regulations*, paragraph 3(1)(*l*) stipulates that, "an application for a licence shall contain a description of any proposed financial guarantee related to the activity for which a licence application is submitted." The CNSC's Regulatory Guide G-206, *Financial Guarantees for the Decommissioning of Licensed Activities* covers the provision of financial guarantees for decommissioning activities.

5.4.1 Discussion

As discussed in subsection 3.5.1, Orano has revised their PDP and cost estimate for the MLO. The revised plan was prepared based on a "decommission tomorrow" scenario and covered all decommissioning costs. Orano proposed a revised financial guarantee of **C$102,098,000**, which was reviewed by CNSC staff. This amount is a decrease from the previously held financial guarantee of C$107,241,000. This decrease of $5.1M is mainly due to the:

- tailings volume in the JEB TMF, which has displaced the total volume of waste rock that was required to backfill the JEB TMF to surface during decommissioning
- reduction in camp and operation costs.

CNSC staff and SMOE officials reviewed the proposed revisions and concluded that the revised PDP including cost estimates and FGs meet regulatory requirements [9].

The Government of Saskatchewan, under *The Mineral Industry Environmental Protection Regulations, 1996*, also requires that mining and milling projects be covered by financial guarantees. The provincial review of Orano's PDP and cost estimate is independent of CNSC staff's review. The MOU [21] between CNSC and the province allows a single PDP and financial assurance, subject to consultation and mutual acceptance. The MOU also specifies that the financial guarantee is conditional until approved by the Commission. The SMOE is the beneficiary of the financial guarantee for all the operating and decommissioned uranium mines and mills, and is the owner of the lands.

As a financial guarantee instrument, Orano continues to use letters of credit and surety bonds previously accepted by the Commission and in accordance with CNSC's Regulatory Guide G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*. The financial guarantee covers the MLO and the Midwest Project and the value of the financial guarantee is split between Orano and Denison Mines Corp. as joint venture agreements and according to their share of ownership (Orano 77.5% and Denison 22.5%). Orano has provided copies of letters of credit and surety bond for the current financial guarantee of C$107,241,000 in place to the CNSC [24] and confirmed that Orano does not intend to change the types of financial instruments when updating the amounts for the proposed financial guarantee of **C$102,098,000**.

5.4.2 Conclusion

CNSC staff have reviewed the proposed revisions and concluded that the revised PDP including cost estimates and financial guarantees meet regulatory requirements of CNSC's Regulatory Guide *G-206, Financial Guarantees for the Decommissioning of Licensed Activities*. CNSC staff are satisfied Orano's proposed financial guarantee is adequate for decommissioning of the MLO and recommend that the Commission accept Orano's proposed financial guarantee in the amount of **C$102,098,000**.

5.4.3 Recommendation

One condition in the proposed licence is associated with financial guarantees. Licence condition G.3, Financial Guarantees, requires Orano to maintain a financial guarantee for decommissioning that is acceptable to the Commission.

CNSC staff recommend that the existing licence condition remain.

5.5 Public Information and Disclosure

A Public Information and Disclosure Program (PIDP) is a regulatory requirement for licence applicants and licensees of Class I nuclear facilities, uranium mines and mills and certain Class II nuclear facilities. These requirements are found in CNSC's REGDOC-3.2.1, *Public Information and Disclosure*.

The primary goal of the PIDP 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.

The program must include a commitment to and protocol for ongoing, timely communication of information related to the licensed facility during the course of the licence period.

Orano has demonstrated their commitment to disseminating appropriate and timely health and safety information to the public and community members through face-to-face and virtual meetings, website and social media, and paid advertisements, along with community public surveying each year.

5.5.1 Discussion

Orano is required under their licence to maintain a PIDP as per CNSC's REGDOC-3.2.1.

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

- identifies clear goals and objectives in terms of dissemination of information to three levels of target audiences including the Athabasca Basin Communities, the Northern Administrative District and the province of Saskatchewan
- is available to the public and is posted on the licensee's website
- provides information on the facilities requiring a CNSC licence for nuclear related activities.

Orano keeps their audiences informed in a variety of ways including:

- community information sessions, technical briefings, regular participation in the Northern Saskatchewan Environmental Quality Committee, social media, and website
- targeting multiple audiences including the impacted communities as well as the broader regions
- providing contact information for those who want to obtain additional information.

Improvements to PIDP during the current licence period

Orano conducts periodic public opinion surveys to help gain insight into specific community interests based on the geographical distribution of the population of northern Saskatchewan. The data collected from opinion surveys serves as a baseline to identify areas of interest among the distributed population and to support modern communication practices. Communication products are created and distributed to local audiences in English, Cree and Dene. Orano staff periodically visit local communities, which may be to host an open house or to participate in community-led events. Orano representatives use these opportunities to share information about their projects and activities. When relevant and appropriate, Orano provides Dene and Cree interpretation services during meetings and for advertisements of upcoming events. Orano does this through radio announcements, news advertisements, and posters displayed in public locations such as the main stores and community centres.

Social media has evolved significantly during the current licence period and Orano has increased their online presence. As identified by their target audience polling, using a variety of social media platforms is beneficial to communicate directly to some primary audiences. Orano uses these online tools to share information and monitor their public environment.

Proposed improvements

Orano is encouraged to complete more frequent reviews and updating of their PIDP to adapt communications programming to suit the needs of their multiple audiences. Although the licensee has heavily weighted the use of regular face-to-face meetings in the past, CNSC staff expect a significant increase in online meeting availabilities in the future.

CNSC staff also expect the licensee to conduct a yearly review of the disclosure protocol with the impacted communities to ensure the commitment maintains relevance and importance to those communities.

5.5.2 Conclusion

CNSC staff conclude that Orano's PIDP for the MLO meets the regulatory requirements of CNSC's RD/GD-99.3, *Public Information and Disclosure*. CNSC staff continue to oversee Orano's implementation of the PIDP to ensure that Orano meets their obligations regarding disseminating and notifying their target audiences of operational changes, and impacts on health, safety and the environment specific to their licensed activities. CNSC staff also encourage Orano to update their PIDP on a regular basis to meet the changing information needs of target audiences and conduct thorough evaluation of social media channels to ensure they are meeting the needs of the McClean Lake target audiences.

5.5.3 Recommendation

One condition in the proposed licence is associated with public information and disclosure. Licence condition G.4, Public Information and Disclosure, requires Orano to implement and maintain a public information and disclosure program. Compliance verification criteria for this licence condition are provided in the draft licence conditions handbook (LCH). CNSC staff recommend that the existing licence condition remain.

6. OVERALL CONCLUSIONS AND RECOMMENDATIONS

CNSC staff conclusions and recommendations consider an assessment of Orano's licence amendment application and supporting documentation for the JEB TMF expansion. Orano has programs, resources, and measures in place at the MLO to ensure the health and safety of persons and the environment and of the measures related to security and Canada's international obligations.

6.1 Overall Conclusions

CNSC staff reviewed Orano's licence amendment application and supporting documents and has concluded that Orano meets CNSC's regulatory requirements.

6.2 Overall Recommendations

CNSC staff recommend that the Commission:

1. Conclude that Orano, pursuant to subsection 24(4) of the *Nuclear Safety and Control Act*, is qualified to carry out the activities authorized by the uranium mine and mill operating licence.

2. Amend the McClean Lake Licence UMOL-MINEMILL-McCLEAN.01/2027 as put forward in this CMD.

3. Accept the proposed revised financial guarantee amount for Orano's McClean Lake Operation for decommissioning.

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GLOSSARY

For definitions of terms used in this document, see *CNSC's REGDOC-3.6, Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

ACRONYMS

Additional items and acronyms used in the CMD are listed below:

Acronym	Term
AECB	Atomic Energy Control Board
ALARA	As low as reasonably achievable
AREVA	AREVA Resources Canada Inc.
BE	Below expectations
CA	Complementary access
CDA	Canadian Dam Association
CEAA	*Canadian Environmental Assessment Act*
CMD	Commission member document
CNSC	Canadian Nuclear Safety Commission
COPC	Contaminants of potential concerns
CRFR	*Cost Recovery Fees Regulation*
CSA	CSA Group (formerly Canadian Standards Association)
EA	Environmental assessment
EIR	Event initial report
EMP	Environmental monitoring program
EPR	Environmental protection review
ERA	Environmental risk assessment
FDM	Facility description manual
FHA	Fire Hazard Assessment
FPP	Fire protection program
FRC	Funding review committee
FS	Fully satisfactory
IAEA	International Atomic Energy Agency
IMS	Integrated management system
JEB	John Everett Bates
Kg	Kilogram

kPa	Kilopascals
L	Litre
LCH	Licence conditions handbook
mASL	Metres above sea level
MCM	Million cubic metres
MLO	McClean Lake Operation
MOU	Memorandum of Understanding
m/s	Metres per second
mSv	Millisievert
NP	Net percolation
NSCA	*Nuclear Safety and Control Act*
Orano	Orano Canada Inc.
PAD	Personal alpha dosimeter
PDP	Preliminary decommissioning plan
PFP	Participant funding program
PIDP	Public Information and Disclosure Program
QC/QA	Quality Control/Quality Assurance
RCOP	Radiation Code of Practice
REGDOC	Regulatory document
RP	Radiation Protection
SA	Satisfactory
SCA	Safety and control area
SMOE	Saskatchewan Ministry of Environment
TMTID	Tailings Management Technical Information Document
TMF	Tailings management facility
TOVP	Tailings optimization and validation plan
UA	Unacceptable
µg	Microgram
WTP	Water treatment plant

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 CSA 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 safety and 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. BASIS FOR THE RECOMMENDATION(S)

C.1 Regulatory Basis

The recommendations presented in this CMD are based on compliance objectives and expectations associated with the relevant SCAs and other matters. The regulatory basis for the matters that are relevant to this CMD are as follows.

Management System

The regulatory foundation for the recommendation(s) associated with management system includes the following:

- The *General Nuclear Safety and Control Regulations* requires that an application for a licence shall contain, under paragraph:
  - 3(1)(*k*), the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under section 15 that every applicant for a licence and every licensee shall notify the Commission of:
  - 15(*a*), the persons who have the authority to act for them (the applicant/licensee) in their dealings with the Commission.
  - 15(*b*), the names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence.
  - 15(c), any change in the information referred to in paragraphs (a) and (b) within 15 days after the change occurs.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (b) in relation to the activity to be licensed:
  - 3(b)(v), the proposed quality assurance program for the activity.

Human Performance Management

The regulatory foundation for the recommendation(s) associated with human performance management includes the following:

- It is a requirement of the *General Nuclear Safety and Control Regulations* under section 12, that every licensee shall:
  - 12(1)(*a*), ensure the presence of a sufficient number of qualified workers to carry on the licensed activity safely and in accordance with the Act, the regulations made under the Act and the licence.
  - 12(1)(*b*), train the workers to carry on the licensed activity in accordance with the Act, the regulations made under the Act and the licence.
  - 12(1)(*e*), require that every person at the site of the licensed activity to use equipment, devices, clothing and procedures in accordance with the Act, the regulations made under the Act and the licence.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (d) in relation to health and safety:
  - 3(d)(v), proposed training program for workers.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 10, in relation to operating procedures:
  - 10(b), that every licensee shall train its workers to perform their work in accordance with operating procedures.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 15, in relation to training program:
  - 15(1), that where a worker successfully completes the training program in basic radiation health and safety referred to in a licence, the licensee shall issue to the worker a certificate indicating that the worker has completed a training program in basic radiation health and safety that is acceptable to the Commission.
  - 15(2), that every licensee shall provide a copy of the training program referred to in the licence to a worker's representative.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 16, in relation to records to be kept and made available:
  - 16(1)(k), that every licensee shall keep a record of the training received by each worker.
  - 16(3), that every licensee shall retain a record of the training referred to in paragraph (1)(k) for the period that the worker is employed at the uranium mine or mill.

Operating Performance

The regulatory foundation for the recommendation(s) associated with operating performance SCA includes the following:

- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 29(1), that every licensee who becomes aware of any of the following situations shall immediately make a preliminary report to the Commission of the location and circumstances of the situation and of any action that the licensee has taken or proposes to take with respect to it:
  - 29(1)(a), a situation referred to in paragraph 27(b) of the Act.
  - 29(1)(b), the occurrence of an event that is likely to result in the exposure of persons to radiation in excess of the applicable radiation dose limits prescribed by the *Radiation Protection Regulations*.
  - 29(1)(c) a release, not authorized by the licence, of a quantity of radioactive nuclear substance into the environment.
  - 29(1)(d), a situation or event that requires the implementation of a contingency plan in accordance with the licence.
  - 29(1)(f), information that reveals the incipient failure, abnormal degradation or weakening of any component or system at the site of the licensed activity, the failure of which could have a serious adverse effect on the environment or constitutes or is likely to constitute or contribute to a serious risk to the health and safety of persons or the maintenance of security.
  - 29(1)(h), a serious illness or injury incurred or possibly incurred as a result of the licensed activity.
  - 29(1)(i) the death of any person at a nuclear facility.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 29(2), that every licensee who becomes aware of a situation referred to in subsection (1) shall file a full report of the situation with the Commission within 21 days after becoming aware of it, unless some other period is specified in the licence, and the report shall contain the following information:
  - 29(2)(a), the date, time and location of becoming aware of the situation.
  - 29(2)(b), a description of the situation and the circumstances.
  - 29(2)(c), the probable cause of the situation.
  - 29(2)(d), the effects on the environment, the health and safety of persons and the maintenance of security that have resulted or may result from the situation.
  - 29(2)(e), the effective dose and equivalent dose of radiation received by any person as a result of the situation.
  - 29(2)(f), the actions that the licensee has taken or proposes to take with respect to the situation.

- It is a requirement of the *Uranium Mines and Mills Regulations* under paragraphs 6(1)(a) and 6(2)(a), that an application for a licence in respect of a uranium mine and mill shall contain the results of any commissioning work.
- It is a requirement of the *Uranium Mines and Mills Regulations* under paragraphs 6(1)(c) that an application for a licence in respect of a uranium mine and mill shall contain the proposed policies, methods and programs for operating and maintaining the mine.
- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 10(a), that every licensee shall establish, implement and maintain written operating procedures for the licensed activity.

Safety Analysis

The regulatory foundation for the recommendation(s) associated with safety analysis includes the following:

- 3(1)(i) of the *General Nuclear Safety and Control Regulations* requires that an application for a licence shall contain a description and the results of any test, analysis or calculation performed to substantiate the information included in the application.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (c) in relation to the environment and waste management, and (d) health and safety:
  - 3(c)(iii), effects on the environment that may result from the activity to be licensed and the measures that will be taken to prevent or mitigate those effects.
  - 3(d)(i) the effects on the health and safety of persons that may result from the activity to be licensed, and the measures that will be taken to prevent or mitigate those effects.

Physical Design

The regulatory foundation for the recommendation(s) associated with physical design includes the following:

- Paragraph 3(1)(d) of the *General Nuclear Safety and Control Regulations* requires that an application for a licence shall contain a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (a) in relation to the plan and description of the mine or mill:

- 3(a)(ii), a surface plan indicating the boundaries of the mine or mill and the area where the activity to be licensed is proposed to be carried on.
- 3(a)(iii), a plan showing existing and planned structures, excavations and underground development.
- 3(a)(iv) a description of the mine or mill, including the installations, its purpose and capacity, and any excavations and underground development.

- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 5(2), that an application for a licence to prepare a site for and construct a uranium mill shall contain the following information in addition to the information required by section 3 and subsection 4(2):
  - 5(2)(h), a description of all proposed laboratory facilities and programs.
- It is a requirement of the *Uranium Mines and Mills Regulations* under paragraphs 6(1)(b) and 6(2)(b), that an application for a licence to operate a uranium mine and mill shall contain a description of the structures, components, systems and equipment including any changes to its design and its design operating conditions as a result of the commissioning.
- It is a requirement of the *Uranium Mines and Mills Regulations* under paragraphs 16(1)(e) that every licensee shall keep a record of the design of the uranium mine or mill and of the components and systems installed at the mine or mill.

Fitness for Service

The regulatory foundation for the recommendation(s) associated with fitness for service includes the following:

- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (a) in relation to the plan and description of the mine or mill:
  - 3(a)(vii), a description of the design of and the maintenance program for every eating area.
- It is a requirement of the *Uranium Mines and Mills Regulations* under paragraphs 16(1)(a) and 16(1)(h), that every licensee shall keep a record of its operating and maintenance procedures and the inspections and maintenance carried out in accordance with the licence or the regulations made under the Act.

Radiation Protection

The regulatory foundation for the recommendation(s) associated with radiation protection includes the following:

- The *General Nuclear Safety and Control Regulations* require, under subsection 3(1), that a licence application contain the following information under paragraphs:
  - 3(1)(*e*), the proposed measures to ensure compliance with the *Radiation Protection Regulations*.
  - 3(1)(*f*), any proposed action level for the purpose of section 6 of the *Radiation Protection Regulations*.
- The *General Nuclear Safety and Control Regulations* require, under subsection 17(b), that a worker comply with the measures established by the licensee to protect the environment and the health and safety of persons, maintain security, control the levels and doses of radiation, and control releases of radioactive nuclear substances and hazardous substances into the environment.
- It is a requirement for uranium mines and mills licensee to follow the *Radiation Protection Regulations*.
- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 4(2), that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain a proposed code of practice that includes:
  - 4(2)(a), any action level that the applicant considers appropriate for the purpose of this subsection.
  - 4(2)(b), a description of any action that the applicant will take if an action level is reached.
  - 4(2)(c), the reporting procedures that will be followed if an action level is reached.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 9, that every licensee shall post a copy of the code of practice referred to in the licence at a location within the uranium mine or mill that is accessible to all workers and where it is most likely to come to their attention.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 13, that no licensee shall rely on the use of a respirator to comply with the *Radiation Protection Regulations* unless the use of the respirator:
  - 13(a), is for a temporary or unforeseen situation.
  - 13(b), is permitted by the code of practice referred to in the licence.

- It is a requirement of the *Uranium Mines and Mills Regulations* under section 14, that every licensee shall:
  - 14(a), post signs at all entrances to each area where the dose rate of gamma radiation exceeds 25 µSv/h, designating the area as a radiation area and indicating the dose rate of gamma radiation in that area.
  - 14(b), provide every worker who is to enter an area where the dose rate of gamma radiation exceeds 100 µSv/h with a direct-reading dosimeter.
- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 16(1), that every licensee shall keep a record of:
  - 16(1)(f), the method and relevant data used to ascertain the doses of radiation received by the workers at the uranium mine or mill and the intake of radioactive nuclear substances by those workers.

Conventional Health and Safety

The regulatory foundation for the recommendation(s) associated with conventional health and safety includes the following:

- The *General Nuclear Safety and Control Regulations* require, under paragraph 12(1)(c), that every licensee shall take all reasonable precautions to protect the environment and the health and safety of persons and to maintain the security of nuclear facilities and of nuclear substances.
- The *General Nuclear Safety and Control Regulations* require, under subsection 16(1), that every licensee shall make available to all workers the health and safety information with respect to their workplace that has been collected by the licensee in accordance with the Act, the regulations made under the Act and the licence.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under section 17, that every worker shall:
  - 17(a), use equipment, devices, facilities and clothing for protecting the environment or the health and safety of persons, or for determining doses of radiation, dose rates or concentrations of radioactive nuclear substances, in a responsible and reasonable manner and in accordance with the Act, the regulations made under the Act and the licence.
  - 17(b), comply with the measures established by the licensee to protect the environment and the health and safety of persons, maintain security, control the levels and doses of radiation, and control releases of radioactive nuclear substances and hazardous substances into the environment.
  - 17(c)(i), promptly inform the licensee or the worker's supervisor of any situation in which the worker believes there may be a significant increase in the risk to the environment or the health and safety of persons.
  - 17(e), take all reasonable precautions to ensure the worker's own safety, the safety of the other persons at the site of the licensed activity, the protection of the environment, the protection of the public and the maintenance of the security of nuclear facilities and of nuclear substances.

- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (d) in relation to health and safety:
  - 3(d)(i), the effects on the health and safety of persons that may result from the activity to be licensed, and the measures that will be taken to prevent or mitigate those effects.
  - 3(d)(ii), the proposed program for selecting, using and maintaining personal protective equipment.
  - 3(d)(iii), the proposed worker health and safety policies and programs.
- Orano's McClean Lake Operation activities and operations must comply with the *Canada Labour Code*, Part II: *Occupational Health and Safety*.

Environmental Protection

The regulatory foundation for the recommendation(s) associated with environmental protection includes the following:

- The *General Nuclear Safety and Control Regulations*, under paragraphs 12(1)(c) and (f), require that each licensee take all reasonable precautions to protect the environment and the health and safety of persons, and to control the release of radioactive nuclear substances and hazardous substances within the site of the licensed activity and into the environment.
- The *Radiation Protection Regulations* prescribe dose limits for the general public, which under subsection 1(3) is 1 mSv per calendar year.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under section 17, that every worker shall:
  - 17(a), use equipment, devices, facilities and clothing for protecting the environment or the health and safety of persons, or for determining doses of radiation, dose rates or concentrations of radioactive nuclear substances, in a responsible and reasonable manner and in accordance with the Act, the regulations made under the Act and the licence.
  - 17(b), comply with the measures established by the licensee to protect the environment and the health and safety of persons, maintain security, control the levels and doses of radiation, and control releases of radioactive nuclear substances and hazardous substances into the environment.
  - 17(c)(i), promptly inform the licensee or the worker's supervisor of any situation in which the worker believes there may be a significant increase in the risk to the environment or the health and safety of persons.
  - 17(e), take all reasonable precautions to ensure the worker's own safety, the safety of the other persons at the site of the licensed activity, the protection of the environment, the protection of the public and the maintenance of the security of nuclear facilities and of nuclear substances.

- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (c) in relation to the environment and waste management:
  - 3(c)(ii), the program to determine the environmental baseline characteristics of the site and the surrounding area.
  - 3(c)(iii), effects on the environment that may result from the activity to be licensed and the measures that will be taken to prevent or mitigate those effects.
  - 3(c)(iv), the proposed positions for and qualifications and responsibilities of environmental protection workers.
  - 3(c)(v), the proposed environmental protection policies and programs.
  - 3(c)(vi), the proposed effluent and environmental monitoring programs.
  - 3(c)(vii), the proposed location, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including its physical, chemical and radiological characteristics.
  - 3(c)(viii), the proposed measures to control releases of nuclear substances and hazardous substances into the environment.
  - 3(c)(ix), a description of the anticipated liquid and solid waste streams within the mine or mill, including the ingress of fresh water and any diversion or control of the flow of uncontaminated surface and groundwater.
- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 4(2), that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain a proposed code of practice that includes:
  - 4(2)(a), any action level that the applicant considers appropriate for the purpose of this subsection.
  - 4(2)(b), a description of any action that the applicant will take if an action level is reached.
  - 4(2)(c), the reporting procedures that will be followed if an action level is reached.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 9, that every licensee shall post a copy of the code of practice referred to in the licence at a location within the uranium mine or mill that is accessible to all workers and where it is most likely to come to their attention.
- The McClean Lake Operation operating licence requires Orano to control, monitor and record releases of effluent concentrations from the facility and that the releases shall not exceed the limits found in the licence.

Emergency Management and Fire Protection

The regulatory foundation for the recommendation(s) associated with emergency management and response includes the following:

- 12(1)(c) of the *General Nuclear Safety and Control Regulations* states that every licensee shall take all reasonable precautions to protect the environment and the health and safety of persons and to maintain security.

  12(1)(f) of the *General Nuclear Safety and Control Regulations* states that every licensee shall take all reasonable precautions to control the release of radioactive nuclear substances or hazardous substances within the site of the licensed activity and into the environment of the licensed activity.

- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (a) in relation to the plan and description of the mine or mill:
  - 3(a)(ix), a description of the proposed emergency power systems and its capacities.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (c) in relation to the environment and waste management:
  - 3(c)(viii), the proposed measures to control releases of nuclear substances and hazardous substances into the environment.
  - 3(c)(x), the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of security, including measures to:
    - 3(c)(x)(A), assist off-site authorities in planning and preparing to limit the adverse effects of an accidental release.
    - 3(c)(x)(B), notify off-site authorities of an accidental release or the imminence of an accidental release.
    - 3(c)(x)(C), report information to off-site authorities during and after an accidental release.
    - 3(c)(x)(D), assist off-site authorities in dealing with the adverse effects of an accidental release.
    - 3(c)(x)(E), test the implementation of the measures to control the adverse effects of an accidental release.

Waste Management

The regulatory foundation for the recommendation(s) associated with waste management includes the following:

It is a requirement of the *General Nuclear Safety and Control Regulations* under paragraph 3(1)(j) that an application for a licence include the name, quantity, form and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste.

- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, (c) in relation to the environment and waste management:
  - 3(c)(ix), a description of the anticipated liquid and solid waste streams within the mine or mill, including the ingress of fresh water and any diversion or control of the flow of uncontaminated surface and ground water.
- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 6(1), that an application for a licence to operate a uranium mine shall contain the following information in addition to the information required by section 3 and subsection 4(2):
  - 6(1)(c), the proposed policies, methods and programs for operating and maintaining the mine.
- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 5(2), that an application for a licence to prepare a site for and construct a uranium mill shall contain the following information in addition to the information required by section 3 and subsection 4(2):
  - 5(2)(f), a description of the proposed design, construction and operation of the waste management system, including the measures to monitor its construction and operation, the construction schedule, the contingency plans for construction and the measures to control the movement of water in existing waterways.
- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 6(2), that an application for a licence to operate a uranium mill shall contain the following information in addition to the information required by section 3 and subsection 4(2):
  - 6(2)(c), the proposed policies, methods and programs for operating and maintaining the mill.
  - 6(2)(g), a description of the proposed operation of the waste management system.

- It is a requirement of the *Uranium Mines and Mills Regulations* under subsection 16(1), that every licensee shall keep a record of:
  - 16(1)(d), the plans of every tailings-containment structure and area and every diversion structure and system associated with the waste management system.

Security

The regulatory foundation for the recommendation(s) associated with security includes the following:

- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 3(1), that an application for a licence shall contain the following information:
  - 3(1)(g), the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information.
  - 3(1)(h), the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 12(1), that every licensee shall:
  - 12(1)(g), implement measures for alerting the licensee to the illegal use or removal of a nuclear substance, prescribed equipment or prescribed information, or the illegal use of a nuclear facility.
  - 12(1)(h), implement measures for alerting the licensee to acts of sabotage or attempted sabotage anywhere at the site of the licensed activity.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under section 17, that every worker shall:
  - 17(c), promptly inform the licensee or the worker's supervisor of any situation in which the worker believes there may be:
  - 17(c)(ii), a threat to the maintenance of the security of nuclear facilities and of nuclear substances or an incident with respect to such security.
  - 17(c)(iv), an act of sabotage, theft, loss or illegal use or possession of a nuclear substance, prescribed equipment or prescribed information.

- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 29(1), that every licensee who becomes aware of any of the following situations shall immediately make a preliminary report to the Commission of the location and circumstances of the situation and of any action that the licensee has taken or proposes to take with respect to it:
  - 29(1)(f), information that reveals the incipient failure, abnormal degradation or weakening of any component or system at the site of the licensed activity, the failure of which could have a serious adverse effect on the environment or constitutes or is likely to constitute or contribute to a serious risk to the health and safety of persons or the maintenance of security.
  - 29(1)(g), an actual, threatened or planned work disruption by workers.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 29(2), that every licensee who becomes aware of a situation referred to in subsection (1) shall file a full report of the situation with the Commission within 21 days after becoming aware of it, unless some other period is specified in the licence, and the report shall contain the following information:
  - 29(2)(d), the effects on the environment, the health and safety of persons and the maintenance of security that have resulted or may result from the situation.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*:
  - 3(e) in relation to security, the proposed measures to alert the licensee to acts of sabotage or attempted sabotage at the mine or mill.

Safeguards and Non-Proliferation

The regulatory foundation for the recommendation(s) associated with safeguards and non-proliferation includes the following:

- It is a requirement of the *General Nuclear Safety and Control Regulations* under paragraph 12(1)(i) that each licensee take all necessary measures to facilitate Canada's compliance with any applicable safeguards agreement.
- Under subsection 21(1) of the *General Nuclear Safety and Control Regulations*, information that concerns any of the following, including a record of that information, is prescribed information for the purposes of the Act:
  - 21(1)(a), a nuclear substance that is required for the design, production, use, operation or maintenance of a nuclear weapon or nuclear explosive device, including the properties of the nuclear substance.
  - 21(1)(b), the design, production, use, operation or maintenance of a nuclear weapon or nuclear explosive device.

- 21(1)(c), the security arrangements, security equipment, security systems and security procedures established by a licensee in accordance with the Act, the regulations made under the Act or the licence, and any incident relating to security.
- 21(1)(d), the route or schedule for the transport of Category I, II or III nuclear material, as defined in section 1 of the *Nuclear Security Regulations.*

- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 30(1), that every licensee who becomes aware of any of the following situations shall immediately make a preliminary report to the Commission of the situation and of any action that the licensee has taken or proposes to take with respect to it:
  - 30(1)(a), interference with or an interruption in the operation of safeguards equipment or the alteration, defacement or breakage of a safeguards seal, other than in accordance with the safeguards agreement, the Act, the regulations made under the Act or the licence.
  - 30(1)(b), the theft, loss or sabotage of safeguards equipment or samples collected for the purpose of a safeguards inspection, damage to such equipment or samples, or the illegal use, possession, operation or removal of such equipment or samples.
- It is a requirement of the *General Nuclear Safety and Control Regulations* under subsection 30(2), that every licensee who becomes aware of a situation referred to in subsection (1) shall file a full report of the situation with the Commission within 21 days after becoming aware of it, unless some other period is specified in the licence, and the report shall contain the following information:
  - 30(2)(a), the date, time and location of becoming aware of the situation.
  - 30(2)(b), a description of the situation and the circumstances.
  - 30(2)(c), the probable cause of the situation.
  - 30(2)(d), the adverse effects on the environment, the health and safety of persons and the maintenance of national and international security that have resulted or may result from the situation.
- The Agreement between the Government of Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the *Treaty on the Non-Proliferation of Nuclear Weapons*.
- The Protocol Additional to the Agreement between Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the *Treaty on the Non-Proliferation of Nuclear Weapons*.

Packaging and Transport

Orano's McClean Lake Operation is required to comply with the *Packaging and Transport of Nuclear Substances Regulations 2015* and Transport Canada's *Transportation of Dangerous Goods Regulations*.

Decommissioning Strategy and Financial Guarantees

The regulatory foundation for the recommendation(s) associated with Orano's "McClean Lake Operation Decommissioning Strategy and Financial Guarantees" includes:

- The *General Nuclear Safety and Control Regulations* requires under paragraph 3(1)(l) that a licence application contains a description of any proposed financial guarantee relating to the activity to be licensed.
- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, in relation to the plan and description of the mine or mill:
  - 3(a)(viii), the proposed plan for the decommissioning of the mine or mill.

Licensee's Public Information Program

- It is a requirement of the *Uranium Mines and Mills Regulations* under section 3, that an application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*, in relation to the environment and waste management:
  - 3(c)(i), the program to inform persons living in the vicinity of the mine or mill of the general nature and characteristics of the anticipated effects of the activity to be licensed on the environment and the health and safety of persons.

C.2 Technical Basis

The technical basis for recommendations, including several guidance documents, national standards and regulatory documents has been presented in this CMD and is addressed in detail in the LCH.

D. SAFETY AND CONTROL AREA FRAMEWORK

D.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 3.5 and 4.1 through 4.9 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 sections 3 and 4 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.
	Fitness for service	Covers activities that impact on the physical condition of systems, components and structures to ensure that they remain effective over time. This includes programs that ensure all equipment is available to perform its intended design function when called upon to do so.

SAFETY AND CONTROL AREA FRAMEWORK		
Functional Area	**Safety and Control Area**	**Definition**
Core Control Processes	Radiation protection	Covers the implementation of a radiation protection program in accordance with the *Radiation Protection Regulations*. This program must ensure that contamination and radiation doses received are monitored and controlled.
	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 *Treaty on the Non-Proliferation of Nuclear Weapons*.
	Packaging and transport	Programs that cover the safe packaging and transport of nuclear devices to and from the licensed facility.

D.2 Specific Areas for this Facility Type

The following table identifies the specific areas that comprise each SCA for a uranium mine or mill:

SPECIFIC AREAS FOR THIS FACILITY TYPE		
Functional Area	**Safety and Control Area**	**Specific Areas**
Management	Operating performance	▪ Not addressed individually
Facility and Equipment	Safety analysis	▪ Hazard Analysis ▪ Safety Analysis of Containment Structure ▪ Severe Accident Analysis
	Physical design	▪ Site Characterization ▪ Structure Design ▪ Component Design
Core Control Processes	Environmental protection	▪ Effluent and Emissions Control (releases) ▪ Environmental Risk Assessment ▪ Long-term Assessment Under Normal Design Conditions ▪ Disruptive Event – Cover Erosion Scenario ▪ Assessment and Monitoring ▪ Protection of People
	Waste management	▪ Decommissioning Plans

E. ENVIRONMENTAL PROTECTION REVIEW REPORT

e-Doc # 6403796 (Word)

e-Doc # 6492969 (PDF)

Canada's Nuclear Regulator

ENVIRONMENTAL PROTECTION REVIEW REPORT:

Licence Amendment for the JEB TMF Expansion

June 2021

e-Doc: 6403796 (Word)
e-Doc: 6492969 (PDF)

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

REVISION HISTORY

The following table identifies the revision history of this document.

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

EXECUTIVE SUMMARY

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

This EPR report, written by CNSC staff for the Commission, Indigenous peoples and the public, describes the scientific, evidence-based findings of the EPR completed for the licence application by Orano Canada Inc. (Orano) to amend their current Uranium Mine Operation Licence – UMOLMINEMILL-McClean.01/2027 to allow for the expansion of the existing JEB tailings management facility (TMF) from the currently approved elevation of 457.5 meters above sea level (mASL) up to an elevation of 468 mASL. This expansion would allow for the height of the consolidated tailings to increase from 448 mASL to 462 mASL. To achieve this, Orano has also requested within the licence amendment to include the activity of modifying/expanding the outer perimeter of the JEB TMF to accommodate disposal of tailings to a consolidated tailings elevation of 462 mASL.

This EPR report includes CNSC staff's assessment of Orano's 2020 licence amendment application, Orano's 2019 JEB TMF Expansion (468 mASL) Notification and Project Description, Orano's response to CNSC staff comments on the Notification and Project Description.

The focus of this EPR report is on items of regulatory oversight and on typical topics of interest to Indigenous groups and members of the public related to the alterations to the nuclear facility involved with the proposed licence amendment, such as releases to the environment and human health protection.

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

- Orano's design and operation of the currently approved JEB TMF
- CNSC staff's assessment of Orano's proposed technical designs for the construction, operation and decommissioning of the JEB TMF expansion
- CNSC staff's assessment of Orano's environmental protection analyses for the JEB TMF expansion

The information provided in this EPR Report supports the conclusions made by CNSC staff in Commission Member Document (CMD) 21-H6. Based on the EPR conducted for this licence amendment application, CNSC staff conclude that the potential risks to human health and the environment from radiological and hazardous releases to the atmospheric, terrestrial, hydrogeological and aquatic environments from the proposed JEB TMF expansion are low to negligble. Risks to human health and the environment are considered low to negligble provided Orano implements mitigation measures, monitoring programs and commits to completion of additional analysis. Should the Commission decide to amend Orano's McClean Lake licence, CNSC staff will continue to verify and evaluate, through onoging licensing and compliance activities and reviews, that the environment and the health of persons are protected and will

continue to be protected throughout the construction, operation and decommissioning of the proposed JEB TMF expansion.

For more information on the McClean Lake Operation and Orano's licence amendment application, visit CNSC's webpage and Orano's webpage.

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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's review of licensing and environmental compliance activities conducted under the *Nuclear Safety and Control Act* (NSCA). These serve to determine whether the licensee Orano Canada Inc. (Orano), formerly Areva, has and will continue to make adequate provision for the protection of the environment and the health of persons.

This EPR Report supplements the environmental protection information detailed in CNSC staff CMD 21-H6 and supports staff's recommendations to the Commission for Orano's licence amendment application to allow for the expansion of the existing JEB tailings management facility (TMF) from the approved elevation of 457.5 meters above sea level (mASL) up to an elevation of 468 mASL [1].

1.2 Project Background

This section of the report provides general information on the proposed JEB TMF Expansion Project. This includes a description of the site location and the proposed licensing amendment. This information is intended to provide context for later sections of this report, which discuss CNSC staff's review of submitted documentation completed in support of the proposed licensing activity.

1.2.1 Site Description

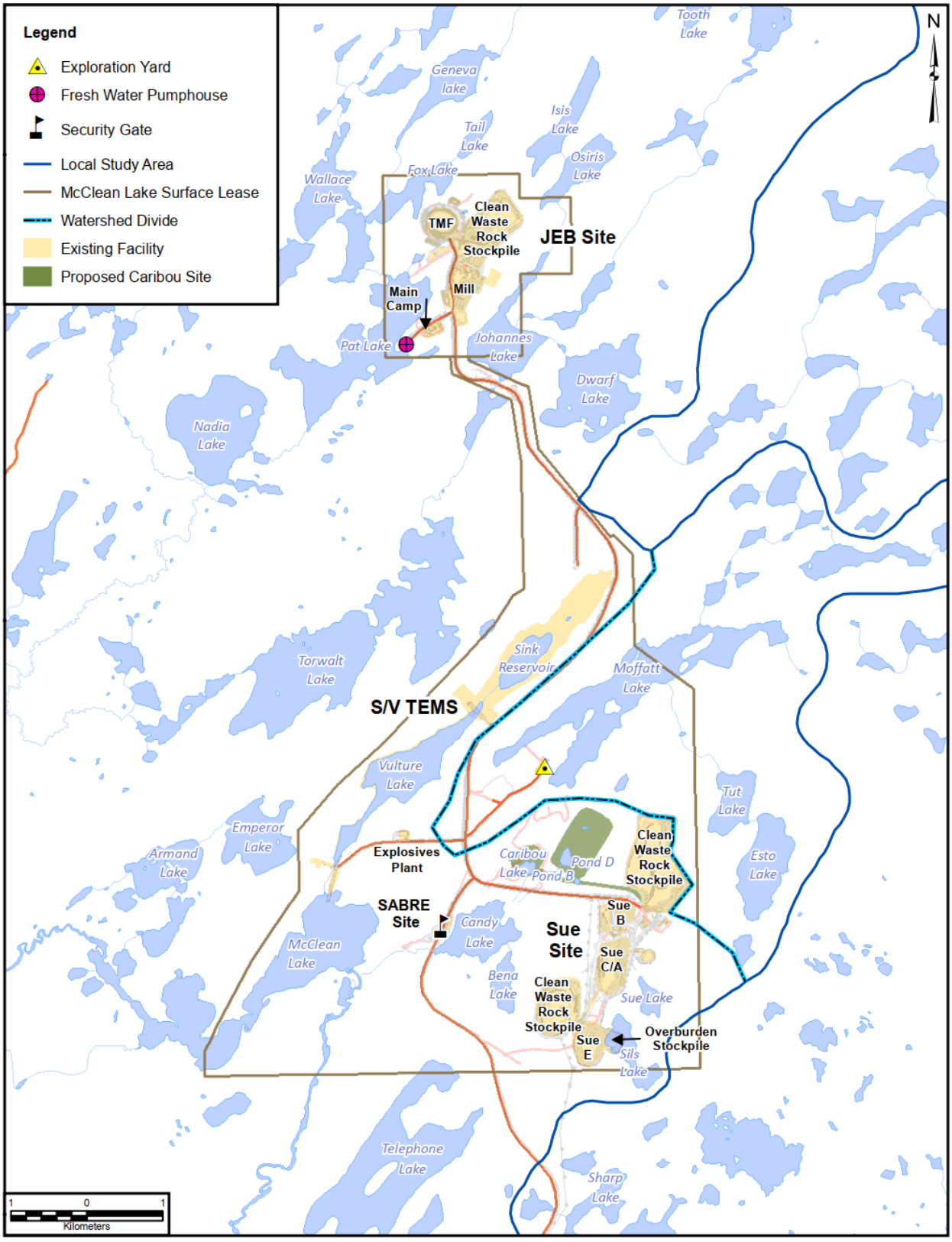
Orano's McClean Lake operation is located in the northern Saskatchewan about 750 km north-east of Saskatoon and 15 km west of Wollaston Lake (figure 1.1). The facility operations began in 1994, and mining and milling of uranium ore from the five open-pit mines has now been completed. No conventional mining has been conducted since 2008. The McClean Lake mill currently accepts uranium ore mined at the Cigar Lake Mine for processing.

The site consists of three main areas (figure 1.2):

- the JEB area which includes the permanent camp, the McClean Lake mill (previously referred to as the JEB mill), the JEB TMF, the clean waste rock management area, and the JEB water treatment plant (WTP)
- the Sue mining area which includes the mined out Sue A/C, Sue B, and Sue E pits, and the Sue WTP
- the Sink/Vulture Treated Effluent Management System (S/V TEMS) which includes Sink Reservoir and its control structure, Vulture Lake, and the effluent diffuser system which discharges effluent into the east basin of McClean Lake

Figure 1.1: Location of McClean Lake Operation [2]

Figure 1.2: McClean Lake Operation general site layout [3]



1.2.2 Project Overview

The current Uranium Mine Operation Licence – UMOLMINEMILL-McClean.01/2027 for the McClean Lake operation, was issued on July 1, 2017 and is valid for a period of 10 years, with an expiry date of June 30, 2027. The current licence allows Orano to operate the McClean Lake mill and the associated activities that arise as a part of processing uranium ore [4].

In November 2019, Orano submitted the JEB TMF Expansion (468 mASL) Notification and Project Description [3] to the CNSC outlining Orano's intent to modify/expand the embankment around the entire JEB TMF perimeter to an elevation of 468 mASL, from its currently approved elevation of 457.5 mASL. This proposal is to accommodate disposal of tailings of an additional 2.3 million m^3 to a consolidated tailings elevation of up to 462 mASL, from the currently approved consolidated tailings elevation of 448 mASL. Table 1.1 shows the different components of the JEB TMF and consolidated tailings with the current and proposed embankment elevations.

Table 1.1: Reference information for the current and proposed JEB TMF consolidated tailings and embankment elevation

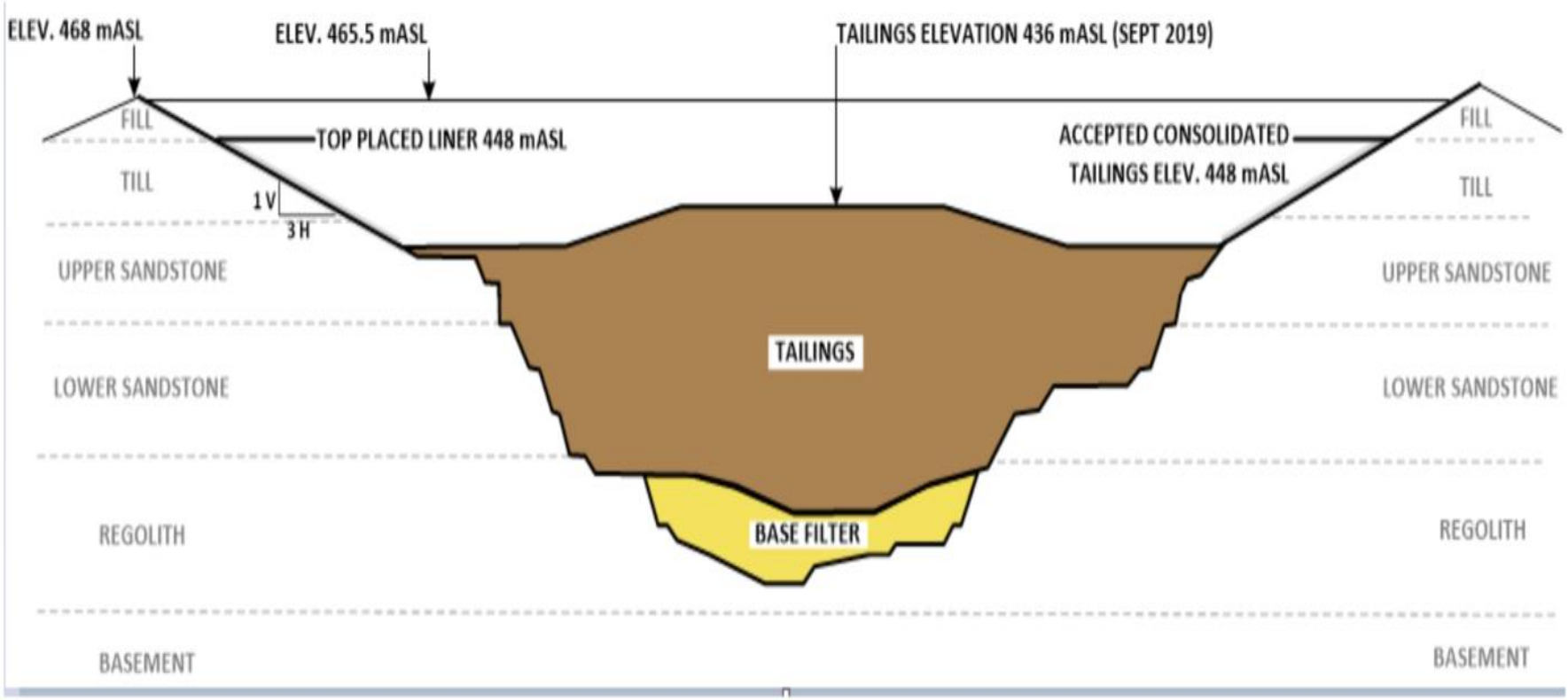
Component	Accepted embankment to 457.5 mASL	Proposed embankment to 468 mASL
Top of embankment	457.5 mASL	468 mASL
Top of placed tailings	452 mASL	465.5 mASL
Top of consolidated tailings	448 mASL	462 mASL
Created additional tailings capacity	1.5 million m^3	2.3 million m^3
Total volume of tailings capacity	4.6 million m^3	6.9 million m^3
Toe distance to high water mark of Fox Lake	58 m	10 m

A conceptual cross-section of the JEB TMF with the current and proposed elevations as they correspond to the consolidated tailings, is shown in figure 1.3. Other works included in the scope of this project are:

- placement of a processed waste rock/till bentonite-amended liner to contain the operating pond throughout operations
- update of the surface water management plan for management of Probable Maximum Precipitation (PMP) event runoff:
    - conduct modifications to the waste rock runoff pond and storm water storage pond
    - construction of a new mill site runoff pond for surface water management

- decommissioning of groundwater monitoring wells affected by the project footprint, modification or replacement of drift monitoring well(s) and installation of new groundwater monitoring wells
- decommissioning of the JEB TMF and placement of an engineered cover and vegetation cover to reduce net percolation to levels protective of the environment

Figure 1.3: Conceptual cross-section showing the JEB TMF consolidated tailings and the different elevations [3]



1.2.3 Previous and Ongoing Regulatory Oversight

The subsections below provide a summary of the regulatory history of the current operation of the JEB TMF and the proposed decommissioned state after operations cease. This information is provided to contextualize the potential effects of the 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] discussed in section 3 of this report.

JEB Tailings Management Facility Description – Current Operations

The JEB TMF contains the tailings that are generated by the milling of uranium ore or ore slurry at the McClean Lake mill. Tailings are the waste material and water that remains after the extraction of uranium from the mined ore or ore slurry. The extraction process includes leaching, decanting and clarifying the uranium solution before it is precipitated to form uranium concentrate or yellowcake. The tailings may include ground rock material, sand, clay, chemical residues from the ore milling process, residual radionuclides, metals and minerals, and waste water treatment plant sludge.

The tailings are neutralized and then pumped as a thickened slurry from the McClean Lake mill to the JEB TMF. The JEB TMF was previously an open pit mine excavated to extract uranium ore. Figure 1.4 displays a schematic cross section of a generic in-pit TMF, which following open pit mining is engineered to operate as a TMF. Figure 1.3 provides a conceptual cross section of the JEB TMF proposed expansion, which was initially constructed as an in-pit TMF. The tailings at the expanded JEB TMF will be contained largely within the sandstone layer and within a constructed embankment. A base filter of permeable sand or rock is constructed and a base drain installed which continually pumps water from the bottom of the facility, creating an inward and downward movement of groundwater into the TMF or a groundwater cone of depression. The containment of Constituents of Potential Concern (COPCs) within the TMF is confirmed via the regular sampling of groundwater monitoring wells located outside the TMF. At the McClean Lake Operation, the pumped water from the base drain to the surface via a raise well. The pumped water is then piped to the JEB WTP, where it is treated before being released to the S/V TEMS, which in turn discharges to the downstream surface water receiving environment of McClean Lake East and Collin’s Creek.

A water cover is maintained over the tailings (see figure 1.5) as a requirement of the operation and to prevent the release of contaminants from the tailings into the air. The method used for tailings placement results in the fine grained material migrating to the outside edge of the pit, creating a less pervious layer or “surround”. The pumping from the bottom drain to the raise well and the pervious surround prevents contaminants in the TMF from migrating outward into groundwater and surface water.

Figure 1.4: Schematic diagram of an in-pit TMF [5]

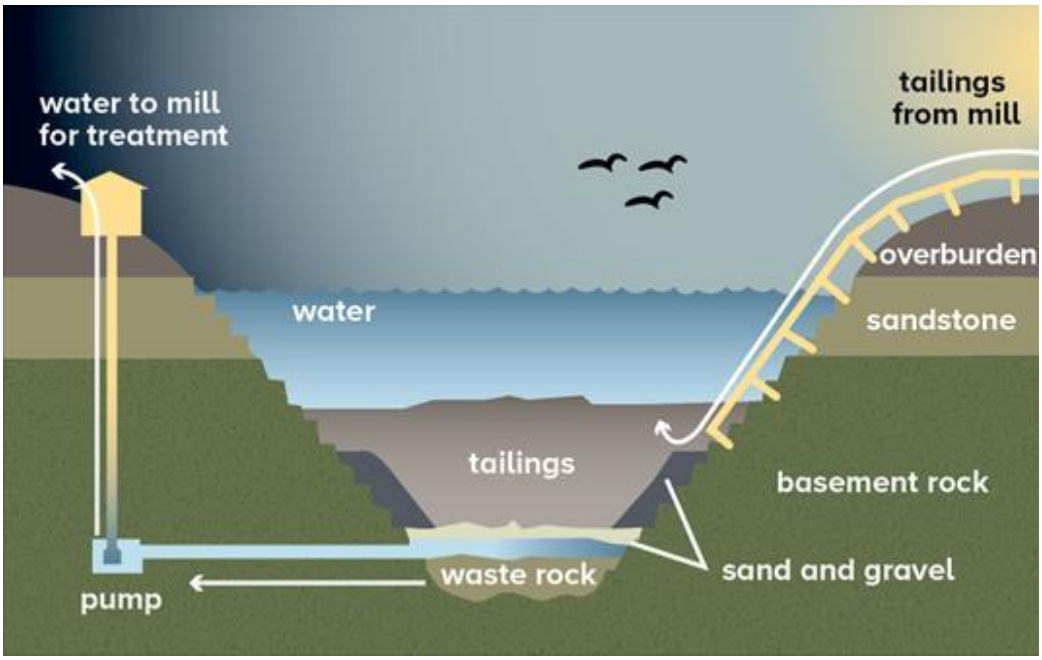


Figure 1.5: Aerial photograph of the JEB TMF Site [5]

In 2020, Orano completed an update to their Tailings Optimization and Validation Program (TOVP) Report. The TOVP assessments and future predictions were contained within the Tailings Management Technical Information Document (TMTID) [6] which was submitted to the CNSC for review. The current concentrations of COPCs in the tailings were assessed and modelling was completed to predict the concentrations of COPCs in the tailings over the long-

term, through the decommissioning period and for thousands of years into the future. The tailings are regularly sampled to assess the current concentrations of COPCs and the geochemistry of the tailings, which are used to predict mobility of the COPCs from the tailings into the tailings pore water. The TMTID included predictions of the post-decommissioning concentrations of COPCs in groundwater surrounding the JEB TMF and in surface water in the Pat Lake watershed as the groundwater COPCs will discharge to surface water features in this watershed over the long term.

Previous Applications for Expansion of the JEB Tailings Management Facility

Orano previously submitted a project description and request for expansion of the JEB TMF to 468 mASL to the CNSC in 2011. In November 2011, the CNSC determined that the project required a federal screening level environmental assessment (EA) under the *Canadian Environmental Assessment Act, 1992* [7], however following the coming into force of the *Canadian Environmental Assessment Act, 2012* [8] in July 2012, Orano was notified by the CNSC that the EA would no longer be required and the project would continue through the licensing process under the NSCA. Orano chose not to continue with the licensing process for the proposed expansion to 468 mASL.

In 2014, Orano revised its forecasted mine development plans which reduced the forecasted tailings volume. This reduction led to Orano revisiting the JEB TMF expansion project and in 2016, Orano submitted a revised project description with a lower elevation expansion for the JEB TMF to allow the top of the consolidated tailings to be 448 mASL, through the construction of an embankment to an elevation of 457.5 mASL.

The existing ground elevation of the top of the JEB TMF perimeter ranges from 448 mASL on the low side to 462 mASL on the high side. The 2016 approved and on-going expansion of the JEB TMF to an elevation of 457.5 mASL requires the construction of a 9.5 m embankment on a portion of the low side of the JEB TMF. During operation the tailings mass will be above the ground elevation (up to 457.5 mASL) and contained within a temporary engineered embankment, but at decommissioning, the final elevation of the tailings will be coincident with the ground elevation at 448 mASL after the tailings are dewatered and consolidated.

CNSC staff accepted the JEB TMF 2016 expansion as within the licensing basis because the accompanying Environmental Risk Assessment (ERA) indicated that the sandstone and clay liner surrounding the tailings mass up to the ground surface and the engineered cover on top of the tailings would limit COPCs infiltration into the groundwater. The predicted worst case concentrations of COPCs (metals and radionuclides) in surface water of the adjacent Fox and Pat Lakes after the closure and decommissioning of the JEB TMF remained similar to baseline concentrations, except for sulphate, ammonia, arsenic, molybdenum, nickel and uranium. Although above baseline, these COPCs are predicted to remain below *Health Canada's Guidelines for Canadian Drinking Water Quality* [9] and *Saskatchewan Surface Water Quality Objectives* [10] and/or the *Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines* [11] for the protection of aquatic life. Therefore, Orano predicted no effects to the aquatic environment of Fox and Pat Lakes and no significant effects on human health as a result of the 2016 expansion project. Based on the submission, CNSC staff determined that the expansion of the JEB TMF to 457.5 mASL remained within the licensing basis and the 2016 expansion project was included in Orano's updated Licence Condition Handbook (LCH) accepted by the Commission as part of the June 2017 licence renewal.

2019 Proposed Expansion of the JEB Tailings Management Facility

Orano plans to begin the construction of the proposed expansion in 2025 and be completed by 2030. Orano's November 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] included the resubmission of an options study conducted in 2014. Initial screening of more than 20 options for the management of additional tailings resulted in several alternatives that were suitable for further investigation. The alternatives included the conversion of the existing Sue C and Sue E open pits to engineered tailings management facilities, the construction of a new purpose built in-ground TMF within the leased boundary and the expansion of the existing JEB TMF. The alternatives were assessed according to environmental, technical, operational, and economic criteria.

Orano's 2019 preferred alternative was the optimization of the tailings storage capacity of the existing JEB TMF through the construction of a permanent embankment with a bentonite-amended crushed sandstone to contain the water of the TMF pond during operation. This option requires a vertical expansion of the JEB TMF to 468 mASL during operation.

The hydraulic containment of the tailings via pumping water from the base drain will continue for the proposed expansion. The pumped water (reclaim water) from the base drain will continue to be piped to and treated at the JEB WTP before being released to the S/V TEMS which discharges into the downstream surface water receiving environment of McClean Lake East and Collin's Creek. Orano has determined the JEB WTP has the capacity to treat the reclaim water from the proposed JEB TMF expansion.

The pumping of water from the base drain will continue throughout operations for the proposed expansion and will continue to prevent COPCs in the TMF from migrating outward into groundwater and surface water features. A water cover will continue to be maintained over the tailings to facilitate operations and to prevent the release of COPCs from the tailings into the air.

The proposed JEB TMF expansion will require the relocation and reconstruction of some of the infrastructure of the existing JEB TMF. This will include the construction of a new Mill Site Runoff Pond and modifications to the Storm Water Storage Pond and the Waste Rock Runoff Pond.

Decommissioning of the 2019 Proposed Expansion of the JEB Tailings Management Facility

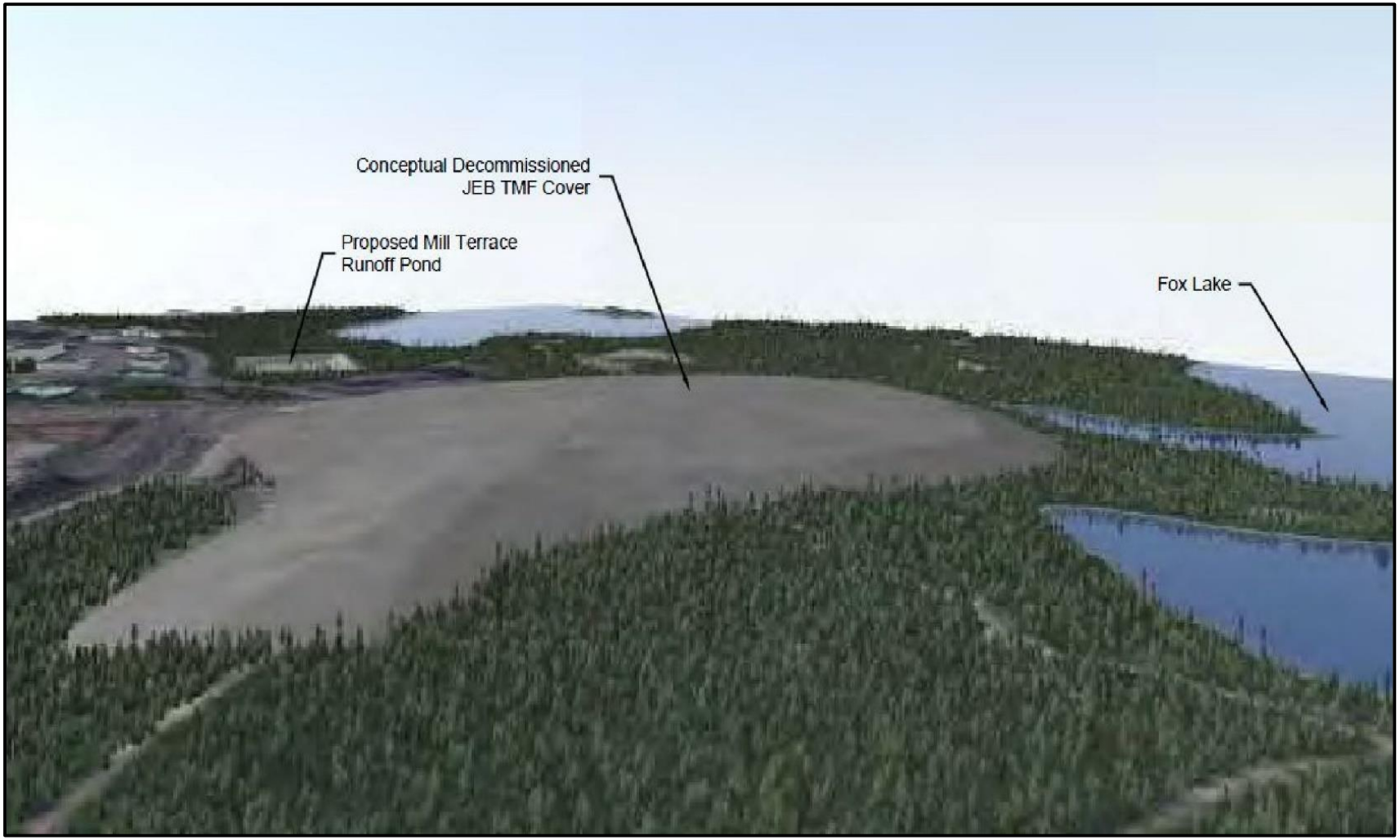
At decommissioning, water will continue to be pumped from the base drain to facilitate consolidation of the tailings. An engineered cover will be placed over the tailings after the water cover is either allowed to evaporate or is pumped off the TMF. After the tailings are fully consolidated, the pumping from the base drain will cease. The proposed expansion of the JEB TMF will result in a final consolidated tailings elevation of 462 mASL, up to 14 m above the existing ground surface on the low side of the facility, adjacent to Fox Lake. The final consolidated tailings will be contained within a permanent engineered embankment. The toe of the slope of the constructed embankment will be set back 10 m from the highest recorded surface water elevation of Fox Lake.

The closed and decommissioned JEB TMF will be designed to mimic nearby natural landforms by including similar slope angles, slope lengths and drainage features and systems. The cover will be designed to encourage drainage away from the waste form and minimize rainwater and snow melt from infiltrating into the consolidated tailings. The proposed preliminary design is for

the constructed cover to range in depth from 4.5 m at the perimeter of the facility to a maximum of 8.5 m in the centre and to be composed of drainage sand, drain rock and sandstone waste rock fill, a filter zone, and an engineered barrier and a surface layer of soil. The proposed engineered barrier will be a mixture of crushed sandstone and bentonite clay to limit the percolation or infiltration of precipitation into the waste. The constructed cover will be topped with a vegetation cover. A conceptual aerial view of the proposed decommissioned JEB TMF before the installation of the vegetation cover is displayed in figure 1.6.

After decommissioning, the hydraulic conductivity of the consolidated tailings is predicted to be two orders of magnitude less than the surrounding sandstone formation which will result in groundwater preferentially flowing around rather than through the tailings mass. This will minimize the movement of COPCs from the tailings mass into groundwater and subsequently into surface water in the Pat Lake watershed.

Figure 1.6: Conceptual aerial view of the proposed decommissioned JEB TMF before vegetation [3



2.0 SCOPE OF ASSESSMENT

This EPR includes CNSC staff's assessment of the licence amendment application [1], Orano's JEB TMF Expansion (468 mASL) Notification and Project Description [3] and Orano's responses to CNSC staff technical assessment of the JEB TMF Expansion (468 mASL) Notification and Project Description [12-18]. Information found within these documents combined together form the foundation that ensures the public, workers and the environment will be protected from changes arising from the JEB TMF Expansion Project.

This report was produced to expand upon and support CNSC staff's recommendations, for the environmental protection safety and control area, regarding the licence amendment submitted by Orano for the JEB TMF Expansion project. It does not include staff's assessments of other aspects of the McClean Lake Operation site such as factors associated with normal operations for the milling of uranium ore because those activities have been assessed previously as a part of the licence renewal in 2017, and on an ongoing basis with compliance verification activities.

3.0 STATUS OF THE ENVIRONMENT

The following sections of this EPR Report include summaries of the project-environment interactions as detailed in Orano's JEB TMF Expansion Notification and Project Description [3], and CNSC staff's review of these documents and their conclusions. The provided summaries below include descriptions of radiological and hazardous releases to air and water, followed by assessments of any potential effects of on human health and the environment.

3.1 Releases to the Environment from the JEB TMF Expansion

CNSC staff determined that the predicted environmental risks for the JEB TMF Expansion project are within those already considered through prior assessments of the McClean Lake Operation, and the project will not result in significant changes to the way the JEB TMF will be operated. However, some changes to the existing monitoring programs will be implemented as part of the project. These changes are related to the groundwater monitoring program and the tailings optimization and validation program. The environmental monitoring program (EMP) requires little change to monitor any potential risk from the proposed JEB TMF expansion project since the EMP was designed to monitor the existing JEB TMF.

3.1.1 Airborne Emissions

Orano controls and monitors airborne emissions to the environment under its effluent monitoring program [19] for the McClean Lake Operation, which is based on Canadian Standards Association (CSA) N288.4-10, *Environmental monitoring programs at class 1 nuclear facilities and uranium mines and mills*.

Orano identified some potential project-environment interactions for the atmospheric environmental components for the construction, operation and decommissioning phases of the proposed JEB TMF expansion project. These interactions include dust deposition and air emissions of sulphur dioxide, nitrogen oxides, particulate matter, and total suspended particulates. Orano has proposed some mitigation measures, including low sulphur diesel for equipment to reduce air emissions, standard dust suppression procedures on site roads, and adherence to speed limits to assist in reducing the potential for the generation of dust. The

existing water cover is expected to control air quality and dust. In addition, Orano will continue to monitor airborne emissions arising from the JEB TMF Expansion project.

3.1.1.1 Conclusion – Airborne Emissions

Based on CNSC staff's review of Orano's Notification and Project Description [3], CNSC staff conclude that Orano's airborne emissions, both radiological and hazardous, to the environment as a result of the proposed JEB TMF Expansion project will be low and will continue to provide adequate protection of people and the environment from airborne emissions.

3.1.2 Waterborne Effluent

Orano controls and monitors waterborne effluent to the environment under its effluent monitoring program for the McClean Lake Operation [19], which is based on CSA N288.4-10.

Orano also identified some potential project-environment interactions for the waterborne environmental components. These interactions include the potential for treated effluent discharge from the JEB WTP to change surface water and sediment quality, and the potential for site runoff and erosion to affect surface water quality and aquatic biota and habitat. Orano has proposed some mitigation measures, including continuing to monitor the batch releases from the JEB WTP to ensure that water quality meets specific discharge criteria, that Orano has developed, before being discharged to the S/V TEMS and diverting runoff from the JEB clean waste rock pile to either the runoff collection pond or directed to a sedimentation pond to settle out solids prior to release.

There are no releases of waterborne effluent expected from the expansion of the JEB TMF. Furthermore, the expansion of the JEB TMF is not expected to alter the effluent quality that is discharged from the JEB WTP.

3.1.2.1 Conclusion – Waterborne Effluent

Based on CNSC staff's review of Orano's Notification and Project Description [3], CNSC staff conclude that there is no expected impact to the environment from Orano's waterborne effluent, both radiological and hazardous, as a result of the proposed JEB TMF Expansion project and will continue to provide adequate protection of people and the environment from waterborne effluent. Orano will continue to monitor waterborne effluent during the JEB TMF Expansion project.

3.2 Environmental Effects Assessment

The following sub-sections discuss the activities proposed in Orano's licence amendment application, which includes the required modifications for the expansion of the JEB TMF, its continued operation and decommissioning. CNSC staff's conclusions on whether Orano will continue to make adequate provision for the protection of the environment and human health during construction, operation and post-decommissioning of the JEB TMF expansion are also provided.

As noted earlier in this report, Orano prepared and submitted the 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] in support of the proposed licence amendment. This included an assessment of the potential environmental interactions of the activities in each phase of the project and proposed associated mitigation methods and monitoring. Environmental effects of the proposed JEB TMF are presented in the following sections. Risk to both human and ecological receptors from the previous JEB TMF Expansion to 457.5 mASL was assessed in

the 2016 McClean Lake Operation Environmental Performance Technical Information Document [20], which included an ERA. CNSC staff reviewed the 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] to determine whether the predicted concentrations of COPCs would result in an appreciable increase of risk to receptors as compared to the 2016 ERA.

The assessment of predicted effects of the licenced activities was carried out in a stepwise manner as follows:

- identifying potential environmental and health effects
- determining whether the environment and health of persons are protected

A review was conducted for all environmental components, but only a selection of topics are presented in detail in this section. These components were selected based on licensing requirements, as well as those that have historically been of interest to, Indigenous peoples, the public and the Commission.

3.2.1 Atmospheric and Terrestrial Environment

The construction phase of the proposed expansion of the JEB TMF will include the construction of the embankment to hold the additional 2.3 million m^3 of unconsolidated tailings, modifications to the waste rock runoff pond and storm water storage pond, construction of a new mill site runoff pond for surface water management and the relocation of infrastructure.

The footprint of the JEB TMF expansion is located in an area that has already been disturbed by the construction and operation of the existing JEB TMF and therefore the loss or alteration of local soil and loss and fragmentation of vegetation and wildlife habitat will not occur. During construction Orano will implement erosion control practices to limit the offsite movement of soil [3].

Orano predicts that the noise, vibration and dust and particulate matter from construction, operation and decommissioning of the proposed expansion would be similar to those previously assessed in the 2016 ERA [20] and that the potential effects of the proposed expansion during construction on soil, air, vegetation and wildlife would be negligible. Noise and vibration from the McClean Lake operation was predicted to be imperceptible beyond 3 km from the site and the proposed JEB TMF Expansion is not expected to alter the prediction [3]. Annual mean concentrations of total suspended particulates (dust) monitored in the air around the JEB TMF in 2019 was within the 2016 ERA predictions [21], well below the Saskatchewan Ambient Air Quality Standard [22] for total suspended particulates of 60 µg/m³ annually and similar to previous years.

During operation, the tailings produced at the McClean Lake Mill will continue to be neutralized and piped into the JEB TMF under the water cover [3]. The water cover prevents the release of particulate matter and radon to the atmosphere. Releases to the air and the terrestrial environment during the operation of the proposed JEB TMF expansion are therefore expected to be similar to those from the operation of the currently approved JEB TMF.

The decommissioning of the expanded JEB TMF will include an engineered cover and vegetation cover. This will prevent the release of radiological and hazardous COPCs to the air. The cover and landform of the decommissioned JEB TMF expansion will be designed to limit erosion of the cover, and prevent exposure of the consolidated tailings to the air and terrestrial environment over the long-term. The engineered cover will be of sufficient depth and

composition to prevent the roots of vegetation from intersecting the waste and tailings so COPCs will not be translocated from the roots to the foliage and stems of plants. Therefore wildlife feeding on vegetation in the area would not be exposed to COPCs from the expanded JEB TMF.

Conclusion – Atmospheric and Terrestrial Environment

Based on CNSC staff's review of Orano's Notification and Project Description [3], CNSC staff conclude that the release of radiological and hazardous contaminants to the atmospheric and terrestrial environment as a result of Orano's proposed JEB TMF Expansion project will be similar to those previously assessed in the 2016 ERA. The potential effects of the proposed expansion during construction and operation and after decommissioning of the expanded TMF on air, soil, vegetation and wildlife will be of low to negligible risk to the terrestrial environment provided the mitigation measures included in Orano's Notification and Project Description [3] are effectively implemented.

3.2.2 Hydrogeological Environment

Hydraulic containment of the JEB TMF is currently provided by pumping from the JEB TMF base drain using the existing raise well. Groundwater monitoring data collected by Orano and provided in the 2019 Annual Report, and reviewed by CNSC staff, confirmed that contaminants have not migrated outward from the existing JEB TMF [21].

Pumping from the JEB TMF base drain will continue during construction and operation of the proposed TMF expansion, and therefore hydraulic containment of the JEB TMF will continue. Tailings COPCs are not expected to move from the tailings into the surrounding groundwater due to the hydraulic containment. Orano provided a groundwater monitoring plan to verify that hydraulic containment will be maintained throughout construction and operation in the JEB TMF Expansion (468 mASL) Notification and Project Description [3], which was reviewed and accepted by CNSC staff.

Throughout the current operation of the JEB TMF, Orano has completed analyses and studies on the tailings and pore water in the TMF within the TOVP, which was provided in the 2020 TMTID [6]. These studies are aimed at predicting the long-term COPCs concentrations in the tailings and tailings pore water and are used to model or predict the flux or movement of COPCs from the tailings mass into the groundwater at decommissioning and over the long term. Orano's 2020 TMTID [6] included predictions of future COPCs tailings concentrations, geochemistry and COPCs transport from the tailings into groundwater and subsequently into Fox and Pat Lakes for the proposed TMF expansion after it is closed and decommissioned. CNSC staff reviewed the 2020 TMTID [6] and Orano provided satisfactory responses to CNSC staff comments [25].

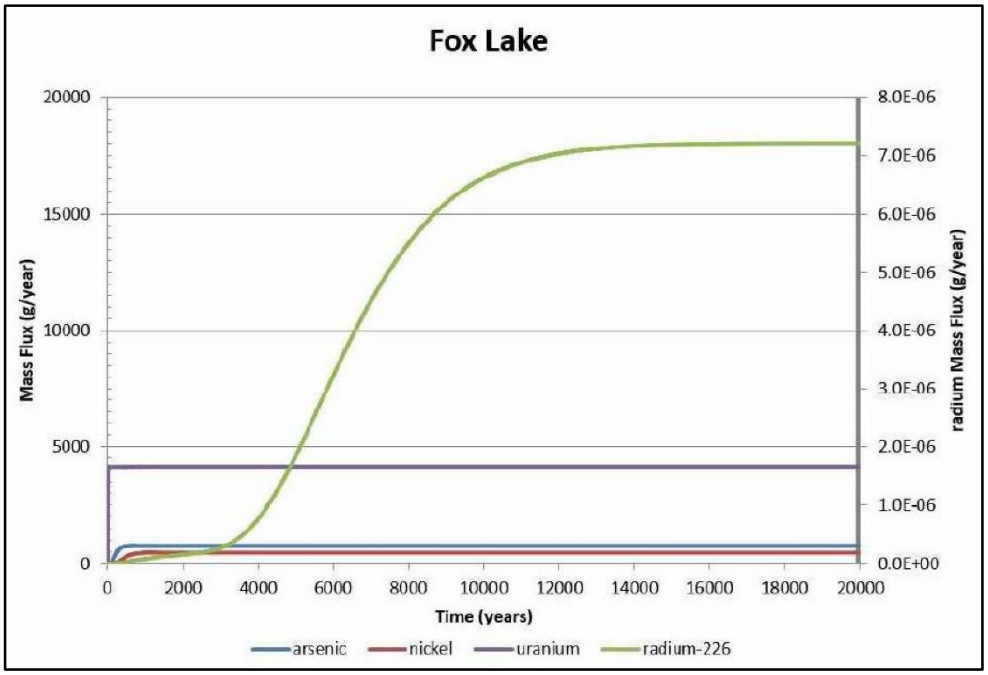
The final design of the decommissioned JEB TMF will encourage precipitation and snowfall melt to runoff from the surface of the TMF. The decommissioned JEB TMF will have an engineered cover topped by a vegetation cover which will limit the amount of precipitation infiltrating through the cover and into the waste and tailings mass below. Regardless, after decommissioning, some precipitation will infiltrate through the cover and migrate through the waste and tailings and into the surrounding sandstone and base drain. There will be a slow discharge of COPCs from the waste and the tailings into groundwater and subsequently to surface water. The predicted surface water concentrations were considered to meet decommissioning criteria for the currently approved JEB TMF.

The groundwater discharge from the expanded JEB TMF after decommissioning is anticipated to migrate west and south towards Fox and Pat Lakes, respectively. Orano modelling predicts approximately 70% and 30% of the groundwater flow will discharge to Fox Lake and Pat Lake, respectively, however, 100% of the flow will ultimately reach Pat Lake since Fox Lake flows into Pat Lake. Figure 3.1 displays Orano's predicted mass flux or movement of arsenic, nickel, uranium and radium-226 to Fox Lake via groundwater over time. The migration of COPCs via groundwater to surface water will occur over various time periods based on their mobility, attenuation and decay characteristics, and on advective and diffusive transport mechanisms. Movement of COPCs from the JEB TMF to groundwater and subsequently to surface water will continue for hundreds to thousands of years after decommissioning [3]. This slow movement of contaminants in groundwater to surface water was simulated and the predicted surface water concentrations were considered to meet decommissioning criteria for the currently approved JEB TMF, and will occur in a similar way over a similar time frame for the expanded JEB TMF. A sensitivity analysis of the modelled mass COPCs loading rates to groundwater noted that the rate of precipitation infiltrating through the engineered cover and the pore water concentrations of the COPCs had the most influence on the predicted mass flux or movement of COPCs from the JEB TMF into groundwater [3].

CNSC staff reviewed Orano's post-decommissioning predictions of groundwater discharge and contaminant transport modelling in the JEB TMF Expansion (468 mASL) Notification and Project Description [3] and found them acceptable. However, given the very long time frame associated with the predictions, CNSC staff requested that groundwater quality be monitored after decommissioning to track the fluxes of unattenuated COPCs, such as chloride and sulphate, from the closed and decommissioned JEB TMF to groundwater to provide an early indication of the accuracy of the flux predictions.

Pending Commission approval of the project, Orano has agreed to monitor groundwater quality at wells close to the JEB TMF to provide an early performance indicator of the contaminant plume migration, the groundwater COPC concentration predictions and the long-term COPC concentration predictions in Fox Lake and Pat Lake. If the revised COPCs predictions in Fox Lake and Pat Lake water are above the current long-term assessment predictions, Orano has committed to assess risks to the receiving environment and if necessary, implement mitigation measures [23].

Figure 3.1: Mass flux of COPCs to Fox Lake versus time [3]



Conclusion – Hydrogeological Environment

Orano's proposed groundwater monitoring program to confirm hydraulic containment has been accepted by CNSC staff and as requested by CNSC staff, Orano has committed to undertake the following activity, if the JEB TMF expansion is approved by the Commission:

- monitor groundwater quality at wells close to the JEB TMF to provide an early performance indicator of the contaminant plume migration, the groundwater COPC concentration predictions and the long-term COPC concentration predictions in Fox Lake and Pat Lake. If the revised COPCs predictions in Fox Lake and Pat Lake are above the current long-term assessment predictions, Orano will assess risks to the receiving environment and if necessary, implement additional mitigation measures

Based on CNSC staff's review of Orano's Notification and Project Description [3] and Orano's commitments to the above activity, CNSC staff conclude that the hydrogeological containment during construction and operation and the predicted flow, flux and concentrations of radiological and hazardous contaminants to the hydrogeological environment after decommissioning of Orano's proposed JEB TMF Expansion project will be of low to negligible risk to the hydrogeological environment.

3.2.3 Surface Water and Aquatic Environment

The proposed JEB TMF expansion will result in the toe of the embankment being 10 m from the high water mark of Fox Lake, which will provide the minimum buffer necessary to minimize impacts to the lake. Erosion controls at the 10 m buffer limit, such as sediment fencing, will protect the Fox Lake shoreline by preventing the driving of construction machinery in the buffer and preventing soil or construction materials from entering the buffer and surface water [3].

The embankment will be monitored during operations to confirm the maintenance of groundwater quality, the absence of solute transport through the liner and slope stability [3]. A failure of the embankment is considered of low probability, however Orano's 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] included an "Environmental Consequence Assessment" of the potential impacts of an embankment failure during the operational phase to the adjacent Fox Lake and downstream surface water features. The findings of the assessment are summarized in section 3.3.

The continued hydraulic containment of the expanded JEB TMF will prevent COPCs from migrating to surface water and the aquatic environment during operations. The reclaim water pumped from the base drain of the proposed JEB TMF expansion will continue be treated at the JEB WTP during operation and decommissioning [3]. The JEB WTP effluent is discharged to the S/V TEMS and in turn discharges to McClean Lake East and Collin's Creek. Orano will continue to monitor the effluent to confirm the effluent quality meets regulatory limits before discharge. The surface water and aquatic environment downstream of the JEB WTP effluent release point in the S/V TEMS, McClean Lake East and Collin's Creek will continue to be monitored regularly and the results included in Annual Reports to confirm concentrations of COPCs and aquatic biota are within the predictions of the 2016 ERA [20] and future ERAs.

The preliminary decommissioning design proposed the downstream slopes of the embankment will be flattened to minimize erosion potential, improve the long term stability of the slope and limit the potential for failure or erosion of the embankment and the subsequent impact to the surface water and aquatic environment of Fox Lake [3].

As discussed in section 3.2.2, after closure and decommissioning of the JEB TMF, COPCs will slowly move from the tailings to groundwater and subsequently to the surface water and sediments of Fox Lake and Pat Lake. The average arrival time of a groundwater plume reaching Fox and/or Pat Lake is predicted to vary for each COPC depending on its' attenuation. Unattenuated COPCs such as chloride and sulphate is predicted to reach the lakes in approximately 200 years. As depicted in figure 3.1, moderately attenuated COPCs such as arsenic and nickel are predicted to reach the lakes in 200 to 300 years (average arrival time). Radium-226 is predicted to be at maximum concentration in the lakes after 10,000 years [3]. The timing of the movement of the groundwater plume to Fox and Pat Lakes is similar to that of the currently accepted and approved JEB TMF [20].

Orano conducted modelling to predict the base case and upper bound mass flux of COPCs to the surface water of Fox and Pat Lakes. The mass fluxes were used to calculate predicted base case and upper bound incremental increases to COPC concentrations in the surface water of Fox and Pat Lakes from the proposed JEB TMF expansion to 468 mASL. Orano's base case and upper bound predictions of surface water quality in Fox and Pat Lakes are shown in tables 3.1 and 3.2 respectively. Orano's modelling has shown that similar to the currently approved expansion to 457.5 mASL, all COPCs in Fox and Pat Lakes in the base case will remain below *Saskatchewan Surface Water Quality Objectives* [10] or the *Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines* [11] at all times or within background levels (i.e. cadmium and lead), at all times in the future, which are protective of aquatic life. For the upper bound case scenario, selenium and copper surface water concentrations are predicted to be at or marginally above the *Saskatchewan Surface Water Quality Objectives* [10] and/or *Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines* [11] in Fox and Pat Lakes, but the baseline or current concentrations of selenium and copper are already the water quality objectives and/or guidelines. As noted in section 3.2.2, Orano has agreed to monitor groundwater

quality at wells close to the JEB TMF to provide an early performance indicator of the contaminant plume migration, the groundwater COPC concentration predictions and the long-term COPC concentration predictions in Fox Lake and Pat Lake. Orano has agreed that if this results in revised COPCs predictions in Fox Lake and Pat Lake that are above the current long-term assessment predictions, they will assess risks to the receiving environment and if necessary, implement mitigation measures [23]. CNSC staff are satisfied that the surface water in Fox Lake and Pat Lake will remain protected.

Table 3.1: JEB TMF base case receptor surface water quality (468 mASL case) [3]

Constituent	Units	Baseline concentration			Incremental concentration			Resulting concentration			Water quality criteria
		Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	SEQG-fresh water aquatic life
chloride	mg/L	0.133	0.133	0.120	7.66E-02	3.00E-02	3.42E-02	0.21	0.16	0.15	120
sulphate	mg/L	0.633	0.633	0.710	2.28E+00	8.90E-01	1.02E+00	2.91	1.52	1.73	-
ammonia	mg/L	0.021	0.021	0.014	6.91E-03	2.70E-03	3.08E-03	0.028	0.024	0.017	1.27(a,b)
arsenic	mg/L	0.00052	0.00052	0.00074	3.62E-04	1.41E-04	1.14E-04	0.00088	0.00066	0.00085	0.005(,b)
cadmium	mg/L	0.001	0.001	0.001	3.47E-08	1.36E-08	1.55E-08	0.0010	0.0010	0.0010	0.00004(a)
cobalt	mg/L	0.001	0.001	0.001	2.58E-05	1.01E-05	1.15E-05	0.0010	0.0010	0.0010	-
copper	mg/L	0.002	0.002	0.002	3.30E-06	1.29E-06	1.47E-06	0.0020	0.0020	0.0020	0.002(b)
lead	mg/L	0.005	0.005	0.006	3.49E-06	1.37E-06	1.56E-06	0.0050	0.0050	0.0060	0.001(b)
molybdenum	mg/L	0.005	0.005	0.005	1.62E-03	6.34E-04	7.23E-04	0.0066	0.0056	0.0057	31(a,), 0.073(b)
nickel	mg/L	0.003	0.003	0.003	2.23E-04	8.72E-05	6.96E-05	0.0032	0.0031	0.0031	0.025(b)
selenium	mg/L	0.001	0.001	0.001	8.14E-06	3.18E-06	3.63E-06	0.0010	0.0010	0.0010	0.001(a,b)
vanadium	mg/L	0.01	0.01	0.01	2.82E-06	1.10E-06	1.26E-06	0.010	0.010	0.010	-
zinc	mg/L	0.006	0.006	0.006	1.28E-05	5.01E-06	5.72E-06	0.0060	0.0060	0.0060	0.030(b)

Constituent	Units	Baseline concentration			Incremental concentration			Resulting concentration			Water quality criteria
		Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	SEQG-fresh water aquatic life
polonium-210	Bq/L	0.008	0.008	0.006	1.30E-02	5.07E-03	4.02E-03	0.021	0.013	0.0100	-
lead-210	Bq/L	0.022	0.022	0.020	1.29E-02	5.02E-03	3.97E-03	0.035	0.027	0.024	-
radium-226	Bq/L	0.005	0.005	0.006	1.24E-04	4.84E-05	3.87E-05	0.0051	0.0050	0.0060	0.11[a]
thorium-230	Bq/L	0.012	0.012	0.013	2.35E-04	9.19E-05	7.39E-05	0.012	0.012	0.013	-
uranium	mg/L	0.0006	0.0006	0.0006	1.97E-03	7.69E-04	8.77E-04	0.0026	0.0014	0.0015	0.015[,b]

[a] SEQG (Government of Saskatchewan 2019) [10]
[b] CWQG (CCME 2007a) [11]
Bold indicates an exceedance of CWQG or SEQG
mg/L = milligrams per litre; Bq/L = Becquerel per litre; CCME = Canadian Council of Ministers of the Environment; CWQGs = Canadian Water Quality Guidelines; SEQG = Saskatchewan Environmental Quality Guidelines

Table 3.2: JEB TMF upper bound predicted receptor surface water quality (468 mASL case) [3]

Constituent	Units	Baseline concentration			Incremental concentration			Resulting concentration			Water quality criteria
		Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	SEQG-fresh water aquatic life
chloride	mg/L	0.133	0.133	0.12	0.25	0.10	0.11	0.38	0.23	0.23	120
sulphate	mg/L	0.633	0.633	0.71	5.48	2.14	2.44	6.12	2.78	3.15	-
ammonia	mg/L	0.021	0.021	0.014	0.021	0.008	0.009	0.042	0.029	0.023	1.27(a,b)
arsenic	mg/L	0.00052	0.00052	0.00074	0.00128	0.00050	0.00040	0.00180	0.00102	0.00114	0.005(,b)
cadmium	mg/L	0.001	0.001	0.001	1.1E-07	4.5E-08	5.1E-08	0.0010	0.0010	0.0010	0.00004(a)
cobalt	mg/L	0.001	0.001	0.001	0.000090	0.000035	0.000040	0.0011	0.0010	0.0010	-
copper	mg/L	0.002	0.002	0.002	0.00012	0.00005	0.00005	0.0021	0.0020	0.0021	0.002(b)
lead	mg/L	0.005	0.005	0.006	0.00003	0.00001	0.00001	0.0050	0.0050	0.0060	0.001(b)
molybdenum	mg/L	0.005	0.005	0.005	0.0051	0.0020	0.0023	0.0101	0.0070	0.0073	31(a,), 0.073(b)
nickel	mg/L	0.003	0.003	0.003	0.00090	0.00035	0.00028	0.0039	0.0034	0.0033	0.025(b)
selenium	mg/L	0.001	0.001	0.001	0.00007	0.00003	0.00003	0.0011	0.0010	0.0010	0.001(a,b)
vanadium	mg/L	0.01	0.01	0.01	0.00001	0.00001	0.00001	0.010	0.010	0.010	-
zinc	mg/L	0.006	0.006	0.006	0.00006	0.00002	0.00003	0.0061	0.0060	0.0060	0.030(b)

Constituent	Units	Baseline concentration			Incremental concentration			Resulting concentration			Water quality criteria
		Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	Fox Lake North Basin	Fox Lake	Pat Lake	SEQG-fresh water aquatic life
polonium-210	Bq/L	0.008	0.008	0.006	0.06	0.02	0.02	0.071	0.033	0.0256	-
lead-210	Bq/L	0.022	0.022	0.02	0.06	0.02	0.02	0.085	0.047	0.039	-
radium-226	Bq/L	0.005	0.005	0.006	0.0006	0.0002	0.0002	0.0056	0.0052	0.0062	0.11[(a)]
thorium-230	Bq/L	0.012	0.012	0.013	0.0007	0.0003	0.0002	0.013	0.012	0.013	-
uranium	mg/L	0.0006	0.0006	0.0006	0.0111	0.0044	0.0050	0.0117	0.0050	0.0056	0.015[(,b)]

(a) SEQG (Government of Saskatchewan 2019) [10]

(b) CWQG (CCME 2007a) [11]

Bold indicates an exceedance of SEQG

mg/L = milligrams per litre; Bq/L = Becquerel per litre; CCME = Canadian Council of Ministers of the Environment; SEQG = Saskatchewan Environmental Quality Guidelines

During CNSC staff review of Orano's assessment, it was noted that Orano did not provide a long-term assessment of predicted contaminant concentrations in sediments in Fox Lake and Pat Lake from the proposed expansion to 468 mASL. While Orano believes contaminant concentrations in surface water will remain below surface water quality guidelines, the breakthrough of contaminants into the receiving environment will occur in 200 to 4000 years and their migration into Fox and Pat Lakes will continue for thousands of years. As a result, it is expected that there will be an accumulation of contaminants in sediments overtime. As required by CNSC staff, and pending Commission approval of the project, Orano has agreed to conduct a long-term assessment of the base case scenario and upper bound scenario of the flux of COPCs via groundwater to predict concentrations of COPCs in Fox Lake and Pat Lake sediments and assess the risk to aquatic receptors due to sediment COPC predictions. In the event that the sediment concentration predictions result in an unreasonable risk to aquatic receptors over the long term, Orano must consider additional mitigation measures on their design to prevent these from occurring. CNSC staff are satisfied that the aquatic environment in Fox Lake and Pat Lake will remain protected.

Conclusion – Surface Water and Aquatic Environment

Orano has committed to undertake the following activity if the JEB TMF expansion is approved by the Commission:

- Conduct a long-term assessment of the base case scenario and upper bound scenario to predict concentrations of COPCs in Fox Lake and Pat Lake sediments and assess the risk to aquatic receptors due to sediment COPC predictions In the event that the sediment concentration predictions will result in an unreasonable risk to aquatic receptors over the long term, Orano must consider additional mitigation measures to prevent these from occurring.

Based on CNSC staff's review of Orano's Notification and Project Description [3] and Orano's commitments to the above activity, CNSC staff conclude that the release of radiological and hazardous contaminants to the surface water and aquatic environment as a result of the proposed JEB TMF Expansion project will be similar to those previously assessed in the 2016 ERA. The potential effects of the proposed expansion during construction and operation and after decommissioning will be of low to negligible risk to the aquatic environment provided the mitigation measures included in Orano's Notification and Project Description [3] are effectively implemented.

3.2.4 Human Health

The potential impact to human health for the currently approved JEB TMF was assessed in the 2016 ERA and found to be negligible [20]. Orano conducts regular monitoring of air quality, groundwater quality, surface water quality at the JEB TMF and surrounding environment and provides the results in annual reports. CNSC staff review of the 2019 Annual Report [21] confirmed that the concentrations of COPCs in air, groundwater and surface water remain low and within the 2016 ERA predictions.

The releases of hazardous COPCs to the air, soil and surface water during construction, operation and decommissioning phases for the proposed JEB TMF expansion are expected to be similar to the existing accepted and approved JEB TMF and will not result in impacts to human health.

Orano included an evaluation of the operational and post-closure radiation exposure conditions of the proposed JEB TMF expansion in the 2019 JEB TMF Expansion (468 mASL) and Project Description [3]. During the operating period, the design criteria were chosen to be the same as the workplace nominal exposure rate objectives for the McClean Lake mill. These values are: 0.005 mSv/h for gamma radiation, 0.03 WL[1] (working levels) for radon progeny, and 0.12 Bq/m^3 for long lived radioactive dust (LLRD). Exposure rates in working areas above the tailings are expected to continue to be less than these objectives, as they are not a function of the tailings elevation.

During the post-closure period, radiological objectives were selected to ensure that the annual effective dose limit for members of the public will not be reached, taking into account future traditional uses of the land. These post-closure radiological objectives for members of the public were selected following workshops with local stakeholders to develop occupancy scenarios for post-closure traditional land use. These objectives limit the annual effective doses to 0.3 mSv, to ensure the public effective dose limit will be met. Radiological exposures post-closure were assessed taking into account exposures to gamma radiation, radon progeny and LLRD. Exposures foreseen to occur in the post-closure period are expected to be indistinguishable from local natural background radiation exposures.

The McClean Lake mill will process high-grade ores from Cigar Lake with nominal grades of up to a bounding value of 17% uranium. The radioactivity within the tailings being dependent on the ore grade processed at the mill, dilution with lower ore grades was not included in the assessment as a conservative measure. Gamma dose rates at 1 m above the tailings were calculated, taking into account the ore grade, and the type and thickness of cover material. The assessment concluded that less than 90 cm of water cover is required to reduce the gamma dose rates above the tailings to less than the workplace nominal exposure rate objectives. Furthermore, 150 cm of water cover, or less than 90 cm of waste rock cover, maintains gamma dose rates at approximately background levels. The current TMF decommissioning plan is such that 5 m to 12 m of covering material are to be place above the tailings, hence reducing gamma dose rates from the tailings to negligible levels.

The radon concentration in air above the tailings, taking into account the characteristics of the tailings and cover, and the meteorological conditions, was modelled for a base case, which represents average meteorological conditions observed at McClean Lake. These were assessed to be between approximately 20 Bq/m^3 and 30 Bq/m^3. This is similar to the upper range of background concentrations from pre-operational (baseline) radon measurements in the McClean Lake area which ranged from < 7.4 to 25 Bq/m^3. The 2016 ERA concludes that at the JEB pit, radon concentrations remain between 15 Bq/m^3 and 25 Bq/m^3. This range correlates well with the predictions of the JEB TMF expansion project during the operational period, namely that radon concentrations are expected to remain between 20 Bq/m^3 and 30 Bq/m^3.

[1] The Working Level (WL) is a unit of measure of the concentration of alpha particle energy released by radon progeny in air.

The water cover prevents tailings from drying and consequently becoming airborne. This is the case during the operations phase. Post-closure, several meters of waste rock, as well as top layers of clean sand-bentonite and till will cover the tailings. As a result, no exposures to long-lived radioactive dust exposure are expected on the surface.

Conclusion – Human Health

Based on CNSC staff's review of Orano's Notification and Project Description [3], including the operational and post-closure radiation exposure conditions, CNSC staff conclude that the release of radiological and hazardous contaminants to the atmospheric, terrestrial, surface water and aquatic environments as a result of the proposed JEB TMF Expansion project will be similar to those previously assessed in the 2016 ERA. Orano's Notification and Project Description [3] ascertained the annual incremental dose to a JEB camp worker, and concluded that the main contributor to their radiological exposure is radon, and to a lesser extent LLRD. In the case of the expansion project, external gamma exposures and LLRD concentrations in air above the TMF are expected to be negligible, while radon concentrations are expected to remain within the range determined in the 2016 ERA. The potential effects of the proposed expansion during construction and operation, and after decommissioning will be of low to negligible risk to human health, provided the mitigation measures included in Orano's Notification and Project Description [3] are effectively implemented.

3.3 Environmental Consequences of Hypothetical Embankment Failure and Cover Erosion after Decommissioning

3.3.1 Embankment Failure during Operation

The proposed expansion of the JEB TMF requires the construction of a permanent embankment to contain the additional tailings mass and water cover during operation and the consolidated tailings at decommissioning. The embankment has been designed to prevent failures and the subsequent loss of tailings into the environment during operation and after decommissioning. The embankment will be monitored during operations to confirm the slope stability and repairs and modifications can be made if required [3]. Orano assessed the safety of the proposed embankment structure through deterministic and probabilistic analysis of the embankment slope stability, and analysed the till collapse potential. This assessment confirmed that a failure of the embankment is of low probability. Regardless, Orano's 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] included an "Environmental Consequence Assessment" of the potential impacts to the Pat Lake watershed if there was an embankment failure during the operational phase. The environmental consequence assessment assumed that the water cover over the tailings (tailings pond) and a portion of the free-flowing tailings would be deposited into Fox Lake, which is directly adjacent to the JEB TMF. Orano assumed that because a hypothetical embankment failure would occur during operations, risk assessments, clean up and remediation targets would be completed at the time of an accident or malfunction of this nature with overview by the CNSC and the Saskatchewan Ministry of the Environment.

The embankment failure assessment provided predictions for surface water quality and associated impacts to humans through comparison to *Health Canada's Guidelines for Canadian Drinking Water Quality* [9] and aquatic organisms through comparison to *Saskatchewan Surface Water Quality Objectives* [10] or the *Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines* [11] for the protection of aquatic life. The assessment also considered

the physical impact of debris falling into Fox Lake and the physical impact of remediating or removing the tailings and debris from Fox Lake.

An embankment failure during operations and the release of both pond water and tailings materials would result in short-term (up to 16 months) impacts to the aquatic environment of Fox Lake due to the predicted significant exceedances of the *Saskatchewan Surface Water Quality Objectives* [10] or the *Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines* [11] for the protection of aquatic life for most COPCs. For example, the short term (immediately after failure) concentration of uranium in Fox Lake's north basin directly adjacent to the embankment is predicted to be 500 µg/L, similar to the concentration of uranium in the pond water, and the water quality guideline for the protection of aquatic life is 15 µg/L. The exceedances of the water quality guidelines for the various COPCs would affect various aquatic species including fish, benthic invertebrates, amphibians and aquatic plants. The concentrations of COPCs in surface water would decline rapidly as remediation activities to remove the tailings and debris progressed. Orano predicts that the effects due to increased COPCs in surface water would be limited to Fox Lake and surface water of Pat Lake, Nadia Lake and Upper Collin's Creek would not be affected at any time.

From a human health perspective, *Health Canada's Guidelines for Canadian Drinking Water Quality* [9] would also be exceeded in Fox Lake for most COPCs and in Pat Lake for radium-226 and polonium-210 for up to 16 months. Orano predicted that 2 years after a hypothetical embankment failure, COPCs concentrations in surface water would be protective of aquatic life and suitable for use as drinking water.

Orano provided a qualitative assessment of the effects of the tailings solids spilling into Fox Lake [3]. It was postulated that the tailings would be mixed with the embankment materials and that some tailings and debris would fall in the buffer between the JEB TMF and Fox Lake, and some would enter Fox Lake. The grain size of the tailings was used to predict the distance that particles would travel in surface water before settling to the sediments. Orano predicted most of the tailings would settle in Fox Lake, although a portion would remain in suspension and travel further into the downstream lakes.

The COPC concentrations of the tailings are several orders of magnitude above *Canadian Council of Ministers of the Environment (CCME) Sediment Quality Guidelines for the Protection of Aquatic Life* [24] but the initial impact would be the physical deposition of the material directly on the riparian habitat of the shoreline and the aquatic habitat in Fox Lake. Orano assumed that the solids would be removed from the lake but acknowledged the remediation activities could not completely remove the tailings and that there would be temporary physical disruption and alteration of aquatic habitat from the remediation activities. The distribution of the remaining tailings and the resultant sediment concentrations would need to be known to assess the impact with more precision. Regardless, it can be assumed that the tailings would impact the aquatic health of Fox Lake and potentially downstream lakes over the medium term, possibly for several decades.

The JEB TMF Expansion closure design for decommissioning aims to reduce the possibility of embankment failure over the long term. The design criteria of the closed JEB TMF aim to mimic the form and stability of natural landforms of the area and to promote the long term resistance of the cover to erosion. Orano stated in the 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] that the occurrence of an unlikely failure after decommissioning would be of lesser consequence than one occurring during operation, since there would no longer

be a tailings water cover that would release to Fox Lake and the tailings would be consolidated rather than free flowing, and a significantly lesser volume of tailings would reach Fox Lake. CNSC staff accepted the rationale that the consequence of an embankment failure post-decommissioning would be of lesser consequence and be bounded by such a failure during operations described above.

3.3.2 Cover Erosion after Decommissioning

The 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3] included a preliminary decommissioning design for the height, grades and composition of the engineered cover. Orano's preliminary decommissioning design was developed to fulfil the key design criterion of "permanent walk-away closure", with the drainage systems and cover features functioning to fulfil this criterion. The aim of the conceptual design was to mimic the form of the natural landforms (drumlins) in the area of the McClean Lake Operation. Orano surmised that the presence and persistence of these drumlins since the last glaciation suggests they are stable and resistant to erosion and that by replicating the key features of these landforms in the conceptual design, the decommissioned JEB TMF should be stable over the long term. The preliminary design includes two vegetated drainage channels 5 m wide and 1.5 m deep to promote the movement of water off the cover, thereby preventing erosion.

CNSC staff accepted the preliminary decommissioning design of the final cover for the purpose of demonstrating the feasibility of the construction of a soil cover to limit net percolation (NP) to values that ensure the overall performance of the decommissioned JEB TMF. CNSC staff requested that at the detailed design stage, the potential erosion of the embankment slopes be further assessed and the need for refinement, such as the flattening of surface gradients and/or drainage distances of the slopes to meet the design criterion of "permanent walk-away closure" be addressed, taking into consideration that the decommissioned JEB TMF will be a tailings disposal facility, and not a natural drumlin feature. CNSC staff also requested that at the detailed design stage, Orano use the probable maximum flood (PMF) event, calculated from the PMP, (including their predicted changes due to climate change) to design the drainage channels and the cover to ensure erosion is minimized.

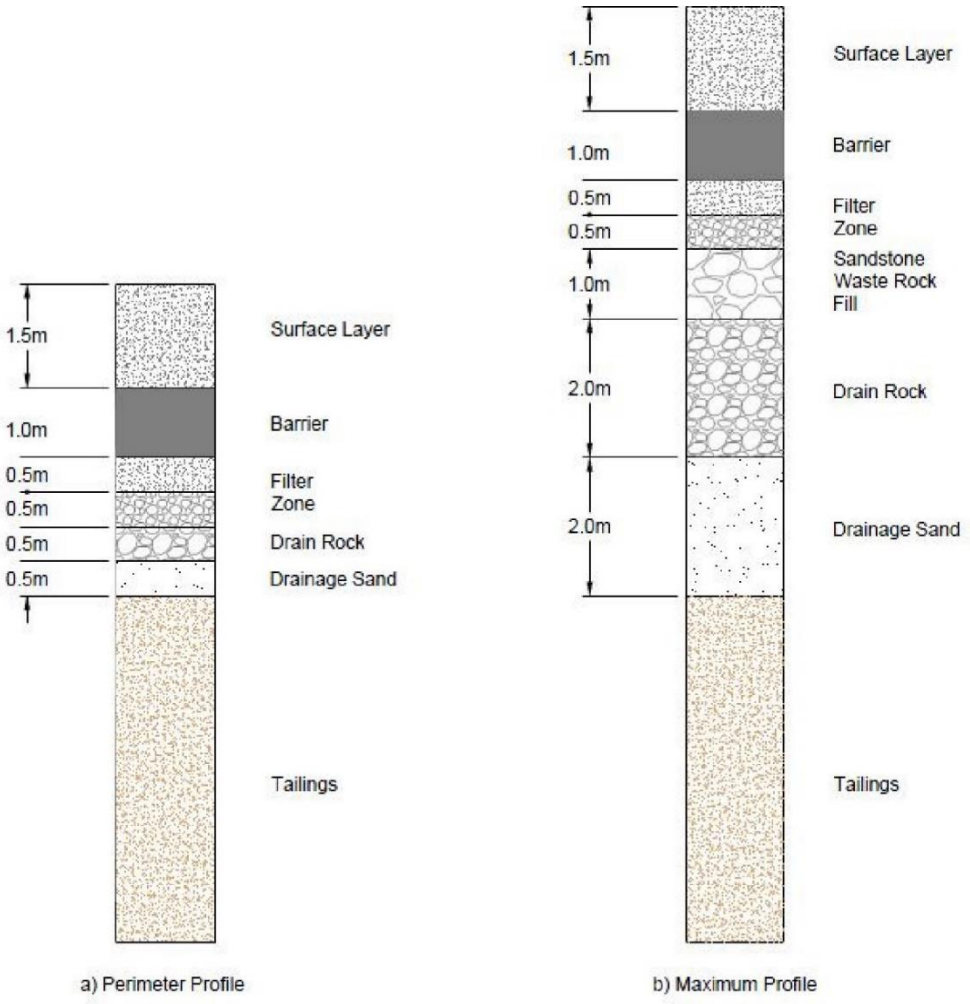
Cross sections through the preliminary design for the proposed soil cover are displayed in figure 3.1. The preliminary design is for the constructed cover to range in depth from 4.5 m at the perimeter of the facility to a maximum of 8.5 m in the centre and to be composed of drainage sand, drain rock and sandstone waste rock fill, a filter zone, an engineered barrier and a surface layer of soil. The proposed engineered barrier will be a mixture of crushed sandstone and bentonite clay to limit the percolation or infiltration of precipitation into the waste. Orano will construct and monitor test cover plots while the JEB TMF is operating to assess the efficacy of the proposed cover design and use the results of the test cover plots to enhance or refine the cover detailed design.

CNSC staff requested that the best science and engineering measures available at the time of decommissioning are incorporated into the detailed design to ensure the integrity of the cover over the long-term. CNSC staff also requested that Orano provide an assessment of a disruptive event or beyond design basis failure of the cover that could occur in the distant future, after the institutional control period, to confirm long term safety of the JEB TMF expansion. Orano responded that such a scenario is not credible, based on the preliminary design of the decommissioned JEB TMF and their commitment to use the best science and engineering measures available for the detailed design to ensure the integrity of the cover over the long-term

[15]. Regardless, Orano provided a Cover Erosion Assessment [15] whereby they considered a hypothetical case of a discrete, beyond design basis erosion event of sufficient concentrated flow that would result in the formation of a V-shaped gully 6 m wide and 3 m deep in the major surface drainage channels in the proposed closed landform. Orano considered this an extreme bounding case for the performance of the cover over the long term. The assumption of 3 m of erosion into the cover would result in the loss of the engineered barrier layer (a mixture of crushed sandstone and bentonite clay) and therefore infiltration of precipitation through the drainage channels would increase to 100 mm/year in the area of the drainage channels only. Orano calculated the formation of a V-shaped gully and accompanying erosion would result in an increase in infiltration rate from 10 mm/year to 12 mm/year over the entire closed JEB TMF surface.

Section 3.2.2 provided Orano's predicted surface water quality in Fox and Pat Lakes for the upper bound scenario, which assumed an infiltration rate of 20 mm/year over the entire closed JEB TMF surface. Since the predicted infiltration rate for the hypothetical event and beyond design basis failure of a portion of the cover is within the upper bound scenario predictions, it was surmised that the hypothetical event would not result in additional risks to aquatic receptors beyond those which have already been evaluated by Orano in the 2019 JEB TMF Expansion (468 mASL) Notification and Project Description [3]. CNSC staff accepted this as a reasonable assessment of a disruptive event or beyond design basis failure of the cover. However, CNSC staff request that Orano provides a future revision to the Cover Erosion Assessment [15], whereby the rationale/justification for selecting a 6m wide x 3 m deep gully as bounding is provided to support the conclusion that erosion beyond the barrier layer and exposure of the tailings is unlikely.

Figure 3.2 Cross-Section through the Preliminary Design for the Soil Cover [3]



Conclusion – Environmental Consequences of Hypothetical Embankment Failure and Cover Erosion after Decommissioning

Orano has committed to undertake the following activities if the JEB TMF expansion is approved by the Commission:

- use the PMF (PMP) for the detailed design of the drainage channel and cover in addition to consideration of potential climate change effect on the design
- use the results of test cover plots and the best science and engineering measures available at the detailed design stage to ensure the integrity of the cover over the long-term
- the detailed design of the cover will further assess erosion on embankment slopes and assess the need for refinement which could include flattening surface gradients and/or drainage distances of the decommissioned JEB TMF slopes to meet the design criterion of "permanent walk-away closure", taking into consideration that the decommissioned JEB TMF is a tailings disposal facility and not a natural drumlin feature
- submit a future revision to the Cover Erosion Assessment, whereby the rationale/justification for selecting a 6m wide x 3 m deep gully as bounding is provided

to support the conclusion that erosion beyond the barrier layer and exposure of the tailings is unlikely

CNSC staff accepted Orano's proposal that reporting on the progress on the commitments will be provided to the CNSC when available, either in the appropriate updates of the McClean Lake Operation Tailings Management Technical Information Document and/or Detailed Decommissioning Plan.

Based on the assessment of effects from a hypothetical embankment failure during operation and cover erosion after decommissioning, and Orano's commitments to the above activities, CNSC staff conclude that the overall risk to the environment and human health is low provided that appropriate mitigation measures included in Orano's Notification and Project Description [3] are effectively implemented.

4.0 CONCLUSION

This EPR focused on items of current public and regulatory interest, including airborne and waterborne releases from the proposed JEB TMF Expansion. CNSC staff conclude that the potential risks to human health and the environment from radiological and hazardous releases to the atmospheric, terrestrial, hydrogeological and aquatic environments from the proposed JEB TMF expansion are low to negligble.

4.1 CNSC Staff Follow-up

Orano has committed to undertake the following activities if the JEB TMF expansion is approved by the Commission:

- monitor groundwater quality at wells close to the JEB TMF to provide an early performance indicator of the contaminant plume migration, the groundwater COPC concentration predictions and the long-term COPC concentration predictions in Fox Lake and Pat Lake. If the revised COPCs predictions in Fox Lake and Pat Lake are above the current long-term assessment predictions, assess risks to the receiving environment and if necessary, implement additional mitigation measures
- conduct a long-term assessment of the base case scenario and upper bound scenario to predict concentrations of COPCs in Fox Lake and Pat Lake sediments and assess the risk to aquatic receptors due to sediment COPC predictions. In the event that the sediment concentration predictions will result in an unreasonable risk to aquatic receptors over the long term, Orano must consider additional mitigation measures to prevent these from occurring
- use the PMF (PMP) for the detailed design of the drainage channel and cover in addition to consideration of potential climate change effect on the design
- use the results of test cover plots and the best science and engineering measures available at the detailed design stage to ensure the integrity of the cover over the long-term
- the detailed design of the cover will further assess erosion on embankment slopes and assess the need for refinement which could include flattening surface gradients and/or drainage distances of the decommissioned JEB TMF slopes to meet the design criterion of “permanent walk-away closure”, taking into consideration that the decommissioned JEB TMF is a tailings disposal facility and not a natural drumlin feature
- submit a future revision to the Cover Erosion Assessment, whereby the rationale/justification for selecting a 6m wide x 3 m deep gully as bounding is provided to support the conclusion that erosion beyond the barrier layer and exposure of the tailings is unlikely

4.2 CNSC Staff Conclusions

CNSC staff reviewed Orano’s licence amendment application for the JEB TMF expansion and the documents submitted in support of the application, all of which are satisfactory and meet CNSC’s regulatory requirements with respect to environmental protection. The EPR conducted for the proposed licence amendment to allow for the JEB TMF Expansion project at the

McClean Lake Operation concludes that Orano has and will continue to make adequate provision for the protection of the environment and the health of persons. Through ongoing licensing and compliance reviews, as well as review of the JEB TMF Expansion Notification and Project Description [3], CNSC staff continue to confirm and ensure that the environment and the health of persons is protected at, and around, the McClean Lake Operation.

The information provided in this EPR Report supports the conclusions made by CNSC staff in CMD 21-H6 and the recommendation to the Commission to amend Orano's UMOLMINEMILL-McClean.01/2027 [4] in order to allow for the expansion of the JEB TMF.

5.0 ACRONYMS

Acronym	Term
CMD	Commission Member Document
CNSC	Canadian Nuclear Safety Commission
COPCs	Constituents of Potential Concern
CSA	Canadian Standards Association
EA	Environmental Assessment
EPR	Environmental Protection Review
ERA	Environmental Risk Assessment
LCH	Licence Conditions Handbook
m^3	Cubic metre
mASL	Meters Above Sea Level
NSCA	Nuclear Safety and Control Act
Orano	Orano Canada Inc.
TMF	Tailings Management Facility
TMTID	Tailings Management Technical Information Document
TOVP	Tailings Optimization Verification Program
S/V TEMS	Sink/Vulture Treated Effluent Management System

6.0 REFERENCES

1) Orano Canada Inc., 2020, Application to Amend Unranium Mine Operation Licence (UMOL-MINEMILL-McClean.01/2027) – JEB Tailings Management Facility Expansion (TMF) Project, e-Doc: 6319439

2) CNSC, 2017, Environmental Assessment under the NSCA Report – McClean Lake Operation – UMOL-MINEMILL-McClean.01/2017 Licence Renewal, e-Doc: 5131150

3) Orano Canada Inc., 2019, Notification of Modification to the JEB Tailings Management Facility Expansion Project to 468 mASL, e-Doc: 6034709

4) CNSC, 2018, Uranium Mine Operating licence – Orano Canada Inc. – McClean Lake Operation – UMOL-MINEMILL-McClean.01/2027, e-Doc: 5515452

5) CNSC, 2019, *Uranium Mines and Mills Waste*, http://nuclearsafety.gc.ca/eng/waste/uranium-mines-and-millswaste/index.cfm

6) Orano Canada Inc., 2020, *Tailings Management Information Document Version 03, Revision 00*, e-Doc: 6305787

7) Government of Canada, 1992, Canadian Environmental Assessment Act, 1992, *https://laws-lois.justice.gc.ca/eng/acts/C-15.2/*

8) Government of Canada, 2012, *Canadian Environmental Assessment Act, 2012*, https://laws-lois.justice.gc.ca/eng/acts/C-15.21/

9) Health Canada, 2017, *Guidelines for Canadian Drinking Water Quality*, prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment, https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html

10) Saskatchewan Water Security Agency, 2015, *Surface Water Quality Objectives*, *EPB 356*, June 2015 http://www.saskh2o.ca/pdf/epb356.pdf

11) Canadian Council of Ministers of the Environment, 2017, *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, Canadian Environmental Quality Guidelines, Winnipeg

12) Orano Canada Inc. 2020, Letter to S. Akhter (CNSC) from V. Laniece (Orano) *Orano – Response to CNSC Comments on the 2019 JEB TMF Expansion Project Description*, October 2, 2020, e-Doc: 6393437

13) Orano Canada Inc. 2021, Letter to S. Akhter (CNSC) from V. Laniece (Orano) *Orano – Response to CNSC Comments on the 2019 JEB TMF Expansion Project Description – Round 2 – Comments 1A, 1G and 2*, January 13, 202, e-Doc: 6463112

14) Orano Canada Inc. 2021, Letter to S. Akhter (CNSC) from V. Laniece (Orano) Orano – Response to CNSC Comments on the 2019 JEB TMF Expansion Project Description – Round 2 – Comment #10 Till Collapse Potential, January 18, 2021, e-Doc: 6466647

15) Orano Canada Inc. 2021. Letter to S. Akhter (CNSC) from V. Laniece (Orano). *Re: Orano Response to CNSC Comments on the 2019 JEB TMF Expansion Project Description – Round 2 – Comment 3*, January 28, 2021, e-Doc: 6475876

16) Orano Canada Inc. 2021. Letter to S. Akhter (CNSC) from V. Laniece (Orano). *Re: Orano Response to CNSC Comments on the 2019 JEB TMF Expansion Project Description – Round 2 – Comment #11*, January 26, 2021, e-Doc: 6473774

17) Orano Canada Inc. 2021, Letter to S. Akhter (CNSC) from V. Laniece (Orano), *Re: Orano Response to CNSC Comments on the 2019 JEB TMF Expansion Project Description – Round 2 – Comment #12*, January 26, 2021, e-Doc: 6473644

18) Orano Canada Inc. 2021, Letter to S. Akhter (CNSC) from V. Laniece (Orano), *Re: Orano Response to CNSC Comments on the 2019 JEB TMF Expansion Project Description – Round 2 – Comment #8*, January 29, 2021, e-Docs: 6476982 and 6476983

19) Orano Canada Inc., 2018. McClean Lake Operation Environmental Code of Practice, e-Doc: 5107660

20) AREVA Resources Canada Inc., 2016, *McClean Lake Operation, Environmental Performance Technical Information Document Volumes 1 and 2*, e-Docs: 5012881 and 5094511

21) Orano Canada Inc. 2020, *McClean Lake Operation – 2019 Annual Report*, March 2020, e-Doc: 6272334

22) Saskatchewan 1989, Saskatchewan Ambient Air Quality Standards (µg/m^3) https://envrbrportal.crm.saskatchewan.ca/Pages/SEQS/Table20-SEQS-SAAQS.pdf

23) CNSC, 2020. Letter to V. Laniece (Orano) from S. Akhter (CNSC), McClean Lake Operation – Notification of Modification to the JEB Tailings Management Facility Expansion to 468 mASL – CNSC Comments. May 26, 2020, e-Doc: 6303220

24) CCME, 2017, Canadian environmental quality guidelines summary table, http://stts.ccme.ca/en/index.html

25) Orano Canada Inc. 2021, Letter to S. Akhter (CNSC) from V. Laniece (Orano), *Re: Orano – Response to CNSC Comments on the 2020 Tailings Management Technical Information Document*. January 12, 2021, e-Doc: 6462211

PART TWO

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

1. proposed changes to the licence
2. proposed licence, UML-MINEMILL-McCLEAN.02/2027
3. draft licence conditions handbook
4. current licence, UMOL-MINEMILL-McCLEAN.01/2027.

PROPOSED LICENCE CHANGES

Overview

Orano is the operator of the McClean Lake Operation and their current operating licence was renewed by the Commission on July 1, 2017 for a 10-year term with an expiry date of June 30, 2027. There are no changes in the format of the operating licence. One change is proposed in section IV) *Licensed Activities* of the current licence to add a licensed activity and is described below:

b) modify the outer perimeter of the JEB tailings management facility for the vertical expansion up to 468 metres above sea level (mASL) and to accommodate disposal of tailings up to a consolidated tailings elevation of 462 mASL.

Licence Conditions

There are no changes to the existing licence conditions.

Licence Format

The licence format was updated previously as part of "CMD 17-H9, Orano Canada Inc. McClean Lake Operation, Licence Renewal." There are no new changes to the licence format for this CMD.

Licence Number

As per the CNSC's Record of Decision for establishing classes of licences [25], the naming convention for CNSC-issued licences has changed. Words such as "operating" or "decommissioning" are no longer part of the licence name. One proposed change is to delete the letter "O" from the current licence, UMOL-MINEMILL-McCLEAN.01/2027, and recommend the following proposed licence number, UML-MINEMILL-McCLEAN.02/2027.

Licence Period

The licence term remains the same for the proposed amended licence and will expire on June 30, 2027.

CNSC has a standardized licence and licence conditions handbook (LCH) framework, which provides for effective regulatory oversight of operating facilities. Orano is required by its licence to report on the MLO compliance performance through annual compliance reports, including significant changes to its operations. CNSC staff verify compliance through desktop reviews, inspections and event reviews. In addition, CNSC staff report compliance performance of the MLO annually to the Commission in public meetings through the regulatory oversight reports for uranium mines and mills in Canada that ensures adequate oversight of the licensee.

PROPOSED LICENCE

eDoc# 6514234 (Word)

eDoc# 6520597 (PDF)

DRAFT

URANIUM MINE LICENCE
ORANO CANADA INC.
McCLEAN LAKE OPERATION

I) LICENCE NUMBER: **UML-MINEMILL-McCLEAN.02/2027**
(Effective Date: July 12, 2018)

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

Orano Canada Inc.
100 – 833 45th Street West
Saskatoon, Saskatchewan S7L 5X2

III) LICENCE PERIOD: This licence is valid from July 1, 2017 to June 30, 2027, unless suspended, amended, revoked or replaced.

IV) LICENSED ACTIVITIES:

This licence authorizes the licensee to:

a) operate and modify a nuclear facility (hereinafter, "the facility") for the mining of uranium ore and the production of uranium concentrate at a site known as the McClean Lake Operation in the province of Saskatchewan, as shown on the drawing referenced in appendix A to this licence

b) modify the outer perimeter of the JEB Tailings Management Facility for the vertical expansion up to 468 metres above sea level (mASL) and to accommodate disposal of tailings up to a consolidated tailings elevation of 462 mASL

c) mine a nuclear substance (uranium ore)

d) produce a uranium concentrate

e) import, possess, use, store, transfer and dispose of nuclear substances and radiation devices that are required for or associated with laboratory studies, field studies, fixed gauge use and borehole logging devices

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 McClean Lake Operation 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 for decommissioning 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.

1.2 Management of Contractors

The licensee shall ensure that every contractor working at the facility complies with this licence.

2. HUMAN PERFORMANCE MANAGEMENT

2.1 Training Program

The licensee shall implement and maintain a training program.

3. OPERATING PERFORMANCE

3.1 Operations Program

The licensee shall implement and maintain an operating program, which includes a set of operating limits.

3.2 Reporting Requirements

The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

3.3 Nuclear Substances and Radiation Devices

The licensee shall implement and maintain a program for nuclear substances and radiation devices.

4. SAFETY ANALYSIS

4.1 Safety Analysis Program

The licensee shall implement and maintain a safety analysis program.

5. PHYSICAL DESIGN

5.1 Design Program

The licensee shall implement and maintain a design program.

6. FITNESS FOR SERVICE

6.1 Fitness for Service Program

The licensee shall implement and maintain a fitness for service program.

7. RADIATION PROTECTION

7.1 Radiation Protection Program

The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within 24 hours.

8. CONVENTIONAL HEALTH AND SAFETY

8.1 Conventional Health and Safety Program

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

9. ENVIRONMENTAL PROTECTION

9.1 Environmental Protection Program

The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within 24 hours.

9.2 Reaching or Exceeding Effluent Discharge Limits

The licensee shall, where the effluent concentration reaches or exceeds the discharge limits specified in the *Metal and Diamond Mining Effluent Regulations*[1], as amended from time to time, immediately investigate and take corrective action to ensure that the effluent concentration is maintained below the discharge limits.

10. EMERGENCY MANAGEMENT AND FIRE PROTECTION

10.1 Emergency Preparedness Program

The licensee shall implement and maintain an emergency preparedness program.

[1] *Metal and Diamond Mining Effluent Regulations* (SOR/2002-222)

10.2 Fire Protection Program

The licensee shall implement and maintain a fire protection program.

11. WASTE MANAGEMENT

11.1 Waste Management Program

The licensee shall implement and maintain a waste management program.

11.2 Decommissioning Strategy

The licensee shall implement and maintain a decommissioning strategy.

12. SECURITY

12.1 Security Program

The licensee shall implement and maintain a security program.

13. SAFEGUARDS AND NON-PROLIFERATION

13.1 Safeguards Program

The licensee shall implement and maintain a safeguards program.

14. PACKAGING AND TRANSPORT

14.1 Packaging and Transport Program

The licensee shall implement and maintain a packaging and transport program.

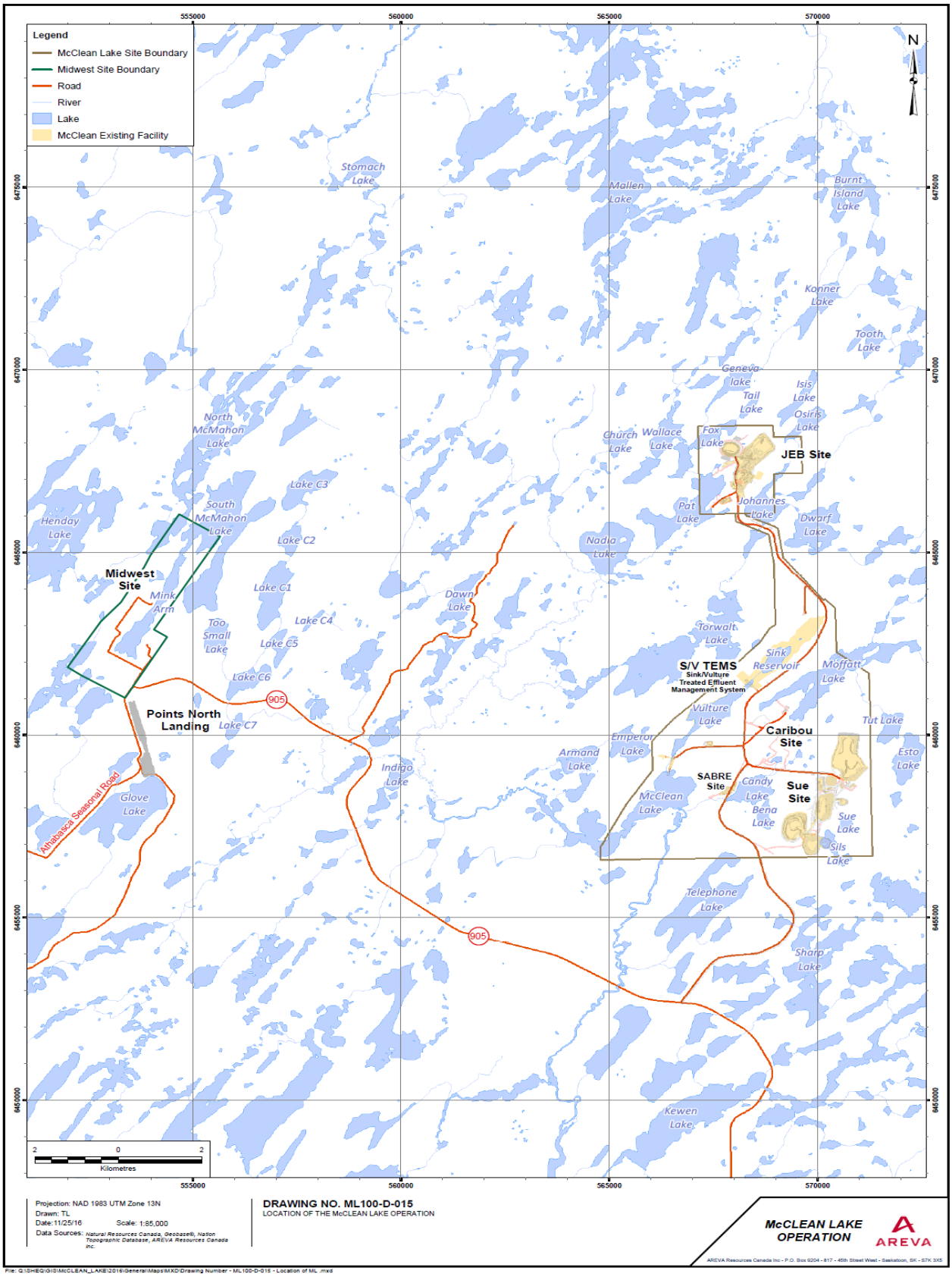
SIGNED at OTTAWA, this _____ day of _____, 2021.

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

APPENDIX A

LOCATION OF THE McCLEAN LAKE OPERATION

The location of the McClean Lake Operation is shown on McClean Lake Operation Drawing No. ML100-D-015 (e-Doc 5146834).



e-Doc 6514234 (Word)
e-Doc 6520597 (PDF)

PROPOSED LICENCE CONDITIONS HANDBOOK

eDoc # 6515760 (Word)

eDoc # 6520560 (PDF)

Canada's Nuclear Regulator

DRAFT

e-Doc 6515760 (Word)
e-Doc 6520560 (PDF)

LICENCE CONDITIONS HANDBOOK

LCH-MINEMILL-McCLEAN.02/2027

McCLEAN LAKE OPERATION URANIUM MINE LICENCE

UML-MINEMILL-McCLEAN.02/2027

Revision 5

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

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Licence Conditions Handbook **Effective: December 15, 2021**

LCH-MINEMILL-McCLEAN.02/2027, Revision 5

McClean Lake Operation

Uranium Mine Operating Licence

UML-MINEMILL-McCLEAN.02/2027
(Effective: July 1, 2017)

SIGNED at OTTAWA this 15th day of December 2021

_____

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	Section(s) Changed	Description of the Changes	DCR e-Doc
March 7, 2013	0	N/A	Original Document	3826266 (Word) 3991355 (PDF)
July 9, 2013	1		Sections changed: 2.4, 4.1, 4.3 Appendix C.1 Added information about the JEB Mill Upgrade Project Updated the versions of the Mining Facility Licensing Manual, the Radiation Protection Code of Practice and the Dosimetry Monitoring Strategy Changed name of MED Program to SABRE Project Added CVC 4.3.9 and made minor editorial changes	3826266 (Word) 3991355 (PDF)
April 23, 2014	2	Sections 4.1, 4.3, 10.1, 13.1, C1, C2, D.2	Throughout document: Changed Document Version Control to Written Notification Documents; Editorial changes Section 4.1: Added reference to Commissioning Management Plan and ore slurry storage on JEB Ore Pad Section 4.3: Added Co-60 nuclear gauges to Table of Authorized Devices Sections 10.1, 13.1, C.1, C.2, D.2: Updated references	3826266 (Word) 3991355 (PDF) All changes recorded in e-Doc 4419950
June 23, 2016	3	Sections 2.4, 3.1, C.1, C.2, D.2	Section 2.4: Added text for use of JEB Ore Pad as a contingency measure changed annual production from 13 to 24 million pounds Section 3.1: Text modified for the sections “Compliance Verification Criteria” and “Recommendations and Guidance” to be consistent with other DNCFR facilities Section C.1: Updated reference for Radiation Code of Practice Section C.2: Documents added to the licensing basis Section D.2: REGDOC-2.2.2 added and updated reference for TPED-01	3826266 (Word) 3991355 (PDF) All changes recorded in e-Doc 5011984

Effective Date	Revision	Section(s) Changed	Description of the Changes	DCR e-Doc
October 6, 2017	4	Sections G.1, 4.1, 9.2	Section G.1: Added text: Disposal of tailings up to 448 metres above sea level Section 4.1: Moved text related to ERA from the safety analysis SCA to the environmental protection SCA Section 9.2: Added authorized effluent discharge limits Updated licensee documents Updated licensing basis and guidance references	5171683 (Word) 5186559 (PDF) All changes are recorded in e-Doc 5171196 New LCH format
December 15, 2021	5	All	Updated LCH text and format. Revised financial guarantee value.	6515760 (Word) 6520560 (PDF)

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PART I - INTRODUCTION

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

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

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

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

PART II – FRAMEWORK FOR EACH CONDITION

G. GENERAL

G.1 Licensing Basis for Licensed Activities

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

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

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

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

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

Preamble

Licence condition G.1 requires activities (defined in Part IV of the licence) be conducted in accordance with the licensing basis. Further information on the licensing basis is available in CNSC regulatory document, REGDOC-3.5.3 *Regulatory Fundamentals*.

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

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

- *Nuclear Safety and Control Act* (NSCA)
- *General Nuclear Safety and Control Regulations (GNSCR)*
- *Uranium Mines and Mills Regulations*
- *Radiation Protection Regulations*
- *Packaging and Transport of Nuclear Substances Regulations, 2015*
- *Nuclear Substances and Radiation Devices Regulations*
- *Metal and Diamond Mining Effluent Regulations*
- Canada/International Atomic Energy Agency (IAEA) Safeguards Agreements

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

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

- operation and changes to the mill and associated site infrastructure within the objective of the licensing basis to produce up to a nominal annual production of 10,909,090 kilograms (24 million pounds) of uranium concentrate (U_3O_8) per year
- mining of uranium ore
- receipt and process Cameco Corporation's Cigar Lake mine ore slurry
- modify the outer perimeter of the JEB Tailings Management Facility for the vertical expansion up to 468 metres above sea level (mASL) and to accommodate disposal of tailings up to a consolidated tailings elevation of 462 mASL
- operation of the JEB dewatering and water management systems and the JEB water treatment plant (JEB WTP)
- operation of the Sue water treatment plant (Sue WTP)
- operation of the Sink/Vulture treated effluent management system (S/V TEMS)
- care and maintenance of the Midwest Project site
- storage of clean and special waste rock
- operation of the Surface Access Borehole Resource Extraction (SABRE) Project
- handling and storage of hazardous materials and disposal of hazardous wastes
- possession, storage, transfer, importation, use and disposal of nuclear substances and radiation devices
- use of storage cell on the JEB ore pad as a contingency measure only to store Cigar Lake ore slurry (ore slurry quantity will not increase from the surrounding ditch capacity available at the time of use; Orano will provide written notification before implementing a contingency plan).

Orano is required to provide prior notification before processing other ore sources or increasing the annual production rate above 10,909,090 kilograms (24 million pounds) of uranium concentrate per year to the CNSC so that it can be verified that the proposed activities meet CNSC requirements and remain within the licensing basis for the McClean Lake Operation.

There are no active mines at McClean Lake; however, environmental assessments have been carried out for the mining of the Midwest, Caribou, McClean, JEB and the Sue ore bodies. Orano is required to provide prior notification before processing other ore sources or increasing the annual production rate above 10,909,090 kilograms (24 million pounds) of uranium concentrate per year to the CNSC so that it can be verified that the proposed activities meet CNSC requirements and remain within the licensing basis for the McClean Lake Operation. Prior to constructing or operating a mine for these ore bodies or future ore bodies, Orano is also required to submit detailed construction and operating plans, designs and programs for mining the ore body or ore bodies to the CNSC so that it can be verified that the proposed activities meet CNSC requirements and remain within the licensing basis for the McClean Lake Operation.

CNSC Staff Follow-up

Orano has committed to undertake the following activities in relation to the JEB TMF expansion:

- monitor groundwater quality at wells close to the JEB TMF to provide an early performance indicator of the contaminant plume migration, the groundwater contaminants of potential concern (COPC) concentration predictions and the long-term COPC concentration predictions in Fox Lake and Pat Lake. If the revised COPC predictions in Fox Lake and Pat Lake are above the current long-term assessment predictions, assess risks to the receiving environment and if necessary, implement additional mitigation measures
- conduct a long-term assessment of the base case scenario and upper bound scenario to predict concentrations of COPCs in Fox Lake and Pat Lake sediments and assess the risk to aquatic receptors due to sediment COPC predictions. In the event that the sediment concentration predictions will result in an unreasonable risk to aquatic receptors over the long term, Orano must consider additional mitigation measures to prevent these from occurring
- use the probable maximum flood event (PMF), calculated from the probable maximum precipitation (PMP), for the detailed design of the drainage channel and cover in addition to consideration of potential climate change effect on the design
- use the results of test cover plots and the best science and engineering measures available at the detailed design stage to ensure the integrity of the cover over the long-term
- the detailed design of the cover will further assess erosion on embankment slopes and assess the need for refinement which could include flattening surface gradients and/or drainage distances of the decommissioned JEB TMF slopes to meet the design criterion of “permanent walk-away closure”, taking into consideration that the decommissioned JEB TMF is a tailings disposal facility and not a natural drumlin feature

- submit a revision to the cover erosion scenario to be conducted during detailed decommissioning planning and/or detailed design stages justifying the 6 metre wide by 3 metre (6 m x 3 m) deep gully selected as the bounding case in the 2021 cover erosion scenario and that erosion beyond the barrier layer and exposure of the tailings is unlikely.
- provide the construction quality control and quality assurance details prior to initiating any construction activities including a safe work plan for CNSC staff review and acceptance
- provide detailed closure landform design prior to the decommissioning of the JEB TMF
- Develop a detailed soil cover performance monitoring program prior to decommissioning of the JEB TMF, including performance indicators to monitor the soil cover performance post decommissioning to confirm / verify that the cover is performing as designed

Compliance Verification Criteria

Licensing Basis Documents

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

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

For operational activities that are not in accordance with the licensing basis, the licensee shall take action as soon as practicable to return to a state that is compliant with the licensing basis, taking into account the risk significance of the situation. Reporting requirements are outlined in CNSC's REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills* and discussed under LC 3.2 of this LCH.

Changes to documentation or activities that result in operational activities not being in accordance with the licensing basis must be approved by the Commission prior to implementation.

Licensing Basis Documents

Source	Document Title	Document Number	Prior Notification Required
AREVA	Minatco Ltd., The McClean Lake Project - Environmental Impact Statement, 1991	3849407	Yes
AREVA	COGEMA Resources Inc., The Midwest Project, Environmental Impact Statement, 1991	N/A	Yes
AREVA	COGEMA Resources Inc., The Midwest Project, Environmental Impact Statement, 1995	N/A	Yes
AREVA	Cameco (Cameco Corporation), Environmental Impact Statement McArthur River Project, 1995	4140075	Yes
AREVA	Cigar Lake Mining Corporation, Cigar Lake Project Environmental Impact Statement, 1995	4870399	Yes
AREVA	COGEMA Resources Inc. and Cigar Lake Mining Corporation, Disposal of Cigar Lake Waste Rock, Environmental Impact Statement, COGEMA Resources Inc. and Cigar Lake Mining Corporation, 2001	1037776	Yes
AREVA	McClean Lake Operation 6 to 8 Million Pound Production Increase Screening Report	N/A	Yes
AREVA	COGEMA Resources Inc., McClean Lake Operation Sue E Project, Environmental Impact Statement, November 2004 and 2005 Addendum	3774961	Yes
AREVA	CNSC, Ferric Sulphate Production at the McClean Lake Operation Screening Report, 2006	1172730	Yes
AREVA	Cameco Corporation and AREVA Resources Canada Inc., Rabbit Lake Solution Processing Project, Environmental Impact Statement, 2008	1378489	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation Caribou Project Environmental Impact Statement, 2009	3353421	Yes
AREVA	AREVA Resources Canada Inc., Midwest Project, Environmental Impact Statement, 2011	3814837	Yes
AREVA	AREVA Resources Canada Inc., Receipt and Processing of McArthur River Ore at the McClean Lake Operation, 2011	3766698	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, Technical Information Document, Hydrogeology and Groundwater Modeling of the Collins Creek Basin, 2011	3870068	Yes

Source	Document Title	Document Number	Prior Notification Required
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, 265ML JEB Mill Upgrade – Technical Support Document, December 2012 and HAZOP Risk Register, 2013	4054241 4115664	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, Technical Information Document, Waste Rock Management, 2013	4163394	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, Notification of Changes to the Leaching Circuit, 2014	4276885	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, Report on Commissioning and Restart of the McClean Lake Mill, 2015	4909213	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, Technical Information Document, Tailings Management, 2015	4775706	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, Notification of Increase to McClean Lake Annual Production Rate, 2016	4932128	Yes
AREVA	McClean Lake Operation – Environmental Performance Technical Information Document, Volume 1 Environmental Monitoring, 2016	5012881 5209521	Yes
AREVA	McClean Lake Operation – Environmental Performance Technical Information Document, Volume 2 of 2 – Environmental Risk Assessment, 2016 and 2017	5094511 5212962	Yes
AREVA	AREVA Resources Canada Inc., McClean Lake Operation, Environmental Monitoring Program Design Document, 2017	5311888	Yes
AREVA	McClean Lake Operation – Notification of Modification to the JEB Tailings Management Facility Expansion Project, 2016 & 2017	5020837 5186303 5200656	Yes
AREVA	Selenium Adaptive Management Plan, 2017 Selenium Adaptive Management Plan Update, Version 2, September 2020	5217270 6392517 6477959	Yes

Guidance

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

G.2 Notification of Changes

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

Preamble

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

Appendix B provides a list of licensee documents that require notification of change. CNSC staff track the current version of these licensee documents separate from the LCH (e-Doc 5345550).

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

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

Prior written notification shall include:

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

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

Guidance

A list of criteria to determine if a change would be in accordance with the licensing basis is provided in appendix A of CNSC process document *Overview of: Assessing licensee changes to documents or operations* (e-Doc 4055483).

G.3 Financial Guarantee

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

Preamble

The licensee is responsible for all costs of decommissioning at the facility. All such costs are included in the licensee's decommissioning cost estimates and are covered by the licensee's financial guarantee for decommissioning. The licensee's decommissioning cost estimate is provided in the facility's preliminary decommissioning plan. The facility's current financial guarantee is covered by specific financial instruments as listed below.

The latest revision of the preliminary decommissioning plan (PDP) and estimation of the cost of decommissioning were finalized in Orano's *Preliminary Decommissioning Plan & Preliminary Cost Estimate,* November 2020.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CSA Group	Decommissioning of facilities containing nuclear substances	N294-09
CSA Group	Decommissioning of facilities containing nuclear substances	N294-19*

* Licensee to implement requirements of CSA N294-19: Decommissioning of facilities containing nuclear substances, for the next scheduled financial guarantee update due in 2023.

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Facility Description Manual	5107638	Yes
Orano	Preliminary Decommissioning Plan and Financial Assurance	6416338	Yes
Orano	Financial Instruments – to be added when confirmed		Yes

The financial guarantee for decommissioning the McClean Lake Operation shall be reviewed and revised by the licensee every five years, when required by the Commission, or following a revision of the preliminary decommissioning plan that significantly impacts the financial guarantee. The next preliminary decommissioning plan and cost estimate update is expected in 2025.

GENERAL

The licensee shall submit annually to the Commission, a written report confirming that the financial guarantees for decommissioning costs remain valid and in effect and sufficient to meet the decommissioning needs. In addition, Orano will provide assurance that all financial instruments used to support the financial guarantee remain valid and accessible on annual basis and meet the criteria of REGDOC 3.3.1 and G-206. The licensee shall submit this report by the end of March of each year, or at any time as the Commission may request.

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Financial Guarantees for the Decommissioning of Licensed Activities	G-206
CNSC	Decommissioning Planning for Licensed Activities	G-219 (REGDOC 3.3.1)

G.4 Public Information and Disclosure

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

Preamble

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

Compliance Verification Criteria

Licensing Basis Publications

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

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	Public Information Program	5311866	Yes

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 and fosters a healthy safety culture.

The management system must satisfy the requirements set out in the NSCA, regulations made pursuant to the NSCA, the licence and the measures necessary to ensure that safety is of paramount consideration in implementation of the management system. An adequately established and implemented management system provides the evidence that the licensing basis remains valid.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CSA Group	Management system requirements for nuclear facilities (except sections identified under other license conditions)	N286-12
CNSC	Safety Culture* (section 2)	REGDOC-2.1.2

* Elements relating to security culture will not be implemented until 2022.

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	McClean Lake Operation Integrated Management System Manual	5103205	Yes

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Safety Culture (excluding section 2)	REGDOC-2.1.2

Licence Condition 1.2

The licensee shall ensure that every contractor working at the facility complies with this licence.

Preamble

This LC requires that the licensee retain responsibility for the protection of the health, safety, and security of the public and workers, and the protection of environment when contractors perform licensed activities.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	Document Number	Prior Notification Required
Orano	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes

The management of contractors shall be evaluated against the following principles:

1.2.1 The risks to contractors and risks to the organization from the use of contractors are evaluated to identify, assess, and eliminate or control hazards.

1.2.2 The duties and authorities of contractor personnel are clearly defined and documented.

1.2.3 When the licensee requires contractors to implement parts of the management system, the licensee is directly responsible for ensuring expectations are established, understood and achieved.

1.2.4 Contractors are adequately trained on relevant licensee procedures and are qualified and competent.

1.2.5 Qualified and competent members of the licensee's staff maintain oversight of the contractors' performance. The oversight program is planned, defined and the results documented.

1.2.6 Contractor personnel are held to the same performance standards as licensee employees.

Guidance

There is no guidance provided for this licence condition.

2. HUMAN PERFORMANCE MANAGEMENT

Licence Condition 2.1

The licensee shall implement and maintain a training program.

Preamble

The "human performance management" safety and control area covers activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee workers are in all relevant job areas and have the necessary knowledge, skills, procedures and tools in place to safely perform their duties.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	McClean Lake Operation Integrated Management System Manual	5103205	Yes

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	*Personnel Training*, Version 2	REGDOC-2.2.2

The human performance management program will be evaluated against the following principles:

2.1.1 A training system is implemented and maintained to ensure that training programs are systematically defined, designed, developed, implemented, evaluated, recorded and managed.

2.1.2 A training system is implemented and maintained to provide a logical progression from an analysis of the training requirements and identification of the qualifications and competencies required for performing a job, to the design, development, implementation, evaluation and management of training. This includes the respective training materials, and the subsequent evaluation and continuous improvement of the training courses and training programs.

2.1.3 All performance requirements of a capability, job or duty are identified by conducting a job analysis to determine all of the tasks, subtasks and task elements involved.

2.1.4 The necessary general worker training, initial job training and continuing training requirements for workers, based on a task analysis of the knowledge, skills, abilities and attitudes required to perform the duties of their position are defined and documented.

2.1.5 Appropriate training is designed, developed and implemented to meet the qualification and competency requirements.

2.1.6 Trainers meet and maintain documented qualification and competency requirements, particularly in the areas of subject matter expertise and instructional skills.

2.1.7 Formal evaluations confirm and document that each trained worker is qualified and competent to perform the duties of his or her position.

2.1.8 The change management process identifies required training and modifications to the training programs.

2.1.9 Continuing training that includes updates to training programs stemming from the change management process is provided to workers.

2.1.10 The results of periodic training program evaluations are incorporated into training program improvements.

2.1.11 Workers are trained in current procedures and in relevant system and equipment configurations and are competent to perform the duties of their position.

2.1.12 Workers training and qualifications records are established and maintained.

2.1.13 Workers have a level of training related to nuclear safety including but not limited to radiation safety, on-site emergency arrangements, conventional health and safety and environmental protection corresponding to the duties of their position and employment.

Guidance

There is no guidance provided for this licence condition.

3. OPERATING PERFORMANCE

Licence Condition 3.1

The licensee shall implement and maintain an operating program, which includes a set of operating limits.

Preamble

The "operating performance" safety and control area includes an overall review of the conduct of the licensed activities and the activities that enable effective performance.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CSA Group	Management system requirements for nuclear facilities	N286-12

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	McClean Lake Operation Integrated Management System Manual	5103205	Yes
Orano	Environmental Protection Code of Practice	5107660	Yes
Orano	Radiation Code of Practice	5335193	Yes
Orano	Technical Information Document, Tailings Management, May 2015	4775706	Yes
Orano	SABRE Project	5158270	Yes
Orano	Facility Description Manual	5107638	Yes

Guidance

There is no guidance provided for this licence condition.

Licence Condition 3.2

The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

Preamble

This LC requires the licensee 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. Sections 29 and 30 of the *General Nuclear Safety and Control Regulations,* section 38 of the *Nuclear Substances and Radiation Devices Regulations* and section 16 of the *Radiation Protection Regulations* provides further insight into reportable events.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	REGDOC-3.1.2

The licensee shall report effluent concentrations that reach or exceed the discharge limits in the *Metal and Diamond Mining Effluent Regulations* in addition to requirements outlined in CNSC's REGDOC-3.1.2.

The licensee shall submit to the CNSC within 90 days after the end of each quarter of a calendar year, the results of the:

- radiation monitoring program
- environmental monitoring program

Results from the above monitoring programs are also to include quality assurance and quality control information. More frequent reporting may be requested on a case-by-case basis.

The licensee shall issue worker radiation dose records within 90 days after the end of each quarter of a calendar year, to:

- the worker
- the CNSC
- the National Dose Registry (NDR)

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

Guidance

Guidance Publications

Source	Document Title	CNSC e-Access Document Number
CNSC/SK	CNSC – Saskatchewan Harmonized Annual Reporting Requirements, August 2010	3678482

Licence Condition 3.3

The licensee shall implement and maintain a program for nuclear substances and radiation devices.

Preamble

Licensees must ensure they receive CNSC authorization before the possession, use, storage, transfer, or disposal of nuclear substances and radiation devices, except as specified in the tables for this section. It is the responsibility of the licensee to ensure that they have CNSC authorization for the import or export of any nuclear substances and radiation devices.

The possession limits for unsealed nuclear substances does not apply to natural uranium and its decay products which originate in the mining or ore-treatment streams.

It is also important to note that there is no possession limit on the number of sealed nuclear sources or radiation devices.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Licence Application Guide: Nuclear Substances and Radiation Devices (excluding section 2)	REGDOC-1.6.1

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
Orano	McClean Lake Operation Integrated Management System Manual	5103205	Yes

The authorized make and model of radiation devices and the maximum quantity of nuclear substance per each device are:

Radiation Device Make and Model	Nuclear Substance	Maximum Quantity per Radiation Device
Ronan Engineering SA-1	Cesium-137	7,400 MBq
Texas Nuclear 5201	Cesium-137	740 MBq
Thermo Fisher Scientific Material Analyzer AM282	Cadmium-109	740 MBq
Niton Thermo Electron 700XLP	Cadmium-109	1,480 MBq
Berthold Technologies LB 7444-CR	Cobalt-60	18,500 MBq
Berthold Technologies LB 300L	Cobalt-60	18,500* MBq

* Consists of two rod sources affixed together (two sources activities are 10,091 and 8,409 MBq)

The authorized possession limits for unsealed nuclear substances are:

Nuclear Substance	Maximum Total Quantity in Possession
Americium-241	1 MBq
Barium-133	10 MBq
Lead-210	400 kBq
Polonium-208	10 kBq
Polonium-210	400 kBq
Radium-226	1 MBq
Thorium-228	5 MBq
Thorium-234	40 MBq

The management of nuclear substances and radiation devices will be evaluated against:

3.3.1 A radioisotope safety poster approved by the Commission or a person authorized by the Commission, which corresponds to the classification of the area, room or enclosure, is posted in a readily visible location in areas, rooms or enclosures where these listed nuclear substances are handled.

3.3.2 When in storage, radioactive nuclear substances or radiation devices are accessible only to persons authorized by the licensee; the dose rate at any occupied location outside the storage area, room or enclosure resulting from the substances or devices in storage does not exceed 2.5 mSv/h and measures are in place to ensure that the dose limits in the *Radiation Protection Regulations* are not exceeded as a result of the substances or devices in storage.

Guidance

There is no guidance provided for this licence condition.

OPERATING PERFORMANCE

4. SAFETY ANALYSIS

Licence Condition 4.1

The licensee shall implement and maintain a safety analysis program.

Preamble

The "safety analysis" safety and control area includes the systematic evaluation of the potential hazards associated with the proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	McClean Lake Operation, Technical Information Document, Hydrogeology and Groundwater Modeling of the Collins Creek Basin	3870068	Yes
AREVA	McClean Lake Operation – Environmental Performance Technical Information Document, Volume 1 Environmental Monitoring	5012881 5209521	Yes
AREVA	McClean Lake Operation – Environmental Performance Technical Information Document, Volume 2 of 2 – Environmental Risk Assessment	5094511 5212962	Yes
AREVA	McClean Lake Operation, Technical Information Document, Waste Rock Management	4163394	Yes

The safety analysis program will be evaluated against the following principles:

4.1.1 A process has been implemented and maintained to identify, assess, and eliminate or control health and safety and environmental risks associated with existing and new processes or changes to work procedures, equipment, organizational structure, staffing, products, services and suppliers.

4.1.2 Risks to health, safety and the environment have been identified, assessed, eliminated or controlled for existing and new processes or for changes to work procedures, equipment, organizational structure, staffing, products, services and suppliers.

4.1.3 Appropriate methodologies are used to identify potential hazards and consider the effectiveness of preventative measures and strategies in reducing the effects of such hazards.

4.1.4 Modeling is regularly updated using measured values to replace important assumptions and to increase the certainty of predicted long-term behaviour of contaminants.

Job hazard assessments conducted when planning non-routine and complex work activities are discussed under operating performance.

Guidance

There is no guidance provided for this licence condition.

5. PHYSICAL DESIGN

Licence Condition 5.1

The licensee shall implement and maintain a design program.

Preamble

The "physical design" safety and control area relates to activities that impact the ability of structures, systems and components to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account.

The design basis is the range of conditions and events taken into account in the design of structures, systems and components of a facility according to established criteria, such that the facility can withstand them without exceeding authorized limits for the planned operation of safety systems.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Design of Uranium Mines and Mills: Ventilation Systems*	REGDOC-2.5.4
CSA Group	Management system requirements for nuclear facilities	N286-12

* Applicable when applying for a CNSC licence to prepare a site for and construct, operate or decommission a uranium mine or mill.

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Facility Description Manual	5107638	Yes

Guidance

There is no guidance provided for this licence condition.

6. FITNESS FOR SERVICE

Licence Condition 6.1

The licensee shall implement and maintain a fitness for service program.

Preamble

The "fitness for service" safety and control area covers activities that impact the physical condition of structures, systems and components to ensure that they remain effective over time. This area includes programs that ensure equipment is available to perform its intended design function when called upon to do so.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CSA Group	Management system requirements for nuclear facilities	N286-12

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Facility Description Manual	5107638	Yes

The fitness for service program will also be assessed against:

6.1.1 Systems, equipment, and devices are maintained in good working order such that they can perform their design function.

6.1.2 Instruments, controls and associated indicators are maintained operational and in calibration. Method and interval of calibrations are defined, and records of calibrations are kept.

6.1.3 Preventative and corrective maintenance processes and systems have been implemented and are maintained.

6.1.4 Regular inspection and testing of critical infrastructure and equipment are carried out.

6.1.5 A process has been implemented to identify, plan and schedule maintenance activities.

6.1.6 Maintenance, testing, surveillance and inspection backlogs are monitored and minimized.

6.1.7 Methods are used to show the current acceptance and operating status, and to prevent the use of systems, equipment or devices that are inaccurate, uncalibrated or not in working order.

6.1.8 When deviations beyond accuracy limits are found or suspected, their consequence on past results, and on present performance is evaluated.

6.1.9 A process exists to verify that changes to calibration, testing and maintenance requirements due to system and equipment modifications and replacements are implemented.

Guidance

There is no guidance provided for this licence condition.

7. RADIATION PROTECTION

Licence Condition 7.1

The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within 24 hours.

Preamble

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

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Facility Description Manual	5107638	Yes
AREVA	Routine Radiological Monitoring Schedule	5335218	Yes
AREVA	Radiation Protection Code of Practice	5335193	Yes
AREVA	Dosimetry Monitoring Strategy	5335219	Yes

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

7.1.1 Radiological conditions are monitored and sources of internal and external radiation exposures are controlled. Access and work in radiological areas are controlled so that collective and individual radiation exposures are kept in accordance with the ALARA principle.

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

7.1.3 The personal dosimetry program ensures that external and internal radiation doses to individuals are accurately determined and recorded.

7.1.4 Appropriate contamination control measures are implemented to control and minimize the contamination of areas, equipment and personnel.

7.1.5 Effective decontamination control measures are implemented to control and prevent the contamination of areas, equipment and personnel.

Action levels (AL) are designed to alert licensees before regulatory dose limits are reached. By definition, if an AL referred to in a licence is reached, a loss of control of some part of the associated RP program may have occurred and specific action is required, as defined in the *Radiation Protection Regulations*, the licence and the applicable code of practice.

Action Level	Dose (mSv)
Weekly Action Level	1
Quarterly Action Level	5

The weekly AL is assessed against official dosimetry results or engineering monitoring data. The quarterly AL is assessed against official dosimetry results. The licensee is expected to review and, if necessary, revise the ALs specified above at least once every five years in order to validate their effectiveness. The results of such reviews should be provided to the CNSC.

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Measuring Airborne Radon Progeny at Uranium Mines and Mills	G-4
CNSC	Ascertaining and Recording Radiation Doses to Individuals	G-91
CNSC	Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"	G-129
CNSC	Preparing Codes of Practice to Control Radiation Doses at Uranium Mines and Mills	G-218
CNSC	Developing and Using Action Levels	G-228
CNSC	Technical and Quality Assurance Requirements for Dosimetry Services	S-106
CNSC	Making Changes to Dose-Related Information Filed with the National Dose Registry	S-260

8. CONVENTIONAL HEALTH AND SAFETY

Licence Condition 8.1

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

Preamble

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

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

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

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes

The conventional health and safety program will be assessed against the following principles:

8.1.1 Housekeeping standards have been identified and are enforced to ensure that work areas are kept clean and organized.

8.1.2 Facilities, processes and procedures have been implemented to ensure the safe management of hazardous materials.

8.1.3 Employees and contractors actively participate in the management of conventional health and safety.

8.1.4 Management verifies that employees and contractors actively participate in the management of health and safety in their workplace.

8.1.5 A process has been established and maintained to monitor, measure and record conventional health and safety performance and the effectiveness of the occupational health and safety program on a regular basis.

8.1.6 Routine inspections are performed by workers, supervisors, senior staff and/or safety professionals to identify any potential safety issues.

8.1.7 Processes and procedures are established and maintained to investigate accidents and incidents, to identify root causes, to implement corrective actions and to verify that corrective actions have been completed and will effectively prevent recurrence.

8.1.8 Procedures have been implemented and maintained for reporting work-related injuries, illnesses, fatalities and conventional health and safety incidents including near misses.

8.1.9 The causes of injuries are investigated, corrective actions implemented, and the effectiveness of corrective actions verified.

8.1.10 A preventative and corrective action procedure has been established and maintained to address non-conformances and inadequately controlled risks.

Guidance

There is no guidance provided for this licence condition.

9. ENVIRONMENTAL PROTECTION

Licence Condition 9.1

The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within 24 hours.

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.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.1	REGDOC-2.9.1
CSA Group	Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills	N288.4-10
CSA Group	Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills	N288.5-11
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	N288.7-15
CSA Group	Establishing and implementing action levels for releases to the environment from nuclear facilities	N288.8-17

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Environmental Monitoring Program - Locations, Frequencies and Parameters	5311881	Yes
AREVA	Environmental Protection Code of Practice	5107660	Yes
AREVA	Technical Information Document Environmental Performance, Volume 2 of 2 – Environmental Risk Assessment	5094511 5212962	Yes
AREVA	Selenium Adaptive Management Plan Selenium Adaptive Management Plan Update, Version 2, September 2020	5217270 6392517 6477959	Yes

To ensure the applicable environmental protection measures have been established, implemented and maintained, the environmental protection program will also be assessed against:

9.1.1 Action levels specified in the Environmental Protection Code of Practice. When the licensee becomes aware that an action level has been triggered, the licensee shall notify the Commission within 24 hours and take specific action as defined in the *Uranium Mines and Mills Regulations* and the environmental code of practice.

9.1.2 The authorized release limits as specified below. When the licensee becomes aware that an authorized release limit has been reached or exceeded, the licensee shall immediately notify the Commission, investigate and take corrective action to ensure that the releases are maintained below the authorized release limits.

Guidance

There is no guidance provided for this licence condition.

Licence Condition 9.2

The licensee shall, where the effluent concentration reaches or exceeds the discharge limits specified in the *Metal and Diamond Mining Effluent Regulations*[1], as amended from time to time, immediately investigate and take corrective action to ensure that the effluent concentration is maintained below the discharge limits.

Preamble

The *Metal and Diamond Mining Effluent Regulations* (MDMER) applies to all Canadian metal mines that exceed an effluent flow rate of 50 cubic metres per day and deposit effluent into fisheries waters at any time after the regulations were registered. The MDMER prescribes limits for arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids (TSS), radium-226, and pH in mine effluent.The MDMER also includes a requirement that effluent be non-acutely lethal to rainbow trout.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Environmental Protection Code of Practice	5107660	Yes

[1] *Metal and Diamond Mining Effluent Regulations* (SOR/2002-222)

The authorized liquid effluent release limits are:

Deleterious Substance	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic (mg/L)	0.30	0.45	0.60
Copper (mg/L)	0.30	0.45	0.60
Lead (mg/L)	0.10	0.15	0.20
Nickel (mg/L)	0.50	0.75	1.00
Zinc (mg/L)	0.50	0.75	1.00
Un-ionized ammonia (mg/L)	0.50	N/A	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_3O^+) reported as pH	In a range of 6.0 to 9.5

Acutely Lethal Effluent	0%

Notes:

1) Authorized release limits have been harmonized, where available, with those required under the *Metal and Diamond Mining Effluent Regulations* (MDMER).

2) Definition of Units: mg/L = milligrams per litre
Bq/L = becquerels per litre

3) All concentrations and activities are total values.

4) The above limits shall apply to all effluent discharged to Sink Reservoir from:

   i) the monitoring ponds at the JEB water treatment plant

   ii) the sand filter discharge tank at the Sue water treatment plant

5) "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.

6) "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.

7) "Grab sample" means a quantity of undiluted effluent collected at any given time.

8) ***"Acutely lethal" (Source MDMER)***, in respect of an effluent, means that the effluent at 100 percent concentration kills

   a) more than 50 percent of the rainbow trout subjected to it for a period of 96 hours, when tested in accordance with the acute lethality test set out in section 14.1; or

   b) more than 50 percent of the threespine stickleback subjected to it for a period of 96 hours, when tested in accordance with the acute lethality test set out in section 14.2.

   c) more than 50 percent of the Daphnia magna subjected to it for a period of 48 hours, when tested in accordance with the acute lethality test set out in section 14.3 (*létalité aiguë*).

This definition will be updated in June of 2021 when the new requirement for daphnia magna testing comes into effect.

Guidance

Guidance Publications

Source	Document Title	Document Number
CSA Group	Environmental management systems – requirements with guidance for use	ISO 14001:2015

10. EMERGENCY MANAGEMENT AND FIRE PROTECTION

Licence Condition 10.1

The licensee shall implement and maintain an emergency preparedness program.

Preamble

The "emergency management and fire protection" safety and control area covers emergency plans and emergency preparedness programs which exist for emergencies and for non-routine conditions. It also includes any results of exercise participation.

Licensees are required to continually maintain and enhance their emergency management programs.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Nuclear Emergency Preparedness and Response, Version 2	REGDOC-2.10.1

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes

The emergency management and fire protection program will be assessed against the following principles:

10.1.1 Potential emergency situations are identified.

10.1.2 Pre-incident plans for response to emergencies are developed and are maintained.

10.1.3 Resources, including facilities and equipment required to respond to emergencies are identified and maintained.

10.1.4 Emergency communication protocols are established and understood.

10.1.5 Organization and responsibilities are identified.

10.1.6 Workers are trained to fulfill duties and responsibilities with respect to emergency management and fire plans and procedures.

10.1.7 Procedures are implemented and maintained to prevent, prepare for, and respond to emergencies.

10.1.8 Response plans are periodically tested.

Guidance

There is no guidance provided for this licence condition.

Licence Condition 10.2

The licensee shall implement and maintain a fire protection program.

Preamble

Licensees are required to implement and maintain a fire protection program (a set of planned, coordinated, controlled and documented activities) to ensure that the licensed activities do not result in an unreasonable risk to the health and safety of persons and to the environment due to fire and to ensure that the licensee is able to efficiently and effectively respond to emergency fire situations.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes

Guidance

Guidance Publications

Source	Document Title	Document Number
CSA Group	Fire protection for facilities that process, handle, or store nuclear substances	CSA N393-13

11. WASTE MANAGEMENT

Licence Condition 11.1

The licensee shall implement and maintain a waste management program.

Preamble

The "waste management" safety and control area covers internal waste-related programs that 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.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CNSC	Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings*	REGDOC-2.11.1

* Applicable to new uranium mine or mill projects and/or to new waste management facilities at existing uranium mines and mills.

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Facility Description Manual	5107638	Yes
AREVA	Technical Information Document, Tailings Management, May 2015	4775706	Yes

The waste management program will be assessed against the following principles:

11.1.1 A radioactive waste management program is implemented to control and minimize the volume of radioactive waste.

11.1.2 The volume of waste is minimized by applying the "reduce, reuse, recycle and recover" principle.

11.1.3 Work is carried out in a manner that minimizes waste and prevents pollution.

11.1.4 Waste is stored or disposed of in the appropriate manner.

11.1.5 Wastes are managed in a manner that does not compromise reclamation or decommissioning plans.

11.1.6 The effectiveness of waste management practices is monitored, measured and recorded on a regular basis.

11.1.7 Routine inspections are performed to identify any potential waste management issues and to verify the condition of containment structures and waste management facilities.

11.1.8 The safety of embankments/dams is inspected and evaluated.

11.1.9 Records are kept of the quantities and types of waste generated and the method of disposal or management.

11.1.10 Wastes are managed to control the present and future releases of contaminants to the environment.

11.1.11 Surface water is managed to prevent or minimize the volume that is contaminated.

Guidance

Guidance Publications

Source	Document Title	Document Number
Canadian Dam Association	Canadian Dam Association, Canadian Dam Safety Guidelines	N/A

Licence Condition 11.2

The licensee shall maintain a decommissioning strategy.

Preamble

This LC requires that the licensee maintain a preliminary decommissioning plan (PDP).

A PDP provides an overview of the proposed decommissioning approach that is sufficiently detailed to assure that the proposed approach is, in the light of existing knowledge, technically and financially feasible, and appropriate in the interests of health, safety, security and the protection of the environment. The PDP defines areas to be decommissioned and the general structure and sequence of the principle work packages. The PDP forms the basis for establishing and maintaining a financial arrangement (financial guarantee) that will assure adequate funding of the decommissioning plan.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Document Number
CSA Group	Decommissioning of facilities containing nuclear substances	N294-09
CSA Group	Decommissioning of facilities containing nuclear substances	N294-19*

* Licensee to implement requirements of CSA N294-19: Decommissioning of facilities containing nuclear substances, for the next scheduled PDP submission due to the CNSC in 2025.

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes
AREVA	Facility Description Manual	5107638	Yes
AREVA	Preliminary Decommissioning Plan and Financial Assurance	6416338	Yes

The PDP is to be revised at a minimum every five years or when required by the Commission; however, is to be kept current to reflect any changes in the site or nuclear facility. The McClean Lake Operation PDP was last revised and submitted to the CNSC in 2020. Orano's next submission of the McClean Lake PDP to the CNSC is due in 2025, at which time it will be reviewed against the current version of the CSA Group Standard.

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Financial Guarantees for the Decommissioning of Licensed Activities	G-206
CNSC	Decommissioning Planning for Licensed Activities	G-219

12. SECURITY

Licence Condition 12.1

The licensee shall implement and maintain a security program.

Preamble

The "security" safety and control area covers the programs required to implement and support the security requirements stipulated in the regulations, the licence, orders, or expectations for the facility or activity.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes

The security program will be assessed against the following principles:

12.1.1 The security program addresses the risks identified in an industrial security threat and risk assessment.

12.1.2 Measures are implemented and maintained to prevent the loss of nuclear substances or prevent acts of sabotage at the facility.

12.1.3 Measures are taken to prevent unauthorized access to the mining facility and to areas within the facility where nuclear substances are stored.

12.1.4 The industrial security threat and risk assessment is periodically reviewed and updated.

Guidance

Guidance Publications

Source	Document Title	Document Number
CNSC	Security of Nuclear Substances: Sealed Sources	REGDOC-2.12.3

13. SAFEGUARDS AND NON-PROLIFERATION

Licence Condition 13.1

The licensee shall implement and maintain a safeguards program.

Preamble

The "safeguards and non-proliferation" safety and control area covers the programs and activities required for the successful implementation of the obligations arising from the Canada/International Atomic Energy Agency (IAEA) safeguards agreements, as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons*.

Compliance Verification Criteria

Source	Document Title	Document Number
CNSC	Safeguards and Nuclear Material Accountancy	REGDOC-2.13.1

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes

The safeguards and non-proliferation program will be assessed against CNSC's REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy,* and the following principles:

13.1.1 Reasonable services and assistance are provided to the IAEA to enable the IAEA to carry out its duties and functions.

13.1.2 Prompt access to all locations at the facility is granted to the IAEA at all reasonable times where such access is required for the purposes of carrying on an activity pursuant to a safeguards agreement. Health and safety services and escorts are provided as required in order to facilitate activities.

13.1.3 Records that must be kept or any reports that are required to be made under a safeguards agreement are disclosed to the CNSC and the IAEA.

13.1.4 Reasonable assistance is provided to the IAEA to enable sampling and removal or shipment of samples.

13.1.5 Reasonable assistance is provided to the IAEA to enable measurements, tests and removal or shipment of equipment.

13.1.6 Measures are implemented 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.

13.1.7 Reports and information, that is required to facilitate Canada's compliance with any applicable safeguards agreement, is provided to the Commission.

Guidance

There is no guidance provided for this licence condition.

14. PACKAGING AND TRANSPORT

Licence Condition 14.1

The licensee shall implement and maintain a packaging and transport program.

Preamble

The "packaging and transport" safety and control area covers the safe packaging and transport of nuclear substances to and from the licensed facility.

Every person who transports radioactive material, or requires it to be transported, shall act in accordance with the requirements of the *Transportation of Dangerous Goods Regulations* and the *Packaging and the Transport of Nuclear Substances Regulations, 2015*.

The *Packaging and Transport of Nuclear Substances Regulations, 2015* and the *Transportation of Dangerous Goods Regulations* provides specific requirements for the design of transport packages, the packaging, marking and labeling of packages and the handling and transport of nuclear substances.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Source	Document Title	CNSC e-Access Document Number	Prior Notification Required
AREVA	McClean Lake Operation Integrated Quality Management System Manual	5103205	Yes

The licensee shall implement and maintain a packaging and transport program that will ensure compliance with the requirements set out in the *Transportation of Dangerous Goods Regulations* and in the *Packaging and Transport of Nuclear Substances Regulations, 2015.*

Guidance

There is no guidance provided for this licence condition.

15. FACILITY SPECIFIC

There are no facility-specific licence conditions.

APPENDIX A CHANGE CONTROL PROCESS

A.1 Change Control Process

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

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

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

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

1. the CNSC receives or initiates written notification of proposed change
2. initiate a change request using the Change Request Form
3. complete a technical review of the proposed change, if required
4. consult the licensee and in case of disagreement on the proposed change, the dispute resolution process outlined in section A.3 will apply
5. obtain consent and signature from a Delegated Officer
6. update the LCH in accordance with the Change Request Form and send the updated document to the parties identified on the distribution list (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 NSCA, a regulation made under the Act or the licence, or has implications under the *Impact Assessment Act*, or whether a licence amendment or other licensing action would likely be required
      - where applicable, the alternatives evaluated and the reasons for selection of the chosen option
      - any changes to the inventories of nuclear substances on site related to the proposed change
      - the construction, commissioning and operating schedule for the proposed change including hold points or progress reports for regulatory review and approval (as appropriate)
      - expected impacts, if any, on the proposed decommissioning or closure plans
      - results of any risk analysis or hazard operability 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.

APPENDIX A

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 annual report to the Commission.

APPENDIX B LICENSEE DOCUMENTS THAT REQUIRE NOTIFICATION OF CHANGE

Document Title	e-Doc
Facility Description Manual	5107638
McClean Lake Operation Integrated Quality Management System Manual	5103205
SABRE Project	5158270
Selenium Adaptive Management Plan	5217270, 6392517 & 6477959
Compliance Achievement with Licence Condition Handbook – Reference Document	5148909
Ventilation Monitoring Specification Report	5148889
Environmental Monitoring Program - Locations, Frequencies and Parameters	5311881
Environmental Protection Code of Practice	5107660
Radiation Protection Code of Practice	5335193
Dosimetry Monitoring Strategy	5335219
Routine Radiological Monitoring Schedule	5335218
Public Information Program	5311866
Preliminary Decommissioning Plan and Financial Assurance	6416338

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

Document	Document Title	Document Number
Canadian Dam Association	Canadian Dam Association, Canadian Dam Safety Guidelines	N/A
CNSC	Change Control Process	19-318-07
CNSC	Measuring Airborne Radon Progeny at Uranium Mines and Mills	G-4
CNSC	Ascertaining and Recording Radiation Doses to Individuals	G-91
CNSC	Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"	G-129
CNSC	Financial Guarantees for the Decommissioning of Licensed Activities	G-206
CNSC	Preparing Codes of Practice to Control Radiation Doses at Uranium Mines and Mills	G-218
CNSC	Decommissioning Planning for Licensed Activities	G-219
CNSC	Developing and Using Action Levels	G-228
CNSC	Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.1	REGDOC-2.9.1
CNSC	Personnel Training, Version 2	REGDOC-2.2.2
CNSC	Nuclear Emergency Preparedness and Response, Version 2	REGDOC-2.10.1
CNSC	Safeguards and Nuclear Material Accountancy	REGDOC-2.13.1
CNSC	Public Information and Disclosure	REGDOC-3.2.1
CNSC	Licence Application Guide Nuclear Substances and Radiation Devices	REGDOC-1.6.1
CNSC	Safety Culture	REGDOC-2.1.2
CNSC	Design of Uranium Mines and Mills: Ventilation Systems	REGDOC-2.5.4
CNSC	Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings	REGDOC-2.11.1
CNSC	Security of Nuclear Substances: Sealed Sources	REGDOC-2.12.3

Document	Document Title	Document Number
CNSC	Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	REGDOC-3.1.2
CNSC	Regulatory Fundamentals	REGDOC-3.5.3
CNSC	Technical and Quality Assurance Requirements for Dosimetry Services	S-106
CNSC	Making Changes to Dose-Related Information Filed with the National Dose Registry	S-260
CNSC/SK	CNSC – Saskatchewan Harmonized Annual Reporting Requirements, August 2010	e-Doc 3678482
CSA Group	Management system requirements for nuclear facilities	N286-12
CSA Group	Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills	N288.4-10
CSA Group	Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills	N288.5-11
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	N288.7-15
CSA Group	Establishing and implementing action levels for releases to the environment from nuclear facilities	N288.8-17
CSA Group	Decommissioning of facilities containing nuclear substances	N294-09
CSA Group	Decommissioning of facilities containing nuclear substances	N294-19*
CSA Group	Environmental management systems – requirements with guidance for use	ISO 14001:2015
CSA Group	Fire protection for facilities that process, handle, or store nuclear substances	CSA N393-13

Note: For CNSC documents, the most recent version of a referenced document shall be implemented following review and agreement between Orano and the Canadian Nuclear Safety Commission.

APPENDIX C

CURRENT LICENCE

eDoc # 5485021 (Word)

eDoc # 5515452 (PDF)

URANIUM MINE OPERATING LICENCE
ORANO CANADA INC.
McCLEAN LAKE OPERATION

I) LICENCE NUMBER: **UMOL-MINEMILL-McCLEAN.01/2027**
(Effective Date: July 12, 2018)

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
P.O. Box 9204
Saskatoon, Saskatchewan S7K 3X5

III) LICENCE PERIOD: This licence is valid from July 1, 2017 to June 30, 2027, unless suspended, amended, revoked or replaced.

IV) LICENSED ACTIVITIES:

This licence authorizes the licensee to:

a) operate and modify a nuclear facility (hereinafter, "the facility") for the mining of uranium ore and the production of uranium concentrate at a site known as the McClean Lake Operation in the province of Saskatchewan, as shown on the drawing referenced in appendix A to this licence

b) mine a nuclear substance (uranium ore)

c) produce a uranium concentrate

d) import, possess, use, store, transfer and dispose of nuclear substances and radiation devices that are required for or associated with laboratory studies, field studies, fixed gauge use and borehole logging devices

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 McClean Lake Operation 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 for decommissioning 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.

1.2 Management of Contractors

The licensee shall ensure that every contractor working at the facility complies with this licence.

2. HUMAN PERFORMANCE MANAGEMENT

2.1 Training Program

The licensee shall implement and maintain a training program.

3. OPERATING PERFORMANCE

3.1 Operations Program

The licensee shall implement and maintain an operating program, which includes a set of operating limits.

3.2 Reporting Requirements

The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

3.3 Nuclear Substances and Radiation Devices

The licensee shall implement and maintain a program for nuclear substances and radiation devices.

4. SAFETY ANALYSIS

4.1 Safety Analysis Program

The licensee shall implement and maintain a safety analysis program.

5. PHYSICAL DESIGN

5.1 Design Program

The licensee shall implement and maintain a design program.

6. FITNESS FOR SERVICE

6.1 Fitness for Service Program

The licensee shall implement and maintain a fitness for service program.

7. *RADIATION PROTECTION*

7.1 Radiation Protection Program

The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within 24 hours.

8. *CONVENTIONAL HEALTH AND SAFETY*

8.1 Conventional Health and Safety Program

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

9. *ENVIRONMENTAL PROTECTION*

9.1 Environmental Protection Program

The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within 24 hours.

9.2 Reaching or Exceeding Effluent Discharge Limits

The licensee shall, where the effluent concentration reaches or exceeds the discharge limits specified in the *Metal Mining Effluent Regulations*[1], as amended from time to time, immediately investigate and take corrective action to ensure that the effluent concentration is maintained below the discharge limits.

10. EMERGENCY MANAGEMENT AND FIRE PROTECTION

10.1 Emergency Preparedness Program

The licensee shall implement and maintain an emergency preparedness program.

[1] Metal Mining Effluent Regulations (SOR/2002-222)

10.2 Fire Protection Program

The licensee shall implement and maintain a fire protection program.

11. WASTE MANAGEMENT

11.1 Waste Management Program

The licensee shall implement and maintain a waste management program.

11.2 Decommissioning Strategy

The licensee shall implement and maintain a decommissioning strategy.

12. SECURITY

12.1 Security Program

The licensee shall implement and maintain a security program.

13. SAFEGUARDS AND NON-PROLIFERATION

13.1 Safeguards Program

The licensee shall implement and maintain a safeguards program.

14. PACKAGING AND TRANSPORT

14.1 Packaging and Transport Program

The licensee shall implement and maintain a packaging and transport program.

SIGNED at OTTAWA, this 12 day of July, 2018.

M. Binder

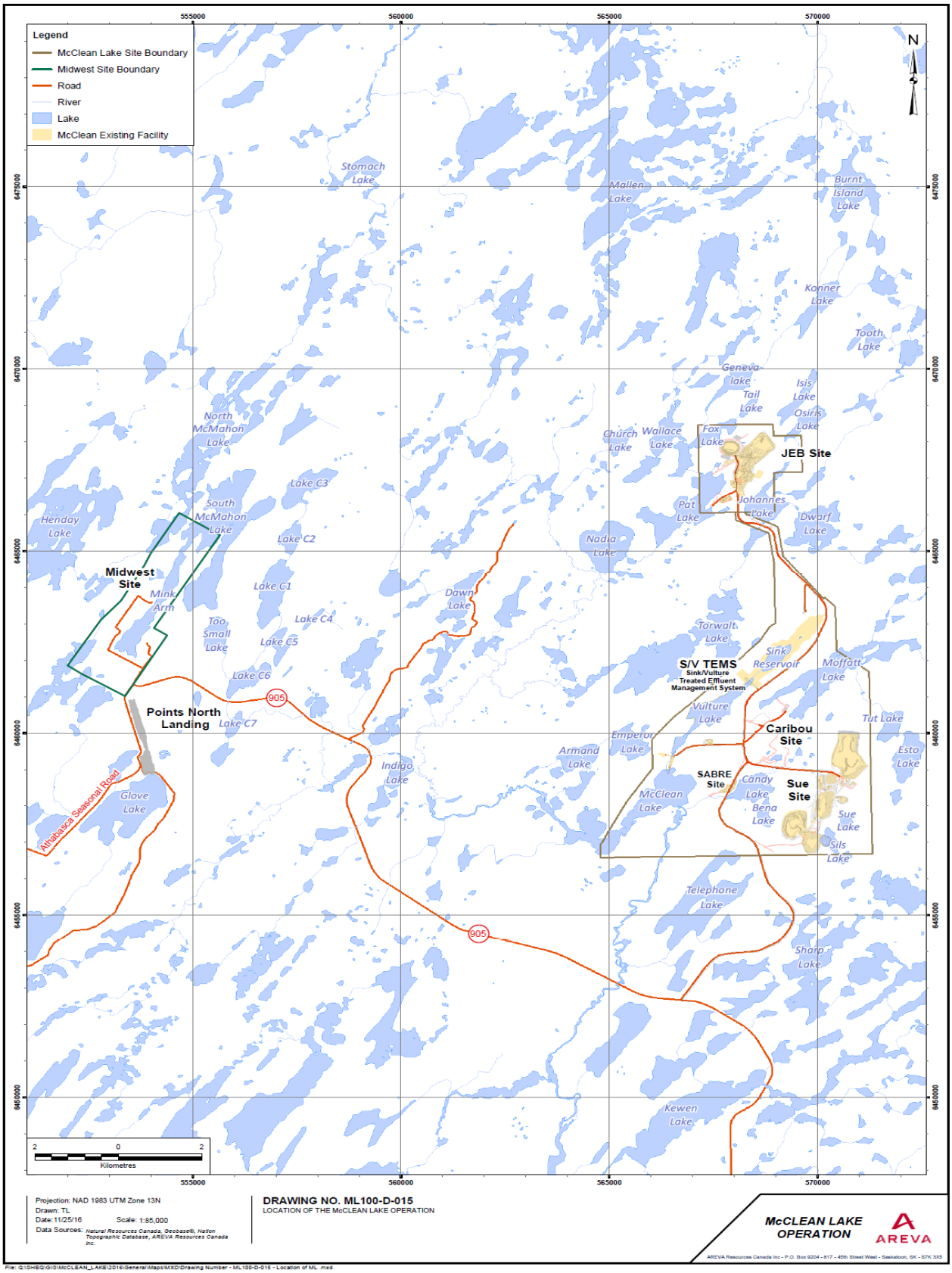
Michael Binder, President
on behalf of the Canadian Nuclear Safety Commission

e-DOC 5485021 (Word)
e-DOC 5515452 (PDF)

APPENDIX A

LOCATION OF THE McCLEAN LAKE OPERATION

The location of the McClean Lake Operation is shown on McClean Lake Operation Drawing No. ML100-D-015 (e-Doc 5146834).



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