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Cameco Corporation**

**Mémoire de
Cameco Corporation**

In the Matter of the

À l'égard de

**Cameco Corporation,
Cigar Lake Operation**

**Cameco Corporation,
établissement de Cigar Lake**

Application for the renewal of Cameco's uranium mine licence for the Cigar Lake Operation

Demande de renouvellement du permis de mine d'uranium de Cameco pour l'établissement de Cigar Lake

Commission Public Hearing

Audience publique de la Commission

April 28-29, 2021

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Executive Summary

Cameco Corporation (Cameco) was granted renewal of the Canadian Nuclear Safety Commission (CNSC) licence for the Cigar Lake uranium mine (Cigar Lake Operation or Cigar Lake) following public Commission hearings on April 3-4, 2013. The current licence (UML-MINE-CIGAR.00/2021) is valid from July 1, 2013 to June 30, 2021. This Commission Member Document provides a high-level summary of the licensing basis and supports Cameco's request for a renewal of the Cigar Lake CNSC licence for a 10-year term.

The Cigar Lake Operation is the second largest high-grade uranium mine in the world and has been in commercial operation since 2015. During the current licence term, Cigar Lake successfully transitioned through the final stages of commissioning and ramped up to full operational status. Cigar Lake achieved this while consistently implementing our programs and protecting the health and safety of its workers and the public, as well as the environment. The following are some highlights of Cigar Lake's performance over the current licence term:

- External recognition for conventional safety programs on three occasions during the licence term, winning the regional John T. Ryan safety trophy for metal mines in 2018, 2019 and 2020.
- Injury statistics have all trended downward.
- Low effective doses received by workers.
- Measures implemented to reduce treated water loadings to the environment during initial commercial production years.

Cameco continues to build understanding and support for Cigar Lake through communications and engagement activities described in the *Public Information Program*. As part of this effort, there has been a particular emphasis on engagement with the rights-bearing Indigenous communities of the Athabasca Basin that are located in the vicinity of Cigar Lake in accordance with Cameco's collaboration agreements. Although the three First Nations and four municipalities are the primary audience for Cigar Lake, additional engagement is also focussed on local Métis people, Cameco employees and long-term contractors as well as the general public of the Northern Administrative District of Saskatchewan.

Engagement activities during the current licence term focused on providing members of the public with ongoing updates on the site's future through presentations, including discussion on the surface and underground facilities that were built at Cigar Lake in order to support the transition to commercial production. Engagement events were held in the current licence term for northern Saskatchewan communities in relation to Cigar Lake activities, including efforts specific to this licence renewal.

In support of the *Public Information Program*, Cigar Lake maintains a Public Disclosure Protocol that was developed in accordance with guidance provided by the CNSC. The

Public Disclosure Protocol describes the types of routine and non-routine information that Cameco is committed to providing to target audiences.

Key to the transition to commercial production was the ability of Cigar Lake to successfully implement the technology of using large-scale freezing from surface to isolate mine infrastructure and workers from the high-grade ore and the water-saturated Athabasca sandstone. In this regard, Cigar Lake was able to safely commission the Jet Boring System (JBS) units to enable mining of the orebody. Cameco declared that the Cigar Lake Operation had met all criteria necessary to achieve commercial production in May 2015 and has been able to safely produce at or near the nominal annual licensed capacity since that time.

In March 2020, Cameco and Orano Canada Inc. (Orano) announced a temporary suspension of production at Cigar Lake as a result of the Coronavirus (COVID-19) pandemic. Cameco's priority is to protect the health and well-being of our employees, their families, and their communities. The proactive decision to suspend production was made to protect our employees and to help slow down the spread of the COVID-19 pandemic. Cameco developed and implemented exposure control measures for our northern Saskatchewan operations, including Cigar Lake. Cameco safely resumed production at Cigar Lake in September 2020. However, due to increasing risks posed by the pandemic and uncertainty regarding continuous access to qualified operational personnel, Cameco again suspended production at Cigar Lake in December 2020.

Cameco believes that Cigar Lake has demonstrated strong performance throughout the current licence term through continuous improvement in our processes. Based on our performance during the current licence period, we have demonstrated that we are qualified to carry on the licensed activities planned for the proposed 10-year licence term and will, in doing so, make the necessary provisions for protecting the health and safety of workers and the public as well as the environment.

1.0 Introduction

1.1 Background

1.1.1 Location

The Cameco Corporation (Cameco) Cigar Lake Operation (Cigar Lake) is a uranium mine in the Athabasca Basin of northern Saskatchewan. It is located approximately 660 km north of Saskatoon at the south end of Waterbury Lake (Figure 1.1-1). The closest communities to Cigar Lake are Hatchet Lake First Nation and the Northern Settlement of Wollaston Lake, which are located about 80 km to the east by air. Cigar Lake is connected by an access road leading to Saskatchewan public Highway 905, which is maintained year-round.

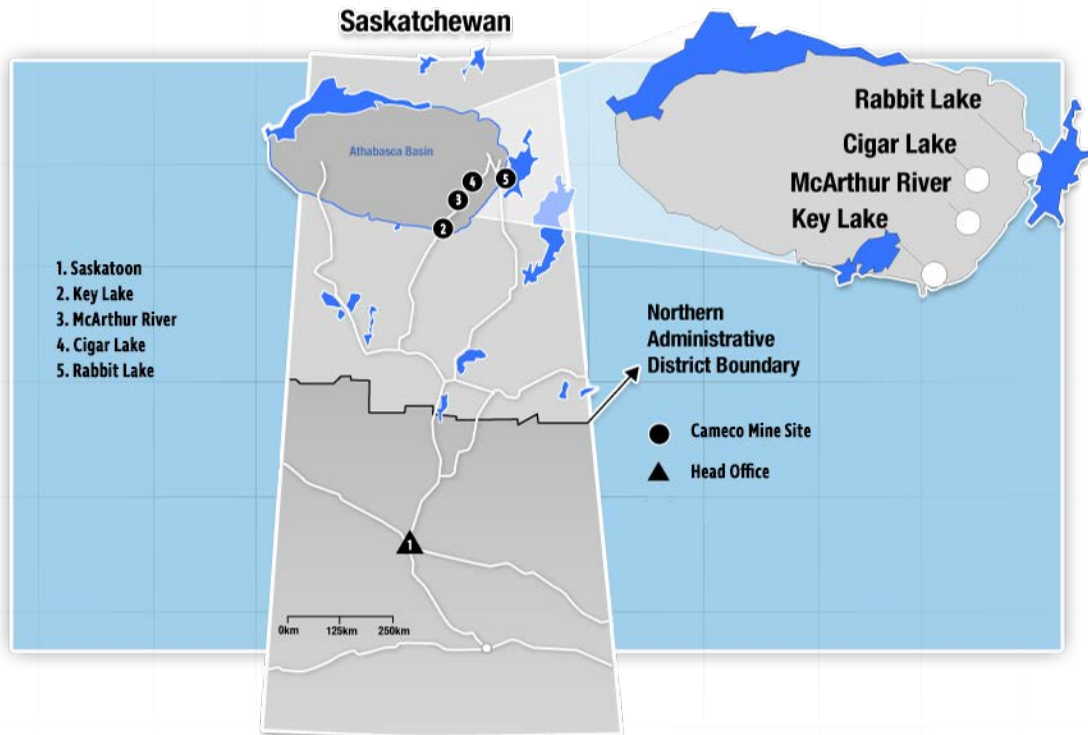


Figure 1.1-1: Cigar Lake Operation location.

Cigar Lake has proven and probable reserves of 66.4 million kg U (172.5 million pounds U_3O_8) at an average grade of 14.7%, which makes it the second-largest, high-grade uranium deposit in the world after Cameco's McArthur River Operation.

Cigar Lake is operated by Cameco on behalf of a joint venture owned by Cameco (50.025%), Orano Canada Inc. (37.1%), Idemitsu Canada Resources Ltd. (7.875%), and TEPCO Resources Inc. (5%).

1.1.2 History

The Cigar Lake deposit was discovered in 1981. While subsequent geological testing confirmed that Cigar Lake was one of the highest-grade uranium deposits ever discovered, it was also clear that development would be challenging given the particular geological setting of the deposit. It would demand innovative approaches to recover the ore and therefore was not a project that was attractive in the low uranium price environment that existed during the years following the deposit's discovery.

The path to production over the three decades following discovery included a period of test mining from underground, which eventually resulted in the decision to employ a jet boring system (JBS) to mine the deposit. A broadly-based environmental assessment process led by a review panel was completed in the 1990s. After that process, an improvement in global uranium prices led to a decision by the joint venture partners to proceed with development. A construction licence was issued by the Canadian Nuclear Safety Commission (CNSC) in late 2004.

Construction at Cigar Lake initially proceeded under the original mining plan that envisioned development under the orebody occurring from two different levels. Freezing of the orebody was to be undertaken underground from the 480-metre level and the JBS mining units would be deployed within cross-cut tunnels constructed at the 465-metre level.

During construction, Cigar Lake incurred several setbacks as a result of water inflow events. Due to these inflow events, Cameco identified a need to manage the higher potential for water inflow that the mine could encounter during construction and operations. However, it was predicted that releasing non-routine, large volumes of treated water into the original treated water discharge point, a muskeg area drained by Aline Creek, could potentially result in erosion within that drainage system. As a result, Cameco proposed building pipelines and discharge points through a diffuser directly to Seru Bay of Waterbury Lake. This proposal triggered a joint federal and provincial environmental assessment, with the final environmental impact statement (EIS) submitted in 2011 [1]. Approval was granted later that year with construction and commissioning of the pipelines and discharge locations, capable of accommodating a predicted non-routine inflow event, completed in 2012.

Cigar Lake developed and successfully executed recovery and remediation plans for the inflows experienced with successful re-entry to the mine workings achieved in early 2010. With the mine fully secured and rehabilitation of underground infrastructure completed, Cameco resumed underground construction activities in 2011. These activities included reinforcing the large run of mine (ROM) opening underground with steel and concrete, installing the remaining processing equipment and completing the furnishing of all ventilation, electrical and piping infrastructure within Shaft No. 2. From 2011 to 2013, Cameco completed the final construction and initial commissioning of facilities and infrastructure.

1.1.3 Activities During the Current Licence Term

CNSC licence UML-MINE-CIGAR.00/2021 was issued to Cameco on July 1, 2013. Initial activities completed under this licence included final commissioning and transition to commercial production. Cigar Lake submitted a final status report and a subsequent addendum in 2016 providing an overview of all final commissioning activities.

Although the final commissioning process did not directly prompt fundamental changes to facilities, equipment or processes, other operational factors necessitated revisions to mine freeze and tunnel development strategies. Chief amongst these were the following:

- Transitioning to a predominantly surface freeze system.
- Changing tunnel liner technology to the *New Austrian Tunneling Method* (NATM) technique.

Additional activities completed during the licence period included construction of:

- Surface freeze pads and freeze plants to support ground freezing from surface.
- Additional slimes pond (Slimes Pond 5).
- A new mechanical shop and associated offices.

Final commissioning activities were successful in maintaining worker health and safety, protecting the environment, and ensuring operational performance targets were met during the transition to production. Cigar Lake ore production began on March 13, 2014 with the first shipment of ore slurry sent to McClean Lake. Production ramp-up continued until May 22, 2015 when Cigar Lake formally announced that it had met all criteria necessary to achieve commercial production. In the first full calendar year of production (2016), Cigar Lake produced 6.8 million kg U, approaching the licensed nominal annual production rate of 7.0 million kg U. Since then, Cigar Lake has been able to produce at or near the licensed nominal production capacity for all subsequent years up to and including 2019.

In March 2020, Cameco and Orano announced a temporary suspension of production at Cigar Lake due to the threat posed by the Coronavirus (COVID-19) pandemic. Cigar Lake remained in a safe state of care and maintenance with reduced levels of on-site personnel for approximately five months, while Cameco monitored the pandemic situation and engaged with our stakeholders in northern Saskatchewan. Cameco developed and implemented exposure control protocols to ensure the protection of our workers, their families, and their communities.

Cigar Lake safety transitioned back into production in September 2020. Upon their return to site, workers were provided an orientation that detailed the new COVID-19 exposure control measures, including site access screening; physical distancing; mask usage; and enhanced cleaning and disinfection protocols. In December 2020, due to increasing risks posed by the pandemic and uncertainty regarding continuous access to qualified operational personnel, Cameco again suspended production at Cigar Lake. At the time of submission of this Commission Member Document (CMD), Cigar Lake remains in a safe

state of care and maintenance. During this time, Cameco will continue to have regular dialogue with public health authorities and northern leaders in Saskatchewan. The timing of an eventual restart will depend on how the COVID-19 pandemic is impacting the availability of the required workforce at Cigar Lake, how cases are trending in Saskatchewan, in particular in northern communities, and the views of public health authorities.

1.2 Summary of Application

Cameco submitted the current application to the CNSC Commission Secretariat on November 18, 2019, requesting the current licence (UML-MINE-CIGAR.00/2021) be renewed prior to its current expiry date of June 30, 2021 for a period of 10 years.

The licensing basis for Cigar Lake is primarily established from the following:

- The regulatory requirements set out in the applicable laws and legislation.
- The conditions and safety and control measures described in the CNSC licence, licence conditions handbook (LCH) and the documents directly referenced in those documents
 - The Cigar Lake *Mining Facility Licensing Manual* (CGR-MFLM).
 - The Cigar Lake *Mining Facility Description Manual* (CGR-MFDM).
 - Cigar Lake program documents and codes of practice.
 - Approved environmental impact statements (EIS).
 - Current environmental risk assessment (ERA).

Cameco submitted the latest revision of the CGR-MFLM along with the application letter. Supporting program level and lower documents have been provided to CNSC staff for their review and acceptance prior to this application to the Commission.

Cameco is requesting a 10-year licence term, following an eight-year licence term where Cigar Lake demonstrated strong performance in safety, radiation, and environmental protection. Cigar Lake successfully transitioned to full commercial production in 2015 and has safely been producing at, or near the nominal average licensed capacity since that time. A 10-year term is also consistent with licence terms granted recently to other nuclear facilities. Cameco expects the upcoming 10 years of operations at Cigar Lake to be marked by a continued focus on the protection of the health and safety of workers and the public and protection of the environment.

2.0 Business Plan

2.1 General

Cigar Lake is a high-grade uranium mine, with grades that are 100 times the world average. Cigar Lake uranium is milled at the McClean Lake mill. Since 2014, Cigar Lake has produced 32.8 million kg U to the end of 2019. Total proven and probable reserves at Cigar Lake are estimated at 66.4 million kg U (172.5 million pounds U_3O_8), while current measured, indicated, and inferred resources are estimated at 48.0 million kg U (125 million pounds U_3O_8). Based on current proven and probable reserves, Cameco is projecting a current mine life for Cigar Lake to 2029.

Despite the challenges of mining high-grade ore located adjacent to water-bearing sandstone under pressure, Cigar Lake has been able to safely produce at its nominal licensed capacity of 7.0 million kg U annually. Cigar Lake has achieved this while exhibiting strong performance in conventional safety and radiation control, thereby keeping workers safe and healthy. Environmental performance at Cigar Lake has also seen continuous improvement. Building on the knowledge and experience gained through the first years of production, Cameco sees Cigar Lake as being well positioned during the proposed licence term to continue to produce at the current licensed production limits while transitioning to new ore zones within the mine.

During the next licence term, Cameco expects to continue to invest capital at Cigar Lake in order to expand the physical infrastructure, which will enable sustained current annual production rates as well as provide the opportunity of optimizing production levels with the use of available infrastructure. Additional infrastructure to support ongoing mining may include, but is not limited to:

- additional surface freeze plants and/or pads
- additional underground freeze infrastructure
- additional ventilation infrastructure
- additional slimes pond(s)
- expansion of waste rock Stockpile C; and
- expansion of surface lease to support additional surface infrastructure.

Further, Cigar Lake will continue to identify and pursue opportunities to improve operational efficiency while continuing to maintain the safety of workers and the public as well as protection of the environment. Such opportunities may include:

- Evaluation of measures to improve safety, environment, and radiation protection performance.
- Examination of opportunities to improve efficiency of current freezing and mine ventilation practices.

- Examination of alternative mining methods.

Existing reserves, which form the basis for the estimated mine life, are the economically mineable portion of the Cigar Lake orebody. Changes in uranium price and/or operating costs can result in conversion of existing resources into reserves. Further, continued exploration may also identify additional resources or reserves within the Cigar Lake orebody.

Cameco expects the track record of Cigar Lake as a safe and environmentally responsible production centre will continue through the remainder of the Cigar Lake mine life, using practices that have been refined in the initial years of commercial production.

3.0 Safety and Control Areas

3.1 General

Cameco recognizes safety and health of our personnel and the public, protection of the environment and quality of our processes as the highest corporate priorities. As such, we strive to be a leading performer through a strong safety culture and our commitment to the following principles in our corporate Safety, Health, Environment and Quality (SHEQ) Policy:

- Preventing injury, ill health, and pollution.
- Fulfilling compliance obligations.
- Keeping risks at levels as low as reasonably achievable, taking into account economic and societal factors.
- Ensuring quality of processes, products, and services.
- Continually improving our overall performance.

During the licence term, the CNSC did not note any concerns related to Safety and Control Areas (SCAs) at Cigar Lake. All SCAs were rated as satisfactory in annual regulatory oversight reports prepared by CNSC Staff.

Additionally, the CNSC conducted 40 inspections at Cigar Lake (Table 3.1-1). In accordance with our corrective action process, all issues identified during inspections were entered into the Cameco Incident Reporting System (CIRS) and addressed to the satisfaction of the CNSC.

Table 3.1-1: CNSC inspections of Cigar Lake SCAs.

	CNSC Inspections	Action Items/ Notices	Recommendations
2013	4	6	6
2014	5	11	12
2015	6	8	8
2016	5	11	12
2017	6	1	4
2018	5	9	12
2019	6	13	3
2020 (to end of Q3)	3	1	0

3.2 Management System

Cameco's corporate policies and programs provide guidance and direction for the site-based programs that support the CGR-MFLM. There are 14 programs, two codes of practice and supporting procedures, work instructions and forms that together comprise the Cigar Lake management system. The Cigar Lake *Quality Management Program* (CGR-QMP) describes the overall site management system as part of the licensing basis. The program addresses the requirements of Cameco's SHEQ Policy as well as providing guidance to the management system aspects of the CNSC SCAs.

The CGR-QMP was built on the 'Plan-Do-Check-Act' model outlined in ISO management standards, including ISO 9001 and ISO 14001. This model is designed to ensure that processes are systematically identified, controlled, and monitored and that those processes, and the program, are continually improved.

Site programs are reviewed and revised as required. Program documents require version control in accordance with the Cigar Lake LCH and are the support references in the CGR-MFLM. The CGR-QMP is reviewed annually for effectiveness through a management review process. Further, Cameco internal audits as well as regulatory audits and inspections are conducted on a regular basis to determine the effectiveness of the quality management system.

3.2.1 Discussion

3.2.1.1 Incident Management

Incidents occurring at Cigar Lake are entered into CIRS and addressed through the corrective action process. Through CIRS, Cigar Lake shares incident trends and corrective action results with the rest of the company to enhance corporate awareness.

Cameco's corrective action process has an incident severity rating system of 1 to 5, with 5 being the most serious. Table 3.2-1 provides a summary of CIRS reporting and corrective actions over the past licence term. During the current licence term there were no Level 5 incidents at Cigar Lake. As shown in the table below, the vast majority of non-conformances entered into CIRS were Level 1 and 2.

Table 3.2-1: CIRS reporting and corrective actions.

	CIRS Events	CIRS Event per FTE on Site	Corrective Actions
2013	1366	0.9	302
2014	1219	1.5	248
2015	1582	2.2	370
2016	1716	2.4	393
2017	1288	2.0	345
2018	975	1.7	340
2019	874	1.6	207
2020 (to end of Q3)	299	0.9	125

Table 3.2-1 also shows a strong reporting culture throughout the current licence term. Through the strength of the Cigar Lake management systems, the overall number of incidents has decreased since the site transitioned into commercial production.

3.2.1.2 Contractor Management

The final commissioning activities conducted over the current licence term often required a large number of contractors on site. Oversight of these contractors was guided by the Cameco corporate *Contractor Management Program (CAM-CMP)*. This program is part of Cameco's integrated SHEQ management system and defines the general process and minimum SHEQ requirements for managing contractors across all of Cameco's sites worldwide. The CAM-CMP ensures:

- Risks are evaluated to identify and eliminate or control hazards,
- Duties of contractors are clearly understood,
- Contractors are adequately trained and qualified for the work, and
- Cameco maintains oversight.

The Cigar Lake contractor management process is guided by a suite of documents within the CGR-QMP. These documents set out comprehensive requirements for contractors to ensure they are held to the same standards as employees, including safety elements, such as participation in job hazard analyses.

3.2.2 Future Plans

Cigar Lake will continue to verify systematically that the controls of the respective management system elements are effectively implemented. Management system documentation will be reviewed and updated for compliance to the applicable sections of

REGDOC-2.1.2, *Safety Culture*. Processes, such as audit and management review, will ensure that enhancements to the site systems are realized.

3.2.3 Conclusion

The CGR-QMP is ensuring the management system aspects of all Cigar Lake programs that address CNSC SCAs are meeting requirements. Through the CGR-QMP Cigar Lake has implemented a number of process improvements during the current licence term. The ongoing improvements reflect the site focus on fulfilling the commitments in Cameco's SHEQ Policy and ensuring a quality management approach is reflected in programs that ensure the quality of our processes and protect the health and safety of persons as well as the environment.

3.3 Human Performance Management

Human performance at Cigar Lake is managed through various processes and systems implemented through the Cigar Lake *Training Development Program* (CGR-TDP). Human performance management covers the activities that enable effective human performance and ensure there are sufficient site personnel in all relevant job areas that have the necessary knowledge, skills, procedures, and tools in place to safely carry out their duties. Cigar Lake has adopted a systematic approach to training (SAT) to ensure these requirements are being met.

3.3.1 Discussion

3.3.1.1 Training

Cigar Lake recognizes that skilled, knowledgeable, and qualified employees, at all stages of our activities, are an integral component of an efficient, safe, and environmentally responsible operation. To support this, Cigar Lake has implemented SAT as a key component of the CGR-TDP.

Implementation of SAT ensures employees are competent based on appropriate education, skills, experience, and behaviours and provides a means of measuring, monitoring, and improving the performance of employees. This has resulted in improved training effectiveness and efficiency and has assisted in the continuous improvement of the CGR-TDP. The implementation of SAT at Cigar Lake was a significant focus during the current licence term and the transition from commissioning to commercial production. All high-risk and medium-risk positions have been through the analysis phase of SAT. Training course materials for those positions have been designed, developed, and implemented. Existing and new employees in these positions are regularly trained and granted new qualifications. New positions are monitored and analyzed for training requirements routinely.

Also, a focus during the transition from commissioning to commercial production was the standardization of training, across Cameco, specific to radiation protection measures

and implementation of core safety standards such as control of hazardous energy and confined space entry. The standardized approach to training across Cameco helped Cigar Lake through the transition to commercial production with minimal safety and radiation incidents.

The CGR-TDP ensures all Cigar Lake employees have training requirements assigned to them based on their role within the organization. Compliance to these training items is tracked by Cameco's *Learning Management System* (LMS). The LMS also enables Cigar Lake to produce a list of mandatory qualifications where there is an expectation of 100% compliance.

3.3.2 Future Plans

The site training department will work with other groups in the corporation to continue to standardize training and training requirements. Through digital transformation, remote training opportunities are becoming more effective and will be evaluated for implementation where practicable. These opportunities will ensure continued compliance with the recently implemented requirements of REGDOC-2.2.2, *Personnel Training*, Version 2.

3.3.3 Conclusions

Cigar Lake has made significant advancements using SAT to document training and ensure all people on site have the training they require to do their jobs safely. The focus on ensuring quality training programs are planned and delivered for new facilities and upgrades will continue.

3.4 Operating Performance

Operating performance at Cigar Lake tracks how the licensed activities are conducted to inform effective performance of the facility. Cameco has developed and implemented programs to mitigate potential risks, maintain integrity of facilities and apply managed processes for operations and control. Cigar Lake reports operational performance, including safety performance, to the CNSC staff annually. Radiation and environmental protection results are reported quarterly to the CNSC staff and yearly in the Cigar Lake Operation Annual Report. Cigar Lake also provides notification to the CNSC staff of any significant event that occurs outside of normal operations.

Operating limits for the site are specified in the CGR-MFLM and operations must meet the requirements of the *Radiation Code of Practice* (RCOP) and *Environmental Code of Practice* (ECOP). Further, Cigar Lake utilizes a formal change management process to improve workflow processes, material management, operator care and engineering reliability with these activities being tracked and documented through the CGR-QMP. This formal approach is part of a larger corporate operational improvement effort.

The Cigar Lake *Mining Operations Program* (CGR-MOP) describes the development and production mining processes at the site, which ensures risks in each area of the mine are identified, reduced and mitigated through assessments that encompass water inflow potential, radiation protection, and ground stability. Through this program, Cigar Lake evaluates area-specific risks, develops ground support models, co-ordinates activities between organizational departments, and facilitates third-party reviews of proposed ground support and development parameters.

The Cigar Lake *Processing Operations Program* (CGR-POP) outlines the specific steps, equipment and procedures used to process uranium ore safely through the underground processing circuit and the surface loadout facility. Through this program, controls are in place to ensure that people and the environment are protected.

3.4.1 Discussion

3.4.1.1 Final Commissioning

During the current licence term, one of the primary goals at Cigar Lake was to safely commission the Jet Boring System (JBS) units to enable mining of the Cigar Lake orebody at rates necessary to achieve commercial production. The JBS is a semi-mobile mining machine that is positioned below the ore body (Figure 3.4-1). The mining sequence is first to establish, or drill, a pilot hole into the ore. Specialty hardware and tooling is then deployed upwards in this hole to mine the ore using high pressure water. Cuttings are contained and fed to a pump box on the JBS, which forwards the material to the run of mine storage sumps. Once a mining cycle is complete, and the cavity has been successfully excavated, the cavity is then backfilled with concrete.

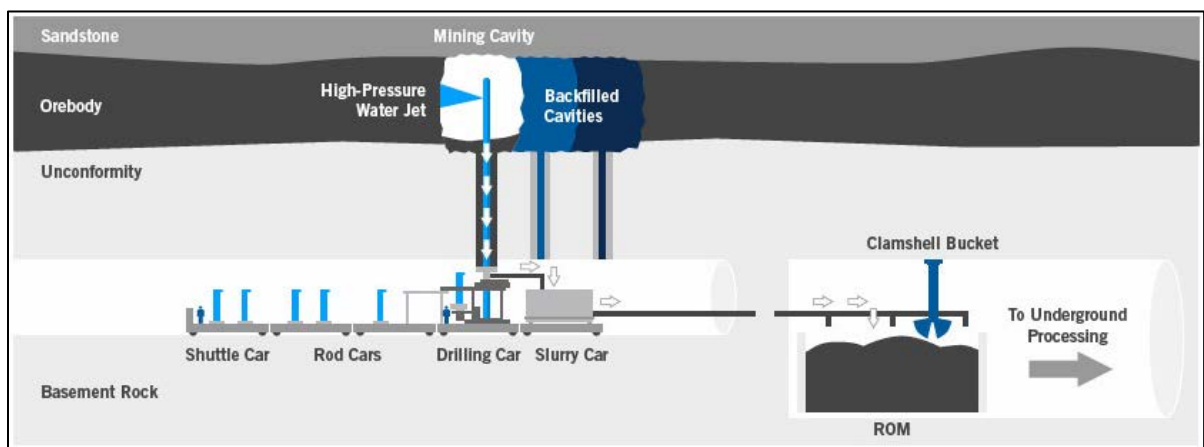


Figure 3.4-1: JBS mining method.

Achieving commercial production rates requires simultaneous operation of three JBS mining units in various stages of the cycle. Cigar Lake measured ongoing operational performance of the JBS units based on continuous production while meeting cycle time requirements. Over the course of final commissioning, Cameco was able to improve the

JBS cycle time greatly, with an average cycle time of approximately eight days being realized by October 2015.

Furthermore, there were no equipment or hardware issues that prompted major overhauls or redesign during the final commissioning period of the ore processing system. The underground ore processing circuit had no material changes to equipment configuration or process design. All final commissioning design and operating ore processing criteria were met safely with no injuries or radiation protection incidents.

3.4.1.2 Commercial Production

In May 2015, Cigar Lake declared it had met all criteria necessary to achieve commercial production. Since that time, Cigar Lake has demonstrated the capability to produce at or near the licensed nominal annual production rate of 7.0 million kg U per year while maintaining the safety of workers and the public and protecting the environment. Operating processes and criteria for production at commercial rates are well understood and documented. Table 3.4-1 provides a summary of annual production rates (100% basis) since declaration of commercial production.

Table 3.4-1: Annual production rates.

	Annual Production (million kg U)
2015	4.95
2016	6.81
2017	6.88
2018	6.94
2019	6.98
2020 (target production) ¹	4.06

¹Temporary suspension of production in March 2020 and December 2020 due to COVID-19.

3.4.2 Future Plans

As a result of activities and successes in the current licence term, Cigar Lake has increased confidence in the JBS mining method for use in future mining zones. However, during the licence term, Cigar Lake will continue to identify and pursue opportunities to improve operational efficiency while continuing to maintain the safety of workers and the public as well as protection of the environment. Such opportunities may include, but are not limited to, improvements to efficiency of current freezing and mine ventilation practices as well as examination of alternative mining methods.

3.4.3 Conclusions

Cameco will continue to invest in capital improvements at Cigar Lake required to ensure safe production through operating performance that remains protective of people and the environment. Along with the facility improvements already undertaken to the mine and process infrastructure, further improvements are planned to keep infrastructure current and improve both mining and processing operations while maintaining the safety of people and protecting the environment.

3.5 Safety Analysis

The major risks at Cigar Lake are associated with the mining of high-grade uranium ore within the water-saturated Athabasca sandstone.

Key mitigation measures that Cameco has employed at Cigar Lake include freezing of the ore deposit and surrounding ground; using the JBS mining process as a non-entry method to separate personnel from the ore; and utilizing ventilation and shielding infrastructure within all underground areas where ore will be processed and transported. The mine plan is developed to mitigate the effects of a potential groundwater inflow through sufficient water handling and pumping capacity within the mine and adequate contingency treatment facilities on surface.

The safety analysis for Cigar Lake mine is derived from the past environmental assessments as well as the CGR-MFLM and its supporting program documents. Together, these programs and mitigation features are meant to ensure the mine complies with all regulations and will be protective of people and the environment. To that end, Cigar Lake systematically assesses risk using risk analysis tools to ensure sustainable and safe operation. These tools include hazards and operability assessments (HAZOPs); job hazard analyses (JHAs); and field level risk assessments (FLRAs). These measures are used to assess new tasks, processes, or equipment.

Additionally, the Cigar Lake approach to risk management is guided by the Cameco corporate standard for the systematic identification and management of risk. The specific risk management tools within the Cigar Lake pre-existing risk management system were adapted to fit under the ISO 31000 standards that guide the Cameco Risk Standard and Cameco Risk Policy. These corporate initiatives ensure that the means by which risks are evaluated, mitigated, and managed are consistent throughout the corporation. The standard also includes clear specifications on the responsibilities and accountabilities for various levels of risk.

3.5.1 Discussion

3.5.1.1 Environmental Assessments

In February 2004, Cameco submitted an environmental assessment study report (EASR) for the Cigar Lake mine to the CNSC in accordance with the *Canadian Environmental*

Assessment Act (CEAA), which identified mitigation measures to be taken related to waste rock [2].

The detailed EASR followed up on the initial 1995 environmental impact assessment of the overall Cigar Lake project undertaken as part of the Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan [3]. The federal and Saskatchewan governments approved the Cigar Lake project in principle in 1998, leaving the issue of a permanent disposal site for waste rock to the later EASR.

Following the 2006 inflow, Cameco identified the need to manage the potential for non-routine inflows that could occur either during construction or operations. A study predicted that releasing large volumes of treated water into the original treated water discharge point, a muskeg area drained by Aline Creek (which ultimately discharges to Waterbury Lake), could result in erosion of that drainage system.

As a result, Cameco proposed building pipelines and discharge points directly to Seru Bay on Waterbury Lake. In 2008, this proposal triggered a joint federal and provincial environmental assessment under CEAA and *Saskatchewan Environmental Assessment Act* respectively. In 2011, Cigar Lake's EIS [1] was accepted and approval was granted to proceed with construction of the Seru Bay pipeline project, which was completed in 2012.

3.5.1.2 Water Management

Through continual improvement at Cigar Lake and lessons learned during production, the mine plan, including the minewater management strategy is continually updated to ensure that risk is managed appropriately.

Routine mine dewatering at Cigar Lake is conducted via conventional sump, pump, and treatment infrastructure. Water from the underground workings is pumped to the surface where it is treated and either recycled for further use in mining operations or treated and discharged to the environment.

In addition to the routine dewatering system, Cigar Lake also maintains infrastructure for use in the event of a non-routine inflow of water into the mine.

Cameco maintains ongoing vigilance with respect to underground conditions necessary to maintain a safe mining environment by implementing regular corporate technical reviews in the areas of ground control, ventilation, and dewatering/hydrogeology as further underground development proceeds. There were no instances of non-routine inflows during the current licence term.

3.5.2 Hazard Identification

Hazards at Cigar Lake are identified using risk analysis tools such as HAZOPs, JHAs, and FLRAs. These analyses ensure changes to the facility are controlled and that risks

posed are acceptable. Described below are some examples of risk analyses completed during the current licence term to support the safety analysis for Cigar Lake:

- HAZOP to identify hazards and potential operability issues for discharge of treated water from the Seru Bay discharge pipelines.
- Risk assessment to evaluate likelihood and consequence of failure to support the change in tunnel liner technology.
- HAZOP on required maintenance activities for critical pieces of equipment.
- FLRAs completed on critical small scope tasks, including start up and shut down of freeze plants or inspections of shaft infrastructure.
- JHA completed on underground inspections activities during the COVID-19 pandemic shutdown and JHAs completed on activities required for re-start in September 2020.

3.5.3 Future Plans

Risks at Cigar Lake are well understood. During the current licence term, improvements in infrastructure and risk assessment processes have reduced the potential risks to Cigar Lake from water inflow. Other infrastructure and process changes are contributing to improved environmental performance. These infrastructure changes as well as improvements in overall risk assessment within key safety areas contribute to the ability of Cigar Lake to continue to operate while protecting the safety of workers and the public and maintaining environmental protection.

3.5.4 Conclusions

Various forms of risk assessment have been completed at Cigar Lake and the risk assessment process continues to be refined and improved. Through these assessments, Cameco continues to better understand the risks at Cigar Lake and ensures adequate mitigation and management of these risks. As a result, risk management at Cigar Lake is effective in ensuring the operation remains within its licensing basis, keeping people safe and healthy as well as protecting the environment.

3.6 Physical Design

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. The principal facilities at Cigar Lake are comprised of an underground mine, which produces uranium ore, and surface support facilities, including large capacity freeze plants, ore slurry loadout facility, minewater treatment plant and lined waste rock pads.

Facility change control and design control are utilized at Cigar Lake to ensure that any physical changes to the facility are reviewed and approved by appropriate personnel

before implementation. The site utilizes an electronic system, which ensures site management is aware of proposed changes and associated risks and controls. It also ensures those responsible are made aware of the changes so that required approvals, including regulatory approvals, are in place prior to the change being implemented.

3.6.1 Discussion

3.6.1.1 Ground Freezing

Artificial ground freezing is utilized at Cigar Lake to bulk freeze the ore body and surrounding rock mass to mitigate the potential for water inflow to the mine during JBS mining. Artificial ground freezing also enhances the stability of the clay altered rock mass that surrounds the ore body. The original ground freezing strategy for Cigar Lake was underground freezing, which involves drilling freeze holes from specially developed underground tunnels that would fall between the pattern of production cross-cuts.

After remediation of the mine in 2010, Cameco requested and received regulatory approval to implement surface freezing at Cigar Lake to facilitate expedited freezing of the ore body during mine construction activities. Freeze holes were drilled from surface and an active freeze horizon was established to bulk freeze the orebody and surrounding rock mass (Figure 3.6-1). This strategy decoupled underground development from surface freeze hole installations, which expedited the construction and mine development schedule. Based on an internal ground freezing options review, Cigar Lake determined that transitioning to a predominantly surface freeze system would continue to provide a high degree of safety and reliability while enabling the site to meet planned production targets.

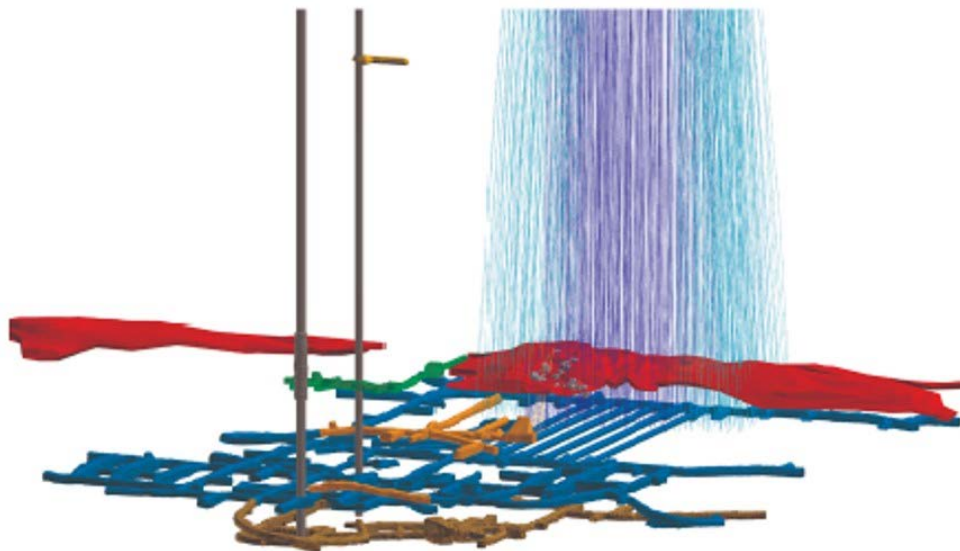


Figure 3.6-1: Surface freezing schematic.

3.6.1.2 Tunnelling Methodology

During the current licence term, Cameco implemented a change in tunnel liner technology at Cigar Lake. Cameco identified that the combination of the high vertical loading from the artificial ground freeze and the squeezing ground conditions that exist at Cigar Lake were likely to lead to deterioration of existing segmental liners. Cigar Lake conducted a risk assessment to evaluate the likelihood and consequence of failure and, although the safety hazards were not considered significant, there were preliminary signs that the existing segmental liner would impact future ore production. To mitigate this risk, a new liner design consisting of sprayed concrete and specially designed yielding elements to control and manage deformations was recommended. The “New Austrian Tunnelling Method” (NATM) was adopted, which utilizes a sequential excavation method with the application of sprayed concrete (Figure 3.6-2).



Figure 3.6-2: Development face using the New Austrian Tunnelling Method.

Cigar Lake has fully transitioned to the use of the NATM methodology with a yielding shotcrete liner as a replacement for the segmental methodology in appropriate areas of the mine and the design is considered fully commissioned. Previous tunnels constructed using segmental liner, required for ongoing production, have been retrofitted by removing all the segmental liner, enlarging the tunnel, and constructing a new yielding shotcrete liner using NATM techniques. All regulatory commitments have been met and Cigar Lake safely transitioned to the use of the NATM for future production tunnel developments.

3.6.2 Future Plans

Over the term of the next licence, Cigar Lake will continue to identify and pursue opportunities to improve efficiency while continuing to maintain the safety of workers and the public as well as protection of the environment. Such opportunities may include, but are not limited to:

- Examination of opportunities to improve efficiency of current freezing and mine ventilation practices.
- Examination of alternative mining methods.

Any new infrastructure, or changes to existing will follow the current design controls that have been shown to be effective at Cigar Lake.

3.6.3 Conclusions

Cigar Lake has proven mine designs, methods and infrastructure that are effective in protecting the environment and the health and safety of people while extracting high-grade ore that is in close proximity to water-bearing sandstone. Cameco expects that further innovations in using freezing and other ground control measures will continue to allow for safe production while protecting the environment during the life of mine as has been clearly demonstrated through the current licence term.

3.7 Fitness for Service

Cigar Lake continues to advance opportunities to improve the overall maintenance and reliability of the facility so that all equipment is available to perform its intended design function. The Cigar Lake *Maintenance Program* (CGR-MP) describes the testing, inspection schedules and work procedures required to ensure that the physical condition of systems, components and structures remain in good operating condition.

The CGR-MP manages routine maintenance, inspection and testing to ensure the availability, reliability and effectiveness of facilities and equipment. The program helps increase equipment availability through more efficient planning, predictive maintenance techniques, training, and documentation.

3.7.1 Discussion

During the licence term, Cigar Lake began a journey towards operational excellence. This encompasses many things, including asset management and reliability, which Cameco strives to be an industry leader in. Asset management and reliability helps Cigar Lake achieve excellence in operational asset management by developing and continuously improving programs, processes, and standards in the area. Following industry standard methods and ratings to assess the overall maintenance and operational reliability program, the site improved from reactive/emerging (scores around 43%) to proactive/excellence (scores around 74%) within the current licence term.

3.7.2 Future Plans

The CGR-MP is effectively managing existing infrastructure to ensure it remains appropriate for supporting safe production as the mine continues to produce ore. Cigar Lake will continue to execute plans to bring the site's maintenance and operational reliability program to an excellent range (>80%) in all facets of the assessment. A large part of this continued evolution is digital transformation, where all personnel will have easy access to information in the field. To support this, everyone is outfitted with a digital device and trained on its use. This will ensure that the best data are being used in decision making, leading to operational excellence.

3.7.3 Conclusions

The CGR-MP has shown to be effective in ensuring proper maintenance schedules and procedures are followed to ensure the integrity of the operation's infrastructure. The CGR-MP has also been effective in adopting technology to improve the preventative and predictive maintenance approach. Reliability engineering tools are deployed to assess components that are more failure prone. These efforts are improving equipment longevity and increasing the time between failures on equipment, helping to ensure continued production that maintains the safety of worker and the public and protects the environment.

3.8 Radiation Protection

The Cigar Lake *Radiation Protection Program* (CGR-RPP) outlines how the site manages radiation protection issues in accordance with the CNSC *Radiation Protection Regulations* with the goal of keeping radiation exposures to workers "as low as reasonably achievable, social and economic factors taken into account" (the ALARA principle). The CGR-RPP includes the RCOP, which details actions to be taken in response to radiation exposure and monitoring results. Periodic audits and reviews help identify improvements and provide assurance that the CGR-RPP is functioning effectively and efficiently.

To this end, radiation exposures are mitigated through a combination of engineering and administrative controls that include non-entry mining methods; ventilation; shielding; training; zone control; radiation work permits; and personal protective equipment (e.g., respiratory protection). The effectiveness of these controls is routinely tracked and confirmed through area monitoring, direct reading dosimeters and personal alpha dosimeters.

3.8.1 Discussion

The main radiological hazards during the construction phase of the mine were associated with the cuttings from freeze-drilling process, which could introduce radon gas and gamma hazards into these work areas. During final commissioning and the transition to full production, additional hazards associated with mining, processing and transport of

ore were managed under the CGR-RPP. As Cigar Lake transitioned into commercial production, engineered controls, including shielding, physical barriers, a non-entry mining method and ventilation have been designed into the mining method and process circuits both underground and on surface to maintain the low radiation exposure for worker radiation exposure as well as potentially reduce them.

The possible spread of radioactive contamination is also a potential concern at Cigar Lake. As such, Cameco has established a four-zone contamination control system to minimize the spread of contaminated material from a zone of high potential contamination (Zone 4 – underground) to an area of low potential contamination (Zone 1 – main camp).

The CGR-RPP has been effective in controlling the potential hazards associated with the transition to commercial production as demonstrated by the results of the radiation monitoring of Nuclear Energy Workers. Monitoring data are reviewed, consolidated, and analyzed regularly to inform work practices and optimize controls. Results are submitted to the CNSC monthly and quarterly for review. The effective and maximum doses received by workers during the licence period are summarized in Table 3.8-1.

Table 3.8-1: Summary of dose statistics during licence term.

	Average Effective Dose (mSv)	Maximum Effective Dose (mSv)
2013	0.27	2.2
2014	0.16	2.0
2015	0.45	6.0
2016	0.39	5.5
2017	0.34	3.3
2018	0.47	7.3
2019	0.57	3.7
2020 (to end of Q3)	0.23	1.3

As set out in the above table, average and maximum effective doses over the licence period remain far below the regulatory limits of 50 mSv per year and 100 mSv over a five-year period, respectively. No member of the workforce received an annual effective dose in excess of 10 mSv at the Cigar Lake site during the licence period.

The RCOP specifies action levels that, if exceeded, may indicate the potential for a loss of control of the CGR-RPP. Within the RCOP, there are specific actions to be taken in response to an exceedance of an action level. In the current licence term, there were three action level exceedances at Cigar Lake as detailed below:

- In June/July 2018, four workers exceeded the weekly action level limit of 1 mSv as determined by personal alpha dosimeters (PAD); one these workers also exceeded the

quarterly action level limit of 5 mSv. The workers were performing replacement of medium pressure pumps in the mine and weekly effective doses for the four workers involved ranged from 1.1 mSv to 1.6 mSv. Cameco conducted a root cause investigation that identified four root causes, which resulted in the elevated long-lived radioactive dust (LLRD) exposures. From the investigation, 10 corrective actions were developed and implemented.

- In November 2018, a worker received an unusually high radon progeny exposure. The worker exceeded both the weekly and quarterly action levels limits. The worker's quarterly effective dose for the fourth quarter of 2018 was 5.1 mSv with 4.3 mSv of that dose occurring in November. The worker received the unusual exposure while performing maintenance on one of the JBS units while it was in stand-by mode, connected to the mining cavity. Cameco immediately initiated a root cause investigation after becoming aware of the event, which identified five root causes and recommended nine corrective actions that have been implemented.
- In September 2020, a worker's effective dose for a one-week period was determined to be 1.16 mSv, exceeding the action level of 1 mSv/week. The worker received the elevated dose while performing welding underground. This work was conducted under a radiation work permit while the worker was wearing a welding helmet with powered air purification. It is suspected that the cause of the elevated dose was related to positioning of the work area relative to the air flow used to ventilate the area. Cameco immediately initiated an apparent cause investigation after becoming aware of the event that identified four apparent causes and recommended nine corrective actions to address the findings. At the time of writing this CMD, five of these corrective actions have been implemented, with the remaining four to be implemented in Q2 2021.

Based on these events, Cigar Lake identified a need to facilitate improvements related to radiation protection. Cigar Lake implemented several corrective actions resulting from these events as summarized below:

- Radiation protection procedures were revised to require quantitative verification that potential dust hazards have been mitigated prior to work on or around equipment in proximity to contamination sources, where practicable. Where not practicable, respiratory protection or other suitable controls are required.
- At regular intervals, Cigar Lake radiation department personnel attend all other site department's safety meetings to present and discuss a topic relevant to radiation protection for the workers in attendance.
- A safety stand-down was held with workers who may be involved with welding and/or grinding activities and a discussion around the specific requirements for conducting those activities was held to ensure worker understanding of the requirements and how they help ensure worker safety.
- The 5-Point Safety card in use at Cigar Lake was revised to include specific information on radiological hazards and information to help workers manage those hazards.

- Work orders for tasks that may include LLRD hazards have been revised to include requirements to confirm with the radiation department that appropriate controls to complete the work are in place prior to work commencing.
- A presentation was developed and delivered to underground maintenance crews discussing LLRD, how it is generated and methods for control.

3.8.2 Future Plans

Cigar Lake will continue to look for opportunities to continually improve the performance of the CGR-RPP in the next licence term. Periodic audits and reviews help identify improvements and provide assurance that the CGR-RPP has and continues to function effectively and efficiently. Specific activities are noted below and will continue during the next licence term.

- Management of the top 25 workers from the previous year using regular dose review with the worker and supervisor and additional Job Task Observations or monitoring as required to achieve a dose reduction the following year.
- Evaluation of prism data for trends as we work to improve our understanding of radon progeny and radon gas concentrations in all work areas.

3.8.3 Conclusions

The CGR-RPP is working as intended to keep worker exposures ALARA. During the current licence term, radiation protection measures remained effective and maximum yearly doses remain consistently well below the regulatory limit.

3.9 Conventional Health and Safety

Workplace safety hazards are managed as part of the processes described within the Cigar Lake *Safety and Health Management Program* (CGR-SHMP). In general, risks to workers are controlled through the adoption of a safety system comprised of five elements:

- Site inspections: formal and informal hazard identification programs by supervisors, Occupational Health Committee, and safety department personnel.
- Safety meetings: once every shift with each department to discuss safety topics, review safety-related procedures, and discuss incidents.
- Daily contact card: a daily practice for supervisors and employees to initiate dialogue regarding safety topics, to identify risks associated with assigned tasks and to track any safety-related issues encountered in the workplace.
- Job task observations: in-person, third party observation of an employee performing a specific task.
- Work permits: activity-specific approvals required before tasks, such as those required confined space entry or involving hot work (welding), are initiated.

Engineered controls and safeguards are also key aspects of the Cigar Lake safety system. Examples of specific key controls at the site include the mine design, ground control methods to stabilize the workings, and water management infrastructure to prevent uncontrolled inflows. These controls are subject to routine assessment by competent personnel to verify their effectiveness and functionality.

Hazards are also managed through the use of job hazard analysis conducted prior to completing non-routine tasks. During the current licence term Cameco placed emphasis on the development of standardized practices in place for core safety aspects, such as control of hazardous energy and confined space entry. The development of these standardized practices and subsequent standardized training was important in transitioning to commercial production with minimal safety incidents.

The effectiveness of these controls is assessed through indicators, such as audits, preventative and predictive maintenance plans, and compliance to program requirements. Specific to worker safety, measures include first aids, medical incident injuries, lost-time injuries (LTI) and the total recordable injury rate (TRIR). Results are routinely reviewed internally and reported externally to regulators as part of annual reports.

3.9.1 Discussion

3.9.1.1 Safety Statistics

Table 3.9-1 provides a summary of the LTI statistics over the licence term. As is shown, injuries have been controlled well with no significant incidents despite the increase in work activity associated with the transition to commercial production. Overall, the systems and controls in place to prevent injuries and ensure the health and safety of all employees and contractors are sufficiently robust. Specifically, Cigar Lake has not recorded an LTI since 2016. In recognition of strong safety performance in the current licence term, Cigar Lake received the Canadian Institute of Mining, Metallurgy and Petroleum John T. Ryan regional safety trophy for metal mines in 2018, 2019 and 2020.

Table 3.9-1: Safety statistics during licence term.

	Total FTE Workers¹	Number of LTIs²	TRIR	Frequency Rate³	Severity Rate⁴
2013	1570	4	5.2	0.30	5.3
2014	833	1	2.5	0.12	0.0
2015	714	4	2.4	0.56	18
2016	701	2	2.1	0.29	8.8
2017	630	0	1.6	0	0
2018	607	0	1.0	0	0
2019	539	0	1.7	0	0
2020 (to end of Q3)	197	0	2.1	0	0

¹ Total number of workers (employees and contractors) expressed as full-time equivalents (FTE) is total person-hours / 2,000 hours worked per employee per year.

² Lost-time incident - an injury that takes place at work and results in the worker being unable to return to work for a period of time.

³ Frequency rate - the accident frequency rate measuring the number of LTIs for every 200,000 person-hours worked at the site. Frequency = [(# of injuries in reporting period) / # of hours worked in reporting period] x 200,000.

⁴ Severity rate - the accident severity rate measures the total number of days lost to injury for every 200,000 person hours worked at the site. Severity = [(# of days lost in reporting period)/# of hours worked in reporting period] x 200,000.

3.9.1.2 Occupational Health Committee

The Occupational Health Committee (OHC) at Cigar Lake consists of employee and employer representatives who are responsible for reviewing past health and safety incidents, conducting safety inspections, evaluating safety programs, and recommending health and safety improvements. Worker involvement and consultation is openly sought and encouraged through daily work assignment meetings, regular safety meetings, town hall meetings and written communications.

3.9.1.3 2016 Wolf Attack

On August 29, 2016, a contractor at Cigar Lake was injured in an attack by a single wolf while walking on an established path between the main camp and the contractor camp. A site security guard interrupted the attack and notified the site Emergency Response Team (ERT) who transported the injured employee to the site health care centre. The injured worker was treated and taken by air ambulance to hospital in Saskatoon for further assessment and treatment.

CNSC staff presented information regarding this event at a meeting of the Commission on September 21, 2016.

Cameco conducted an investigation into this event to identify the root causes and make recommendations for corrective and/or preventative actions. Overall, the investigation found that the risks posed by habituated wildlife at the site had not been fully identified. This led to a situation where employees became tolerant of wildlife. Corrective actions implemented as a result of the investigation included the following:

- Development of explicit safety rules on wildlife management to eliminate human behaviours that may attract wildlife and incorporate these into appropriate site work instructions.
- Update of the Cigar Lake site orientation training to include the explicit rules of wildlife management and information on habituated wildlife behaviours.
- Implementation of more effective wildlife deterrence measures and inclusion of these into appropriate work instructions.
- Revisions to the Cameco Wildlife Management Standard and related documentation, including training material, to include best management practices.

Additionally, the results of the investigation as well as the revised wildlife management practices were reviewed by a third-party expert wildlife biologist. This review agreed with Cameco's findings and also concluded that the revised wildlife management practices were consistent with leading practices in those areas.

3.9.1.4 COVID-19 Response

Cameco has closely monitored the developments related to the outbreak of COVID-19. Cameco's priority is to protect the health and well-being of our employees, their families, and their communities. The Cameco Corporate Crisis Management Plan was activated, which includes our Pandemic Plan, and our various Local and Corporate Business Continuity Plans. Our Pandemic Plan and Local and Corporate Business Continuity Plans continue to be in effect across our global operations. Following the precautions and restrictions enacted by all levels of government where we operate, and considering the unique circumstances at each of our operating sites, we proactively implemented a number of measures and made a number of decisions to ensure a safe working environment for all our employees, including:

- suspending production, in conjunction with Orano, at Cigar Lake in March 2020 and December 2020
- transitioning employees to begin working remotely from home
- mandating that all meetings be conducted by phone or videoconference where possible
- suspending all business travel, unless approved by the CEO
- restricting non-essential contractors, visitors, and deliveries at all locations
- adopting screening protocols for access to our facilities that align with the directives of government and public health authorities

- implementing a number of additional protective measures in the workplace, including increased sanitization, physical distancing, and use of face masks
- setting up and awarding COVID-19 Relief Funds totaling \$1.25 million to support our northern Saskatchewan and Ontario communities impacted by the pandemic

Upon safe resumption of production in September 2020, additional measures were put in place, such as an updated orientation for new and returning employees on COVID-19 measures and core safety procedures.

In December 2020, due to increasing risks posed by the pandemic across northern Saskatchewan and uncertainty regarding continuous access to qualified operational personnel, Cameco again suspended production at Cigar Lake and placed the site in a safe state of care and maintenance.

The proactive decisions we have made to protect our employees and to help slow down the spread of the COVID-19 are necessary decisions that are consistent with our values. The health and safety of our employees, their families and their communities continue to be the priority focus of all our plans, and they will align with the guidance of the relevant health authorities where we operate.

3.9.2 Future Plans

Efforts during the next licence term will continue to build a culture focused on safety and accountability as production continues. Site personnel are encouraged to report all incidents, no matter how minor, into CIRS.

An example of ongoing safety culture improvement is the continued implementation of the Field Leadership Program. This program is designed to ensure that all personnel on site understand how they promote a safe, productive work environment. This is accomplished through having management present at the workface to ensure that policies, programs, standards, and regulatory requirements are implemented and effective for the Operation. Additionally, the program works to ensure that all workers understand the hazards of the work they are undertaking and the controls in place to mitigate those hazards. This is affected through in-the-field discussions between management and employees that allow for verification of safe work practices and provide coaching opportunities where improvements can be made.

3.9.3 Conclusions

Safety is a core value at Cigar Lake and one of our highest corporate values. Further, a safe, healthy, and rewarding workplace is one of our organizational measures of success. Promoting a strong safety culture at Cigar Lake is achieved through continuous improvement and consistent application of the CGR-SHMP, including ongoing education and training, inspections and improvements to processes and safety equipment to ensure all people working at site are equipped to work safely.

3.10 Environmental Protection

The Cigar Lake *Environmental Management Program* (CGR-EMP) formalizes the approach to environmental protection at the site. The CGR-EMP includes details for identifying, controlling, and monitoring potential impacts to the environment. The program includes the ECOP that describes required actions to be taken in response to environmental concerns or environmental monitoring results. Periodic audits and reviews help identify improvements and provide assurance that the CGR-EMP is functioning effectively and efficiently.

Cameco maintains an ISO 14001 certification for our operation's environmental management systems. The ISO 14001 certification ensures that Cigar Lake meets the requirements of Cameco's integrated SHEQ Policy, including:

- Identifying and mitigating environmental risks,
- Complying with applicable laws and regulations,
- Monitoring and measuring operational impacts,
- Reducing and effectively managing waste, and
- Minimizing potential impacts to the environment.

Two key areas of environmental focus at Cigar Lake are preventing uncontrolled releases to the environment and treatment of potentially contaminated water.

3.10.1 Discussion

3.10.1.1 Treated Water

A key area of environmental control at Cigar Lake is treating potentially contaminated water collected from surface and underground. Potentially contaminated water is collected in underground and surface sumps or ponds and then sent to the Cigar Lake minewater treatment plant (MWTP) for treatment. The MWTP is a two-stage chemical treatment process that relies on pH adjustment, reagent addition, and particle settling for the effective removal of metals and radionuclides. Treated water that meets regulatory requirements is discharged to the environment via an engineered diffuser within Seru Bay.

During the current licence term, Cigar Lake has routinely monitored the quality of its treated water discharges and implemented process enhancements to facilitate continual improvement. The key focus of these activities was to reduce total loadings of constituents of potential concern (COPCs) to the environment. This was achieved by a combination of optimizing water usage (total use and recycling) as well as improving treatment effectiveness within the MWTP.

Specific examples of MWTP improvements that Cameco undertook during the licence term are related to the amount of uranium, molybdenum, and arsenic in treated water.

While below regulatory limits, levels of these parameters were either above environmental assessment predictions or trending above levels measured prior to achieving commercial production.

Cameco addressed the elevated molybdenum levels through optimizing underground sump flows and rerouting filter backwash piping. Further enhancements in molybdenum removal were achieved by completing adjustments to reagent dosage (increasing ferric sulphate) in the first stage of the MTWP.

Through benchmarking and test work, Cameco determined that elevated uranium was linked to the pH of the ore grinding and process water circuits. Changes to operating pH in the MWTP that Cameco made on this basis resulted in more efficient removal of uranium and correspondingly lower amounts in the treated water discharged to the environment.

In response to an increasing trend of arsenic levels in treated water that Cameco noted in 2016, a working group was created to identify causes of this trend and to develop mitigation strategies. The investigation identified variable concentrations and species of arsenic throughout the ore body and within the water handling and treatment circuits. Installation of medium pressure pumps, filters and piping modifications were completed to increase the volume of both recycled process water and treated water utilized in the underground mining and processing circuits. This has correspondingly reduced the volume of treated water being discharged to the environment. Cameco also completed work to adjust reagent usage and pH profiles to reduce the mobilization of arsenic from the uranium ore and increase removal efficiencies in the water treatment circuit.

These improvements, as reflected in Table 3.10-1, have reduced the loadings of these parameters, as well as those of selenium, to levels that have been demonstrated by environmental risk assessment modelling to be protective of the environment. In addition, monitoring has shown that their levels in the receiving environment are below applicable environmental quality guidelines and align with predictions made in Cigar Lake's environmental risk assessments, which inform the licensing basis for the facility.

Table 3.10-1: Treated water loadings to the receiving environment.

	Total Water Discharged (m ³)	Total Loadings (kg)			
		Uranium	Molybdenum	Selenium	Arsenic
2013	346,648	0.23	6.7	0.19	0.21
2014	381,247	6.6	13	0.36	1.2
2015	326,886	38	48	1.3	15
2016	396,806	2.4	15	2.4	36
2017	422,674	0.72	28	1.8	32
2018	360,533	0.18	37	1.6	21
2019	335,800	0.24	37	1.3	33
2020 (to end of Q3)	264,742	0.04	19	0.53	13

3.10.1.2 Environmental Risk Assessment

Historic measured loadings to the receiving environment, combined with predicted future loadings for continued mining of the Cigar Lake orebody are input to the Cigar Lake environmental risk assessment (ERA). The ERA is an important tool to assess potential future effects to the environment and human health from the continued operations and decommissioning of Cigar Lake.

The most recent ERA for Cigar Lake was completed in 2017 and was conducted pursuant to the Canadian Standards Association (CSA) N288.6 standard for environmental risk assessments. The 2017 ERA utilized many of the assumptions contained in the approved 2011 Cigar Lake Water Management Project EIS [1], updated where applicable to incorporate actual treated water loadings, environmental monitoring results and operational experience gained since 2011. The 2017 ERA concluded that Cigar Lake remained within the objective of the licensing basis and that human health and the environment in the vicinity of Cigar Lake remain protected.

Given the implementation of operational improvements, and availability of an updated dataset, an addendum to the 2017 ERA was completed in 2019. The 2019 addendum to the 2017 ERA confirmed that the updated projections remained protective of human health and the environment, and that Cigar Lake remained within the objective of the licensing basis established through the 2017 ERA. A summary of the 2017 ERA and 2019 addendum are posted on the Cameco website [4].

3.10.1.3 Environmental Effects Monitoring

In 2019, Cigar Lake completed a comprehensive aquatic monitoring program in order to meet the requirements of Environmental Effects Monitoring (EEM) program in accordance with the *Metal and Diamond Mining Effluent Regulations* (MDMER), CNSC

licence (UML-MINE-CIGAR.00/2021) and the Saskatchewan Ministry of Environment (SMOE) Approval to Operate (PO17-203). The program showed that COPC concentrations in the sampled media remained consistent with historical results. Temporal trends have not been observed in the water quality, sediment chemistry and fish tissue results as Cigar Lake transitioned into commercial production.

Further, measured concentrations remain below predictions contained within the 2017 ERA and 2019 addendum to the 2017 ERA. Comparisons of the measured performance, detailed in the comprehensive aquatic program to predictions contained in the most recent ERAs, are detailed in Table 3.10-2 and Table 3.10-3.

Table 3.10-2: Measured water quality in Seru Bay versus ERA predictions.

	2019 Measured	2017 ERA ¹		2019 Addendum ¹	
		Expected	Upper-bound	Expected	Upper-bound
U (µg/L)	< 0.1	0.16	0.98	0.22	1.1
Mo (mg/L)	0.0011	0.0078	0.064	0.0105	0.074
Se (µg/L)	< 0.1	0.11	0.5	0.14	0.6
As (µg/L)	0.4	0.63	2.3	0.42	1.5

¹ 2020 Concentrations

Table 3.10-3: Measured sediment quality in Seru Bay versus ERA predictions.

	2019 Measured	2017 ERA ¹		2019 Addendum	
		Expected	Upper-bound	Expected	Upper-bound
U (µg/g)	8.9	7.8	22	6.9	15
Mo (mg/g)	15.0	44.0	260.0	35.6	148.0
Se (µg/g)	1.9	1.9	3.2	1.9	2.7
As (µg/g)	8.7	13.0	30.0	10.2	15.0

¹ 2020 Concentrations

Consistent with the findings from the 2017 ERA and the 2019 addendum to the 2017 ERA, results from the 2019 comprehensive program confirm that Cigar Lake remains within the objective of the licensing basis and that human health and the environment in the vicinity of Cigar Lake remain protected.

3.10.1.4 Environmental Performance Report

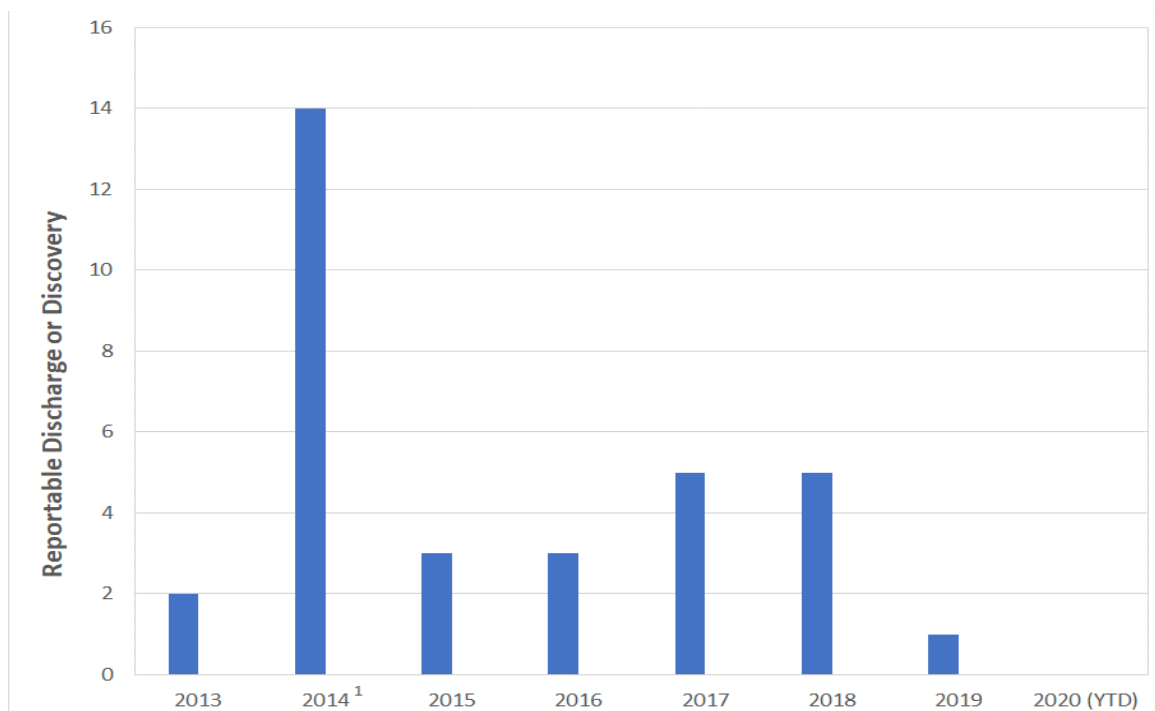
The Environmental Performance Report (EPR) is a requirement of the SMOE for mining operations in the province of Saskatchewan and aids in demonstrating compliance with applicable CSA standards. The EPR provides an update, assessment, and summary of the

operationally-relevant environmental data and other information relating to performance of Cigar Lake. The report also provides comparison of the current study period results to predictions made in the relevant ERA documents. The EPR includes an overall evaluation of environmental monitoring and the environmental condition around Cigar Lake. Further, the EPR provides recommended improvements to site monitoring activities and programs.

In accordance with the provincial requirements, Cameco submitted the most recent Cigar Lake EPR in November 2016, which captured the years 2011 to 2015 inclusive. The EPR concluded that air quality, surface hydrology, water quality, sediment quality and aquatic and terrestrial ecology conditions are consistent with predictions made in previous environmental assessments. Overall, the EPR demonstrated that Cigar Lake is effective in monitoring potential effects on the receiving environment and informing management of issues requiring attention. The next EPR will be submitted in December 2021 and will be inclusive of the years 2016 to 2020.

3.10.1.5 Reportable Discharges and Discoveries

During the licence term, 33 events were reported to CNSC staff that were classified as reportable discharges or discoveries in accordance with the regulations of the Province of Saskatchewan. Cameco's quick response and implementation of corrective actions resulted in minimal impact to the environment for all events. A summary of reportable discharges at Cigar Lake is provided to the Commission in the annual *Regulatory Oversight Report for Uranium Mines and Mills*. Additionally, all reportable discharges, including a summary of the event, are posted on the Cameco website. A summary of reportable discharges during the licence term is provided in Figure 3.10-1.



¹ 2014 includes 10 discharges related to release of brine that were subsequently reclassified as non-reportable.

Figure 3.10-1: Cigar Lake reportable discharges and discoveries.

It is important to note that in 2014, 10 out of the 14 reportable discharges and discoveries were attributed to releases of calcium chloride brine from the surface freeze system. The increased frequency of brine-related incidents led to a site wide focus on brine spill prevention. Weekly meetings were conducted to increase awareness and discuss mitigation measures. Cameco examined the causes of these events and, where necessary, implemented corrective actions to prevent potential future events. Additionally, new legislation introduced by the Province of Saskatchewan in 2015, provided new criteria for classification of releases of calcium chloride brine as reportable discharges, which also attributed to the significant reduction in reportable discharges.

3.10.2 Future Plans

The CGR-EMP is effectively managed, has ensured the site remains in compliance with all environmental regulations, ensures that potential environmental impacts are controlled and monitored, and is internationally certified. Specific to the ECOP, Cigar Lake will continue working with the CNSC to implement changes to treated water action levels in accordance with Canadian Standards Association N288.8-17 *Establishing and Implementing Action Levels for Releases to the Environment from Nuclear Facilities*.

Further, Cameco will incorporate the results from the 2019 comprehensive aquatic monitoring program into the 2021 EPR, which will compare measured values against ERA predictions. An updated ERA will be submitted in 2021 that will also incorporate the data collected in the 2019 EEM program.

3.10.3 Conclusions

The CGR-EMP is effectively managed, has ensured the operation remains in compliance with all environmental regulations, ensures the operation's potential environmental impacts are controlled and monitored, and is internationally certified. Cigar Lake sets continuous improvement goals and benchmarks its performance in achieving them. During the current licence term, Cigar Lake demonstrated effective protection of the environment and the health and safety of people.

3.11 Emergency Management and Fire Protection

The Cigar Lake *Emergency Preparedness and Response Program* (CGR-EPRP) and the *Fire Protection Program* (CGR-FPP) describe how Cigar Lake prepares for and addresses emergencies that may impact the health and safety of the workforce, the environment and the protection of property. Together, they ensure that appropriate emergency response and contingency plans and procedures are developed, maintained and readily available for use.

As with the other safety and control areas, risks are systematically identified and managed through the use of administrative and engineered controls. Administrative controls include, but are not limited to training, routine drills and exercises, communication protocols and the development of knowledgeable emergency response teams (ERT) and a mine rescue teams (MRT) responsible for responding to emergencies. Engineered controls include alarms (fire and smoke sensors, underground stench gas system), emergency facilities (health centre, fire hall and underground refuge stations) and equipment (fire truck, ambulance, and spill response equipment). Periodic audits and reviews during tabletop exercises, drills and simulations help identify improvements and provide assurance that the management systems are functioning effectively and efficiently.

3.11.1 Discussion

3.11.1.1 Emergency Management

Throughout the current licence term, the ERT and/or the MRT safely responded when required to do so. Debrief meetings were held after each event with the objective of identifying strengths and opportunities for improvement. Instances of ERT and/or MRT mobilization are reported to the CNSC Duty Officer as required by the CNSC and Cameco has posted information on our website for them as well.

Emergency response plan training is provided to all new employees, including identification of responsibilities during an emergency. Further, training in all aspects of emergency response, including mine rescue and firefighting continues at Cigar Lake. Currently, the site has approximately 60 emergency responders. While many emergency responders have traditionally been both surface response and mine rescue members, an equal number were just members of either the MRT or the surface ERT. In 2019, the

expectation was set that all members will work towards both. New members are certified for underground mine rescue by the provincial Mine Rescue Coordinator. During the 2020 temporary COVID-19 shutdown, training and certification continued with additional COVID-19 precautions taken by the site trainers.

Testing of the CGR-EPRP is completed through tabletop exercises, drills, or simulations. The testing is intended to evaluate emergency preparedness, increase awareness, familiarity, and confidence with the CGR-EPRP, as well as validate its effectiveness. Cameco carries out all testing of the CGR-EPRP in accordance with internal, provincial, and federal regulatory requirements. A summary of the CGR-EPRP testing conducted during the current licence term is provided in Table 3.11-1.

Table 3.11-1: Emergency response testing during current licence term.

	Tabletop Exercises	Drills	Simulations
2013	1	2	4
2014	1	1	2
2015	2	23	2
2016	3	25	2
2017	4	23	2
2018	3	24	3
2019	3	23	2
2020 (to end of Q3)	4	18	3

In addition to on site training and testing, the Cigar Lake response team members showcase their skills by participating in annual provincial mine rescue competitions sponsored by the Saskatchewan Mining Association.

3.11.1.2 Fire Protection

Fire protection at Cigar Lake is facilitated by the CGR-FPP, which meets the requirements of its operating licence from CNSC (including compliance with the *National Fire Code of Canada* and the *National Building Code of Canada*). This program ensures effective management of fire prevention, detection and suppression systems and processes at site. A third-party expert conducted a fire hazard assessment at Cigar Lake in 2020, as an update to the 2012 assessment. This assessment did not identify any significant issues related to fire protection measures at Cigar Lake. Other (minor) recommendations from this assessment will be tracked and completed using the Cameco's corrective action process.

3.11.2 Future Plans

The CGR-EPRP and the CGR-FPP are meeting regulatory requirements with training and testing as a key component of ongoing efforts for continuous improvements of the programs. Overall, the site has been diligent in dealing with action items and working to ensure compliance with the *National Fire Code of Canada*. In this regard, Cigar Lake continues to make adequate provision for the protection of the environment as well as the health and safety of persons.

3.11.3 Conclusions

The CGR-EPRP and CGR-FPP are meeting regulatory requirements with ongoing training opportunities being provided to response team members. Recent third-party expert assessments have indicated that Cigar Lake has made significant improvement in maintaining compliance to the requirements of the NFCC and that fire hazards are well managed through on-site fire response systems. Cigar Lake continues to make adequate provision for the protection of the environment as well as the health and safety of persons.

3.12 Waste Management

Waste management activities at Cigar Lake are overseen through the Cigar Lake *Waste Management Program* (CGR-WMP). In accordance with the CGR-WMP, Cameco manages and disposes of wastes in compliance with applicable laws and regulations and in accordance with generally accepted industry practices in a manner that mitigates potential adverse impacts to human health and the environment. Cigar Lake stores waste on site only when it cannot be practically reduced, reused, recycled, or and recovered (4Rs). Quantities of wastes produced, recycled, stored, and disposed of and the locations used for waste storage and disposal are tracked as part of the CGR-WMP.

The CGR-WMP applies to the management of waste rock, solid waste, and liquid waste. A detailed breakdown of the waste types generated at Cigar Lake and their storage locations is provided in Table 3.12-1.

Table 3.12-1: Cigar Lake waste types and storage locations.

Waste Type		Storage Location
Waste Rock	Clean	Stockpile A or A1
	Radiologically contaminated	Stockpile B
	Potentially acid generating	Stockpile C
Solid Waste	Non contaminated	Domestic landfill
	Potentially contaminated	Contaminated materials storage building or Stockpile B
	MWTP filter cake	Filter cake storage area
	Hazardous substances and waste dangerous goods (HSWDG)	HSWDG storage units
	Recyclable or reusable materials	Temporary laydown areas
Liquid Waste	Wastewater	Site surface ponds
	Slimes	Slimes ponds
	Sewage	Sewage lagoon system

3.12.1 Discussion

3.12.1.1 Waste Management

During the licensing term, Cigar Lake has made significant efforts to reduce the amount of non-contaminated solid waste disposed of at the landfill. Recycling efforts, coupled with a reduction in construction waste, reduced annual non-contaminated solid waste disposed of at the landfill from 6,680 m³ in 2013 to 3,210 m³ in 2019. Further, the electric fence surrounding the active disposal trench within the landfill was upgraded to a two-layer fence during the current licence term in order to prevent wildlife from entering the landfill area.

Measures were also undertaken to reduce the volume of stored contaminated solid waste on surface. During the licence term, Cigar Lake constructed a contaminated waste storage building in order to temporarily store waste prior to eventual disposal in the underground workings or transport to the Rabbit Lake Operation for final disposal in the above ground tailings management facility (AGTMF). By way of comparison, at the end of 2013, Cigar Lake had approximately 4,500 m³ of contaminated waste in storage on surface. This volume was reduced to 4,090 m³ by the end of 2019 despite ongoing contaminated waste generation during the current licence term.

3.12.2 Progressive Reclamation

Cameco's reclamation efforts during the licence term at Cigar Lake included re-vegetating disturbed side slopes, abandoned roads and site areas that need to be stabilized

against erosion. The site makes extensive use of coconut matting as an erosion control method on slopes followed by hydroseeding.

In the future, any disturbed area that is no longer required to support mining activities at Cigar Lake will be considered for progressive reclamation. The Cigar Lake one- and five-year progressive reclamation plans are submitted each year within the Cigar Lake annual report. Despite many more years of mine life ahead, Cigar Lake endeavours to undertake progressive reclamation in previously disturbed areas that are no longer required, and this program will continue through the life of the mine.

3.12.3 Future Plans

Cigar Lake will continue to look for opportunities to reduce wastes generated and requiring disposal on site during the next licence term. During the current licence term, Cigar Lake received approval for expansion of the domestic landfill. Construction of this expansion will take place during the next licence term.

3.12.4 Conclusions

The CGR-WMP is effective in ensuring volumes of waste material are being reduced wherever possible and that all waste generated is being handled in a way that is protective of the environment. Despite many more years of mine life ahead, Cigar Lake is committed to progressive reclamation in areas where there has been surface disturbance and this program will continue through the life of the mine. In the management of waste, Cigar Lake has adequately protected the environment as well as the health and safety of persons.

3.13 Security

The Cigar Lake *Security Program* (CGR-SP) is designed to prevent the loss or theft of nuclear materials and substances and to prevent the interference of safe activities at the site.

3.13.1 Discussion

During the current licence term, there were no incidents with respect to significant security-related issues.

3.13.2 Future Plans

Cigar Lake does not foresee any significant changes to the management of security at the site in the next licence term.

3.13.3 Conclusions

The CGR-SP and security measures in place at Cigar Lake remain adequate and are expected to remain adequate for the upcoming licence period.

3.14 Safeguards and Non-proliferation

Cigar Lake meets obligations arising from the *Canada-International Atomic Energy Agency (IAEA) Safeguards Agreement* through the CGR-MFLM and the *Access Procedures Under the Additional Protocol*.

3.14.1 Discussion

In carrying out the licensed activities, Cigar Lake makes adequate provision for the maintenance of national security and measures required to implement international obligations to which Canada has agreed. Production results are reported in detail on an annual basis to the CNSC in accordance with international requirements. The IAEA was granted complementary access to Cigar Lake on May 18-19, 2016.

3.14.2 Future Plans

Cigar Lake will continue to ensure Canada's international obligations to safeguard nuclear materials are being met during the next licence term.

3.14.3 Conclusions

Cigar Lake continues to ensure Canada's international obligations to safeguard nuclear materials are being met.

3.15 Packaging and Transport

The Cigar Lake *Transportation Program (CGR-TP)* applies to the activities required to manage transportation activities at Cigar Lake. The CGR-TP details the methods and practices that are utilized for transportation of bulk commodities, freight, ore slurry and waste materials to and from Cigar Lake.

3.15.1 Discussion

During the current licence term, Cigar Lake has safely and effectively managed the transportation of bulk commodities, freight, ore slurry and waste materials to and from site. There have been three incidents involving transport of ore slurry to McClean Lake and one instance involving shipment of ore drums during the current licence term. In accordance with Cameco's corrective action process, these incidents were investigated, and Cameco put in place corrective actions.

Two similar incidents involving the shipment of slurry totes to the McClean Lake mill occurred on June 16, 2015 and December 10, 2015. For both incidents, it was discovered by McClean Lake that there was non-fixed contamination on top of the slurry totes that exceeded the 4 Bq/cm² regulatory limit. McClean Lake notified Cigar Lake of the contaminated totes and cleaned the top of the totes to bring the contamination below the limit. Cameco put in place corrective actions to update the work instructions to perform a more complete cleaning and inspection of the totes, paint the totes in order to make contamination more visible, and create and modify preventative maintenance tasks to ensure that the fill and wash system performed as required.

On January 20, 2018, a slurry tote delivered to McClean Lake was discovered to have visible ore slurry on the top and side of the tote, as well as on the trailer deck. As part of the routine process during ore slurry transport, the tote was inspected by the driver approximately halfway to McClean Lake and found to be clean. The subsequent investigation concluded that the valve on the tote failed sometime after the driver's inspection causing the release onto the trailer deck. Cigar Lake's immediate response to this event was to suspend transport of slurry ore to McClean Lake. Further, Cigar Lake performed an inspection of the road and no evidence of slurry was found on the road. All remaining tote valves were inspected, and leak tested before being put back into service.

A shipment of 37 ore drums from Cigar Lake was received by the McClean Lake mill on June 16, 2015. Eight out of 37 drums were found to have non-fixed contamination above the 4 Bq/cm² regulatory limit on their outer surfaces. There was no evidence of radioactive material leaving the conveyance. The main cause was that not all drums were sealed sufficiently. The corrective action implemented was to review and revise the drum packaging and shipping process and coach all the applicable workers involved in such shipments on the correct way to seal the drums.

3.15.2 Future Plans

Lessons learned during final commissioning and the transition to full production at Cigar Lake have resulted in improvements to the CGR-TP, specifically regarding the transport of ore to McClean Lake. Cigar Lake believes that the CGR-TP supports the safe packaging and transportation of bulk commodities, freight, ore slurry and waste materials and remains protective of the environment and the health and safety of persons.

3.15.3 Conclusions

The CGR-TP has ensured the shipment of uranium ore slurry and mineralized waste rock from Cigar Lake remains protective of the environment and the health and safety of persons.

4.0 Other Matters of Regulatory Interest

4.1 Indigenous Consultation

Cameco recognizes the right of Indigenous groups to be consulted and, where applicable, to have their interests accommodated by the Crown with respect to any activities associated with CNSC-licensed operations and projects that could potentially impact the exercise of Indigenous or treaty rights. Cameco assists the CNSC in the discharge of Indigenous consultation and accommodation obligations where they arise. The Crown's duty to consult and accommodate aligns with Cameco's corporate values, commitments, and measures of success, and as such constitutes sound business practice.

As the majority of northern Saskatchewan residents are of Indigenous origin, including First Nations and Métis, Cameco's public engagement activities relating to Cigar Lake provide opportunities for Cameco, the Province of Saskatchewan and the CNSC to effectively consult with Indigenous groups in northern Saskatchewan. Cigar Lake's engagement process is described, in detail, within the Cigar Lake *Public Information Program* (CGR-PIP) (see Section 4.2).

4.2 Public Information Program

Consistent with Cameco's vision, mission and values and measures of success, the objective of the CGR-PIP is to ensure local target audiences with an interest in Cigar Lake are informed on a timely basis about operations, activities, and anticipated effects on the environment and the health and safety of persons, and thereby build the trust and support of stakeholders.

The primary audience for the CGR-PIP is the rights-bearing First Nation and Métis communities and municipalities of the Athabasca Basin that are located in the vicinity of the site. Specifically, these communities are:

- Black Lake Denesuline First Nation.
- Fond du Lac Denesuline First Nation.
- Hatchet Lake Denesuline First Nation.
- Northern Settlement of Camsell Portage.
- Northern Hamlet of Stony Rapids.
- Northern Settlement of Uranium City.
- Northern Settlement of Wollaston Lake (the adjoining communities of Hatchet Lake and Wollaston are located closest to the Cigar Lake Operation at about 80 kilometres by air).

In June 2016, Cameco and Orano signed a confidential collaboration agreement with these communities known as the Ya'Thi Néné Collaboration Agreement (CA). The

agreement builds on the Impact Management Agreement signed between Cameco, Orano and the communities in 1999. The CA is the primary agreement with the Athabasca Basin Communities associated with Cigar Lake. The agreement is structured on pillars of workforce development, business development, community investment, community engagement and environmental stewardship.

Since the agreement was signed, Cameco and Orano have provided \$414.5 million for workforce development, community investment and business development initiatives for the Athabasca Basin. More than \$36.8 million has been invested in workforce development, including salaries for Athabasca Basin members. There are currently 121 people from the Athabasca Basin employed with Cameco and Orano. Despite recent workforce reductions throughout Saskatchewan, Cameco has maintained basin employment at 93% of the 2017 levels. In addition, more than \$26.9 million has been invested in Athabasca Basin communities and \$350.8 million spent with eligible businesses since 2016. This exceeds the 5-year target of \$250 million under the business development pillar of the agreement.

Engagement between Cameco and the communities under the CA occurs primarily through the Athabasca Joint Engagement and Environment Subcommittee (AJES), a joint committee of community and industry representatives that meets regularly to discuss operational and environment-related matters of importance to the communities and provides a channel for the communities to share traditional knowledge with the companies. In addition, the Ya'Thi Néné Lands and Resource office was established under the terms of the CA to provide support to the subcommittee and the executive director is an AJES member. The office has become a point of contact for the communities.

In addition to engaging with the Métis people in the vicinity of our operations through our CA, Cameco also works with the Métis Local Presidents of the Uranium City Métis Local #50 and the Stony Rapids Métis Local #80.

Cameco employees and long-term contractors at Cigar Lake, about half of which are residents of northern Saskatchewan, are also part of the primary target audience for the CGR-PIP.

While the rights-bearing First Nation and Métis communities under the CA, local Métis people, and Cameco employees and long-term contractors are the primary audience for the CGR-PIP, Cameco considers the general public of the Northern Administrative District (NAD) and the province of Saskatchewan generally to be a secondary audience. Cameco provides information and responds to inquiries from the NAD communities and other organizations or groups such as the Northern Saskatchewan Environmental Quality Committee that may express interest in Cigar Lake through our websites and social media channels and direct engagement when appropriate.

Cameco engagement activities are guided by a set of principles that were developed through roundtable consultation with northern opinion leaders. These principles are:

- Open Channels for Communication

- Make it Simple
- Build Capacity for Understanding
- Hear the Elders
- Include Youth
- Speak and Hear Our Languages

These principles guide Cameco's communication and engagement efforts in northern Saskatchewan. Face to face engagement is Cameco's preferred process for engagement as it provides the best measure of the perceptions and opinions of the target audience. However, in response to COVID, Cameco has conducted recent engagement through virtual means. These engagement activities include meetings and events in stakeholder communities and at our operations, including tours and technical workshops. Other methods of engagement utilized by Cigar Lake include conventional media, social media, and polling.

Additionally, Cigar Lake maintains a public disclosure protocol that was developed in accordance with guidance provided by the CNSC. The public disclosure protocol describes the types of routine and non-routine information that Cameco is committed to providing to target audiences. The public disclosure protocol is posted on Cameco's northern community website (<https://www.cameconorth.com/about/public-disclosure>).

During the licence term, Cigar Lake has continued to show the commitment to conducting engagement activities in accordance with the CGR-PIP. Engagement activities have focused on providing members of the public with ongoing updates on the site's future through presentations, including discussion on the surface and underground facilities that will be built at Cigar Lake in order to support ongoing production.

In all, over 70 specific engagement events were held in the current licence term to engage northern Saskatchewan communities in relation to Cigar Lake activities and projected life of mine activities, among other matters. A summary of these events is provided each year in the Cigar Lake annual report.

Specific to this licence application, Cigar Lake undertook engagement activities beginning in September 2019 to make target audiences aware of the upcoming licence renewal and provide opportunities to communicate any concerns. At the request of AJES members, Cigar Lake provided information on the process for licence renewal, based on previous Cameco experience. The discussion was largely general with no formal inquiries.

4.3 Eastern Athabasca Regional Monitoring Program

The Eastern Athabasca Regional Monitoring Program (EARMP) was established in 2011 under the Province of Saskatchewan's Boreal Watershed Initiative. The program is supported by contributions from several stakeholders including the SMOE, CNSC, Cameco and Orano. The EARMP was designed to identify potential cumulative effects

downstream of uranium mining and milling operations in the Eastern Athabasca region of northern Saskatchewan. The community-based component of the program partners with communities to monitor the safety of traditionally harvested country foods by collecting and testing representative water, fish, berry, and mammal tissue samples from the seven communities located in the region. Harvesting and consuming traditional foods are an important part of the culture in northern Saskatchewan, which contributes to an overall healthy lifestyle through physical activity and healthy eating.

Community members collected and submitted samples of water, fish, berry, and mammals for testing. The 2018/2019 program results continue to show that country foods are safe for consumption with chemical profiles for water, fish, berry, and mammal tissue samples similar to natural background. The reports and data from the program are publicly available at www.earmp.ca.

4.4 Community Based Environmental Monitoring Program

Building off eighteen years of data collected through the Athabasca Working Group (AWG) Environmental Monitoring Program (which was a product of the original Impact Management Agreement signed in 1999), the program was enhanced in 2018 to create a Community Based Environmental Monitoring Program (CBEMP) for the Athabasca region. The new CBEMP allows community members to become more involved and provide input to steer the direction of the program in their particular community. The program focuses on individual communities within the region on a rotating basis.

The overall study objective of the CBEMP is to gain an understanding of traditional food use by community members and to assess if these foods remained safe for consumption. The involvement of community members is one of the fundamental goals of the study. The study obtained information regarding the quantity, type, and harvest location of traditional foods through community interviews. To accomplish these objectives, a Traditional Food Frequency Questionnaire is developed in collaboration with community leadership and band members are hired and trained to conduct interviews with community residents.

In 2019, the CBEMP completed a traditional food study within the community of Fond du Lac Denesuline First Nation (Fond du Lac). Traditional meat that was predominantly harvested included barren ground caribou (meat and organs), moose, and snowshoe hare. More than half of the total meat consumption was from barren-ground caribou. The most common fish species consumed were lake whitefish, lake trout, northern pike, walleye, and suckers. The most frequently consumed birds were spruce grouse and ptarmigan as well as mallard duck for migratory birds. The most common berry types consumed were blueberry, bog cranberry and raspberry. The consumption frequency and quantities reported were generally consistent with other First Nations communities surveyed within Canada and similar to other First Nations in northern Saskatchewan.

The results of the study continue to show harvesting and eating traditional foods are integral components of good health among those living in Fond du Lac, and the chemical

analysis of the common traditional foods from the communities demonstrate that regularly eating locally collected fish, meat, berries, and plants is not a cause for concern.

4.5 Cost Recovery

Cameco is in good standing with the CNSC regarding licensing fees for Cigar Lake.

4.6 Decommissioning and Financial Guarantees

4.6.1 Preliminary Decommissioning Plan and Cost Estimate

The Cigar Lake *Preliminary Decommissioning Plan* (CGR-PDP) describes, at a high level, the methodology that would be undertaken to decommission Cigar Lake under a hypothetical *decommission tomorrow* scenario in the unlikely event that Cameco becomes insolvent and cannot fulfill its decommissioning obligations. The methodologies described within the PDP align with those approved through previous environmental assessments and form the basis for the accompanying *Preliminary Decommissioning Cost Estimate* (CGR-PDCE). The CGR-PDCE provides an estimate of the present value of the decommissioning cost, in accordance with the methodologies described within the CGR-PDP and forms the basis for the financial guarantee for Cigar Lake. A summary of the current CGR-PDP and CGR-PDCE are posted on the Cameco website.

In accordance with CNSC and SMOE requirements, the CGR-PDP and CGR-PDCE are updated at five-year intervals or when a significant change to the site may necessitate an update. The most recent CGR-PDP and CGR-PDCE were submitted in June 2019 and are inclusive of anticipated development at Cigar Lake to the end of 2022 when the next updates are due. Summaries of the PDP and PDCE are posted on the Cameco website. The revised financial guarantee of \$61.79 million was approved by the CNSC through a Public Hearing in Writing on November 13, 2020. Cigar Lake has financial instruments in place for the full amount of the approved financial guarantee.

No changes, outside those already captured in the CGR-PDP and CGR-PDCE, are anticipated to occur at Cigar Lake prior to the end of 2022; thus, the amount of the financial guarantee is considered sufficient for this licence renewal. The CGR-PDP and CGR-PDCE will be next updated in 2022 and will implement the requirements of CSA N294-19: Decommissioning of Facilities Containing Nuclear Substances.

4.7 Other Regulatory Approvals

SMOE provides approvals in accordance with *The Environmental Management and Protection Act, 2010* of Saskatchewan and all associated regulations to assure mineral industrial operations are operated and managed in accordance with provincial legislation. On December 15, 2017, Cameco received an updated Approval to Operate Pollutant Control Facilities (PO17-203), from SMOE that expires October 31, 2023. This document provides approval from SMOE to operate facilities such as the water treatment

plant, the landfill and the hazardous substance and waste dangerous goods storage facilities.

5.0 Conclusions

Cameco believes that Cigar Lake has successfully transitioned the site from construction, through commissioning and ramp up to full commercial operation while maintaining the safety of workers and the public and protecting the environment. Cigar Lake has demonstrated strong performance in all SCAs throughout the current licence term through continuous improvement in our quality management and safety and control programs.

Based on our performance during the current licence period, we have demonstrated that we are qualified to carry on the licensed activities planned for the proposed 10-year licence term and will, in doing so, make the necessary provisions for the protection of the environment as well as the health and safety of persons.

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