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**Written submission from the
English River First Nation**

**Mémoire de la Première
Nation d'English River**

**Regulatory Oversight Report for
Uranium Mines and Mills in
Canada: 2022**

**Rapport de surveillance
réglementaire des mines et usines
de concentration d'uranium au
Canada : 2022**

Commission Meeting

Réunion de la Commission

December 13-14, 2023

13-14 décembre 2023



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November 12, 2023

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“VIA EMAIL cnscc.interventions.ccsn@canada.ca”

**RE: ERFN Intervention- Regulatory Oversight Report for Uranium Mines,
Mills, Historic and Decommissioned Sites in Canada: 2022**

This submission is made on behalf of the English River First Nation (ERFN). This topic is of great importance to the people of the ERFN, because of the presence of the Uranium Mines and Mills located within English River First Nation Ancestral Territory. The people of ERFN have and continue to subsist on this land for generations- fishing, hunting, gathering, and thriving.

English River First Nation is made up of 19 reserves, most of which are located in Northern Saskatchewan. ERFN has a population of approximately 1,800 people. The on-reserve members of the First Nation reside at two small remote Northern Saskatchewan reserves called Wapatuanak and La Plonge. These reserves are located approximately 600 km north of Saskatoon.

On September 20, 2023, ERFN participated in the Canadian Nuclear Safety Commission (CNSC) annual Indigenous engagement session. This engagement session allowed ERFN to receive concise and clear information regarding the Uranium Mines and Mills. Further, ERFN was able to raise and discuss issues of common concern with other impacted Indigenous Nations in the Athabasca Basin. ERFN considers this engagement session invaluable and a good example of the open and effective Indigenous engagement we have grown to rely upon from the CNSC.

In addition to attending the CNSC Engagement Session, ERFN has engaged Robin Kusch to assist the Nation in reviewing and understanding the technical and scientific aspects of the Regulatory Oversight Report for Uranium Mines, Mills, Historic and

Decommissioned Sites in Canada for the 2022 year. Mrs. Kusch has once again provided the people of ERFN a thorough and informative critical review of the RoR.

ERFN concludes that there is no reason to object to the CNSC's conclusions in the 2022 RoR. Further, ERFN does not take issue with the finding that the operations and historical and decommissioned sites are being managed effectively in terms of the SCAs. The RoR concludes that adequate protections are in place to protect the environment and humans during operation and closure/decommissioning activities.

Sincerely,

A handwritten signature in blue ink that reads "Cheyenna Hunt". The signature is written in a cursive style with a long horizontal stroke at the end of the name.

Cheyenna Hunt BA, LL.B.
English River First Nation
Director, Lands & Consultation

Technical Memorandum

Review of the Regulatory Oversight Report for Uranium Mines and Mills in Canada: 2022

November 13, 2023

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Background Information

This technical memorandum has been prepared for the English River First Nation (ERFN) and provides a summary and review of the Regulatory Oversight Report for Uranium Mines and Mills in Canada: 2022 (CMD 23-M37; 2022 RoR) with the intent to inform the ERFN's Intervener Submission. The Commission Member Document (CMD) was 194 pages, the review effort included summarizing relevant information relating to concerns expressed by ERFN. Concerns expressed pertain in general to environmental protection of their Ancestral lands (Nuhtsiye-kwi Benéne in Dene), safeguarding their traditional, current and foreseeable way of life and reclaiming their identity and heritage (culture). Specifically, concerns were related to the preservation of their people's ability to hunt, fish and gather country food and advocate for their devotional connections with the lands of Nuhtsiye-kwi Benéne. Specifically, during engagement this year associated with the Denison Wheeler River Project concerns were heard regarding:

- factors related to cancer rates and metal health concerns in northern communities;
- factors related to low unemployment rate in northern communities, including resistance to in-office work and employee life-work balance expectations following culture shift in response to the COVID-19 pandemic;
- connection between climate change, forest fires and reduced air quality effects such as damaging vegetation foliage;
- factors related to reduced wildlife habitat availability, suitability, connectivity and security.

Introduction

English River First Nation

ERFN is a Dene and Cree First Nation located in Northern Saskatchewan. ERFN's Nuhtsiye-kwi Benéne encompasses a large section of the boreal forest in central-northern Saskatchewan, stretching from the Churchill River in the south to Wapata Lake in the north. ERFN has seven historical settlements located at Porter Island, Cree Lake, Elak Dase, Knee Lake, Dipper Rapids, Wapachewunak and La Plonge. Since 1992, an additional twelve reserve parcels have been added to their land base through the Treaty Land Entitlement process, which aims to resolve outstanding Treaty land obligations. ERFN's two largest reserves are La Plonge Reserve and Wapachewunak, located approximately 600 km north of Saskatoon, Saskatchewan. ERFN's main settlement area is located along the Churchill River, about 500 km north of Saskatoon at the Wapatuanak Reserve, Saskatchewan. The ERFN is a signatory to Treaty 10 (1906) and is comprised of nineteen different reserves:

- La Plonge 192,
- Elak Dase 192A,
- Knee Lake 192B,
- English River (Porter Lake) 192H,
- English River FN Barkwell Bay No. 192I,
- English River FN Haultain Lake No. 192K,

- Dipper Rapids 192C,
- Wapachewunak 192D,
- Ile a la Crosse 192 E,
- Primeau Lake 192F,
- Cree Lake 192G,
- Grasswoods 192J,
- Leaf Rapids 192P,
- English River FN Flatstone Lake No. 192L,
- English River FN Cable Bay Cree Lake No. 192M,
- English River First Nation Cable Bay Cree Lake 192N,
- English River FN Beauval Forks No. 192O,
- Slush Lake Reserve No. 192Q, and
- Mawdsley Lake Reserve No. 192R.

The ERFN's total membership is 1,646, with approximately 710 members living on reserve lands (INAC 2021). Comprised of both Cree and Dene people, the “people of the river” are known for their bold and collaborative spirit and trusting and humble nature (CanNorth 2017).

The ERFN name originates from the English River area, which was inhabited by the Poplar House people for periods during the year. Most of the families that now live at the Wapachewunak Reserve or adjacent Métis hamlet of Patuanak, traditionally lived along the Churchill River system at Primeau Lake, Knee Lake, Dipper Lake and/or Cree Lake to the north. Summers were spent primarily fishing along the river system. For the rest of the year, family units would spread out through the northern forests for trapping and subsistence hunting. Commonly used winter trapping areas included Haultain Lake, Costigan Lake, Foster Lake and the area between Cree Lake and the Churchill River (Jarvenpa 1980, CanNorth 2017, SVS 2022).

The community is shaped by its respected Elders who are widely consulted for decisions, wisdom and strength. ERFN is dedicated to stewardship of the land and the education of future generations through land based learning youth camps and other opportunities to share knowledge on the land (Cameco 2021). ERFN is rising to the challenge of ensuring sustainable development in the vicinity of their communities and within their Nhutsiye-kwi Benéne and recognizes the unique and important role they have to play in the protection of Northern Saskatchewan. While remaining true to traditional values as “keepers of the land,” members also pursue opportunities to participate in the development of ERFN's resources (e.g., forestry, industry and workforce).

ERFN established Des Nedhe Development LP in 1991 to create sustainable employment and business opportunities for English River members. Since its inception, Des Nedhe Development has invested in established companies that are leaders in Saskatchewan's mining and construction industry and expanded its portfolio into the areas of retail and real estate development and management. The company takes pride in its strong focus on growth through investment, experienced management team and history of delivering solid financial results. Looking forward, Des Nedhe is exploring new opportunities across the Country, in multiple sectors, and is positioned to play an important role in Canada's economic future.

Saskatchewan Uranium Industry

The Athabasca Basin of northern Saskatchewan has been the site of several major uranium discoveries and Saskatchewan is recognized as a world leader in uranium production. The uranium is exclusively used for electricity generation at nuclear power plants, which is a non-carbon emitting energy source and provides about 15% of Canada's electricity needs. The uranium industry is a significant economic driver in northern Saskatchewan. Within ERFN's Nhutsiye-kwi Benéne three uranium operations are currently operating or in a state of care and maintenance (Key Lake Mill [1983; halted mining in 1997 and milling halted from 2018 to 2021], McArthur River Mine [1999; halted mining from 2018 to 2021], and Cigar Lake Mine [2015; halted mining from March 2020 to September 2020]), and there are two additional operations just northeast of ERFN Traditional Lands near Wollaston Lake (McCLean Lake Mine and Mill [1999] and Rabbit Lake Mine and Mill [1975; mining and milling halted in 2016 and operations transitioned to care and maintenance]).

Collaboration Agreement

All of the uranium mines, mills, and historical and decommissioned sites in northern Saskatchewan are considered of interest to the communities of ERFN. In northern Saskatchewan, the industry leaders Orano and Cameco Corporation have entered into formal agreements with Indigenous communities, including ERFN (referred to as collaboration agreement (CAs) or impact benefit agreements (IBAs)). These agreements provide Indigenous communities with workforce and business development programs, dedicated community engagement programs, community investment monies and mechanisms to collaborate around environmental stewardship. These industry leaders have also entered into several trapper compensation agreements with individual land users who are affected by their activities.

After three years of thoughtful negotiation and an opportunity for all members to weigh in through a ratification vote, ERFN and Denison Mines signed a Shared Prosperity Agreement on September 26, 2023 in connection with the proposed development of the Denison Wheeler River Project in Northern Saskatchewan. The agreement acknowledges that the proposed project is located within ERFN's ancestral Lands and provides consent from ERFN to advance development of the uranium mine.

These agreements are part of the effort undertaken in recent history to engage and respect local communities, First Nations, Metis Nations and local land users during the planning and execution of industrial developments. Execution of these agreements ensures that engagement occurs with the intent to minimize the potential and perceived negative impacts from a development, as well as optimize potential positive impacts. Signing of these agreements conveys a general trust in the industry's performance and is recognition of a positive working relationship with the industry leaders.

Consultation

Consultation is recognized by the Canadian Nuclear Safety Commission (CNSC) as an important part of the process to develop the details of its regulatory framework. In recent years, specifically since 2018, ERFN has witnessed an evolution in the consultation process that they view as positive. Now there is more readily available and approachable ways to have direct dialogue between the CNSC and First Nations, which ERFN sees as invaluable to the process of building and maintaining trust in Canada's Nuclear Industry. The outcome of feeling like you have no power in a situation is a state of forced apathy,

the direct engagement with ERFN has resulted in a sense of relevance and with the consultation process a sense of consequence. As well, there is a seriousness conveyed about their concerns when during hearings CNSC members reiterate or even directly represent the views the First Nations have conveyed to them directly. Previously, ERFN felt as though their views were filtered through the proponents of projects and/or operating companies to the CNSC and as such could see their perspectives being softened, deemphasized, devalued, or even lost.

Leadership Role

In addition to the recent empowerment discussed above, members of ERFN gained a heightened awareness of the external factors that can affect the mining industry and that life-of-mine estimates based on resource delineation are just projections, in other words there are no guarantees regarding the persistence of the economic benefits to the local economy. In response, the communities shifted their engagement focus from operational performance and economic benefits to the long-term environmental effects of closure and understanding associated reclamation uncertainties. More recently in 2023 with the rebound of uranium prices and projected revival of the nuclear energy industry, members of ERFN are allocating more resources to identifying and pursuing opportunities for their communities to confirm they are optimizing the social and economic benefits presented by having such an industry in northern Saskatchewan.

Key concerns of the ERFN communities continue to include:

- Operation and ultimate closure of the Key Lake Operations, due to the long-term (1000s of year) management of tailings and linkages to Wheeler River system that is an area of heightened value; and
- Operation and ultimate closure of McArthur River Operation and Key Lake Operations, due to potential for cumulative effects on the Wheeler River system.

Key concerns of the ERFN communities now include:

- Development of the proposed Denison Wheeler River Project; specifically, concerns regarding cooperation among existing and proposed operations to confirm adverse environmental and social impacts minimized and cumulative effects assessed sufficiently.

The Wheeler River region is recognized as an important cultural, ecological, and sustainability resources (i.e., drinking water, food and air) area for the communities of ERFN. The prevalence of the importance of the resources (clean air, water, soil, and country foods) in this area is considered likely to increase in value to local land users following closure of local operations.

However, in general, ERFN is dedicated to stewardship of the land for future generations and doesn't take this responsibility lightly. Often in relation to First Nation consultation and engagement the focus is on the spatial extent of their traditional and current land use, and it is conveyed that their concerns should be limited to these areas. However, it is recognized that the climate and environments around the world are changing, and there is no way to know in the future where the traditional resources that could be necessary to support future generations will be located within northern Saskatchewan or even Canada. As such, ERFN has interest in uranium operations and sites from two perspectives: (1) protection of all

lands in northern Saskatchewan and (2) gaining an increased understanding of operational and long-term tailings management methods / technologies.

Summary of Regulatory Oversight Report

In 2022, one of the five operations, Rabbit Lake Operation, was in a state of care and maintenance. Two operations, McArthur River and Key Lake, transitioned from a state of care and maintenance to resumed operation in 2022.

Financial Guarantees

The 2022 RoR provides the financial guarantees for each of the five operations (Appendix F; page 155/194). Complied in [Table 1 provided in Appendix A](#) are the financial guarantees reported from 2017 to 2018 and 2020 to 2022 (values were not provided in the 2019 RoR). Licensees are required to develop and update preliminary decommissioning plans and provide associated financial guarantees to ensure that funds are available to cover all costs necessary to fully decommission and remediate the operation, ensuring the protection of people and the environment. The values are updated to reflect any progressive reclamation (e.g., a mined-out pit and its associated supporting infrastructure is decommissioned and reclaimed), as well as any expansion of the operation's liability (e.g., a new water treatment plant is established).

Percent change from 2014 to 2022 for each operation is provided here: Cigar Lake Operation +25.6%, McArthur River Operation -13.0%, Rabbit Lake Operation 0%, Key Lake Operation -5.2%, and McClean Lake Operation +137.0%. From 2021 and 2022, the following changes were made -4.1% and -4.8% for Key Lake and McClean Lake, respectively.

Inspections & Non-compliances

Adapted in relation to the COVID-19 pandemic most inspections were completed remotely, this was modified starting March of 2023 to a hybrid approach with remote inspection practices being combined with in-person meetings and onsite inspections. In 2022, CNSC completed 25 inspections across the 5 operations. There were 79 non-compliance issues in 2023, as opposed to 19 in 2021. As well, one order was issued to Cameco's Cigar Lake Operation. [Table 2 provided in Appendix A](#) summarize inspections and findings.

With the exception of two, non-compliances were of low safety significance and all were deemed by CNSC staff to have been addressed appropriately and closed. Related to the Cigar Lake Operations, two non-compliance were rated as medium risk:

- One related to Emergency Management Program and based on the risk to emergency responders.
- One related to the Radiation Protection Program and based on concerns regarding implementation of the program.

Ongoing verification of some corrective actions will continue into 2023. One CNSC Order was issued to Cigar Lake Operation (October 2022; [LINK](#)) in relation to the stockpiling an amount of acid generating material in exceedance of limits set in Cigar Lake Waste Management Program (Stockpile C surveyed

volume was 413,172 m³, while capacity is 400,000 m³). The Order was issued to prevent any additional material being placed on the stockpile, and in March 2023 Cameco provided a plan to drawdown the stockpile through onsite processing of material, which has been accepted by CNSC and deemed protective of workers, the public and environment. Ongoing verification of corrective actions will continue into 2024.

Inspections and number of non-compliances are listed in Appendix B of the 2022 RoR; out of the 79 non-compliances issued, 33 were issued to Cigar Lake (41.7%).

Safety and Control Areas

As in 2017 to 2020, in 2021 all safety and control area (SCAs) were rated satisfactory for all mines and mills.

- SCAs = Management Systems, Human Performance Management, Operating Performance, Safety Analysis, Physical Design, Fitness for Service, Radiation Protection, Conventional Health & Safety, Environmental Protections, Emergency Management and Fire Protection, Waste Management, Security, Safeguards and Non-proliferation, and Packaging and Transport

In 2022, there were two exceptions the Management System and Radiation Protection SCAs at Cameco's Cigar Lake Operation were rated below expectations (BE).

Radiation Average and Maximum Individual Dose Limit

Optically simulated luminescence dosimeters (OSLD) measure external gamma radiation exposure and personal alpha dosimeters (PADs) measure internal alpha radiation exposure from radon progeny and long-lived radioactive dust (LLRD). As with 2021, no workers exceeded their regulatory radiation dose limit of 50 mSv annually in 2022. The maximum individual radiation dose to a worker from 2014 to 2022 have been compiled in the [Table 3 in Appendix A](#). In 2022, the maximum individual radiation was 7.14 mSv, which is 14.3% of the annual regulatory limit (50 mSv). The dose occurred to worker at McArthur River Operation. In 2021, the maximum individual radiation exposure was 6.03 mSv, this individual exceeded the weekly Action Level of 1 mSv (4.28 mSv) and Cameco Cigar Lake Operation identified four corrective actions to confirm worker safety. Action Level exceedances reported are provided in Appendix H of the 2022 RoR, none were reported for McArthur River Operation. In June 2022, at the Key Lake Operation for a worker performing cleaning duties in the counter current decantation (CCD) circuit conservatively estimated dose was 4.19 mSv, which above the weekly Action Level. Cameco implemented training and documentation on decontamination procedures and completion LLRD housekeeping inspections. The average individual effective dose by operation is provided in [Table 4 in Appendix A](#).

Lost-time Injuries

A lost-time injury is a workplace injury that results in the worker being unable to return to work for a period of time. As in 2021, five lost-time, work-related injuries were reported in 2022, one each occurred at Rabbit Lake and Key Lake Operations and three at McClean Lake Operation. Unlike in 2021, only one, the injury at Rabbit Lake Operation, was of low safety significance, while the other four were of medium safety significance. The lost-time injuries per year for each operation is provided in the [Table 5 in](#)

[Appendix A](#). Details are provided in Appendix K of 2022 RoR for each lost-time incident, including corrective actions taken.

Rabbit Lake

- October 17, 2022, a worker struck elbow and developed an infection requiring treatment.

Key Lake

- November 19, 2022, while manually turning the yellowcake centrifuge drive belts worker's fingertip was pinched between the belt and sheave causing partial amputation of tissue.

McClellan Lake

- February 27, 2022, worker stepped into open 4 m deep sump.
- May 4, 2022, worker stepped down off a 1-foot platform and rolled their ankle when stepped on a bolt.
- September 27, 2022, worker attempted to catch falling 3 kg item and hurt lower back.

Environmental Protection

As in 2021, all authorized discharged water in 2022 met the federal or provincial discharge limits ensuring the safety of people and the environment near the operations. For Air and vegetation sampling around the operations, all results were well below environmental quality guidelines.

- From 2017 to 2022 the average concentration of molybdenum in effluent for all five operations were well below the most stringent Action Level¹ of 1 mg/L. [Table 6 in Appendix A](#) summarizes the data from 2014 to 2022. The maximum average molybdenum concentration between 2017 and 2022 was 0.213 mg/L, which was report at Rabbit Lake in 2021, and this concentration is 21.3% of the 1 mg/L Action Level. In 2022, the maximum average concentration was 0.162 mg/L, which was also reported for Rabbit lake.

¹ Administrative Level represents the upper range of design specifications for a specific parameter and reaching an administrative level will trigger an internal review by the operation. Exceeding an Action Level indicates a potential loss of control of the environmental protection program and it triggers notification to the CNSC, an immediate investigation, subsequent corrective action and preventative measure in order to restore the effectiveness of the environmental protection program.

- From 2017 to 2021 the average selenium concentration in effluent for all five operations was below the licensed maximum monthly mean effluent Discharge Limit of 0.6. [Table 7 in Appendix A](#) summarizes the data from 2014 to 2022. The maximum average selenium concentration between 2017 and 2022 was 0.042 mg/L reported at McClean Lake in 2020, which is 7% of the guideline. In 2022, the maximum average concentration was 0.0037 mg/L at McClean Lake.
- From 2017 to 2021 the average uranium concentrations in effluent for all five operations was below the licensed maximum monthly mean effluent Discharge Limit of 2.5 mg/L and the CNSN Interim Objective of 0.1 mg/L. [Table 8 in Appendix A](#) summarizes the data from 2014 to 2022. In 2017, the maximum average uranium concentration was 0.07 mg/L reported at Rabbit Lake, which is 2.8% and 70% of the Discharge Limit and Interim Objective, respectively.
- From 2017 to 2021 the average concentration of radium-226 in effluent for all five operations were well below the license-authorized Effluent Discharge Limit of 0.37 Bq/L. [Table 9 in Appendix A](#) summarizes the data from 2014 to 2022. The maximum average concentration was 0.09 Bq/L reported at Key Lake in 2019, which is 24.3% of the Effluent Discharge Limit.

Environmental Protection Reviews (EPRs) were completed in 2023 and Executive Summaries were published online for the following: Cigar Lake ([LINK](#)), Rabbit Lake ([LINK](#)), Key Lake ([LINK](#)), and McArthur Operations ([LINK](#)) and Cluff Lake Project ([LINK](#)). At links for Executive Summaries additional links provided that direct reader to additional information.

It is reported on page 35 of CMD 23-M37 (pg 44/194), there were 9 unauthorized releases in 2022, all releases were of low significance, remediation and prevention were determined to be satisfactory by CNSC staff and no lasting impacts to environment will occur. The number of reportable environmental spills per year for each operation is summarized in [Table 10 in Appendix A](#). The spill details are summarized in [Table 11 of Appendix A](#).

There were five Action Level exceedances reported in 2022, two at Rabbit Lake Operations and three at McClean Lake Operation. Details are summarized in Appendix J of the 2022 RoR. At Rabbit Lake Operation, in October 2022 a monitoring pond with a pond fill sample with a uranium concentration of 60 µg/L (i.e., acceptable for discharge) was discharged. However, the pond discharge composite sample concentration was 81 µg/L, which is above the Action Level of 80 µg/L but below the CNSN Interim Objective of 0.1 mg/L (100 µg/L). The unexpected increase was determined to be the result of activities to remove sediment from the pond, which stirred up the solids in the pond. Discharge was ceased from this pond until results confirmed suitable for release. At Key Lake Operation in November 2022, about a third of a treated effluent pond was discharged with Total Suspended Solid (TSS) concentration of 37 mg/L, which is above the Action Level of 18 mg/L, although the pond fill sample had a concentration of 3.3 mg/L. The pond was taken out of service. At McClean Lake Operation in February 2022, effluent was discharged with a TSS limit of 23 mg/L, which is above the relevant Discharge Limit of 22.5 mg/L. Subsequent sampling, including acute lethality testing, supported conclusion the reported concentration was not representative of the actual readings. In June 2022, as a result of human error effluent was discharged from the wrong pond resulting in release of effluent exceeding Action Level for un-ionized ammonia. Approximately 208 m³ of effluent was discharged to Sink Reservoir with a concentration of 0.60 mg/L exceeding the Action Level of 0.45 mg/L. In July 2022, a 24hr pond composite release was reported

at 14 mg/L, which is above the TSS Action Level of 12 mg/L. Subsequent laboratory testing supported conclusion the reported concentration was not representative of the actual readings.

As stated in the 2021 RoR (CMD 21-M34), soil and vegetation samples analyzed had levels below regulatory limits, and monitoring data demonstrate that effects are within predictions made in the environmental risk assessments (ERAs), including elevated radon gas levels near tailings management facilities and waste rock piles with level falling to background levels within 2 km of these sources.

- At Cigar Lake Operation, soil and lichen samples were collected in 2022 as required under their triennial sampling program, results will be submitted to the CNSC in 2023.
- At McArthur River Operation, soil, blueberry twig and lichen samples were last collected in 2021 as required under their triennial sampling program; the results indicated that all parameters measured within historical ranges. CNSC staff concluded that the level of airborne particulate contaminants produced by the McArthur River Operation is acceptable and does not pose a risk to the environment.
- At Rabbit Lake Operation, lichen samples were last collected in 2019. CNSC staff concluded that the levels of airborne particulate contaminants produced do not pose a risk to lichen consumers, such as caribou.
- At Key Lake Operation, lichen samples were last collected in 2021; there were not significant differences in total lichen richness observed from 2011 to 2021. Overall epiphytic lichen were observed to be increasing in abundance and richness, a sign of a healthy epiphytic lichen community.
- At McClean Lake, in the 2016 Technical Information Document – Environmental Performance (TID-EP) vegetation samples showed that most parameters were within previously measured ranges in samples of lichen, Labrador Tea and blueberry twig. The concentration of metals were higher than background concentration in samples from the immediate vicinity of mining and milling activities, with concentrations decreasing within a short distance. Overall, the results indicated that McClean Lake Operation has a localized effect on vegetation, however, levels were below those toxic to plants and no adverse effects predicted. Lichen and vegetation samples were most recently collected in 2021 and the findings of the 2022 TID-EP confirmed those in the 2016 TID-EP. CNSC staff concluded that the level of airborne particulate contaminants produced by the McClean Lake Operation was acceptable and did not pose a risk to browse (twigs and Labrador tea) and lichen consumers, such as caribou.

In 2022, as part of the CNSC's Independent Environmental Monitoring Program (IEMP; results available at: [LINK](#)), surface water, fish tissue, blueberries and Labrador tea samples were collected at: Rabbit Lake (results available at: [LINK](#)). Ya'thi Néné Lands and Resource Officer (YNLR) was involved in gathering the samples. There were no results of concern, analysis results were consistent with those reported by the operations. I've included below from the IEMP 2022 Report for Rabbit Lake Operation a summary of the findings related to country foods.

Radioactivity levels (radiological contaminants) and concentrations of hazardous contaminants in surface-water samples were within natural background levels and below the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of aquatic life and the Province of Saskatchewan's

drinking water quality standards and objectives. Therefore, the surface water is safe for use relative to the parameters analyzed.

The measured radioactivity levels for all radiological contaminants in fish, Labrador tea and blueberries were below the CNSC screening levels for radionuclides. With the exception of selenium and arsenic in fish, both of which are discussed below, the concentration of hazardous contaminants in fish, blueberries and Labrador tea were below CNSC screening levels for hazardous substances.

The regional background concentration of selenium in fish ranges from 0.12 to 3.03 mg/kg (milligrams per kilogram) fresh weight. The concentration of selenium in northern pike ranged from 0.24 to 0.27 mg/kg fresh weight at the Collins Bay reference station and from 0.36 to 0.77 mg/kg fresh weight at the Hidden Bay exposure station. The concentration of selenium in lake whitefish ranged from 0.29 to 0.35 mg/kg fresh weight at the Collins Bay reference station and from 0.34 to 0.64 mg/kg fresh weight at the Hidden Bay exposure station. The highest concentrations of selenium in lake trout and walleye were 0.22 and 0.25 mg/kg fresh weight. The measured concentrations of selenium in fish at both the exposure and reference stations were within the regional background concentration range. The results are also consistent with the results from the EARMP for the northern Saskatchewan region.

The highest concentration of selenium in fish analyzed in the Rabbit Lake Operation exposure area was 0.77 mg/kg fresh weight in a northern pike sample, caught at the Hidden Bay exposure station. A concentration of 0.77 mg/kg fresh weight in fish is equal to 35% of the selenium Health Canada Tolerable Daily Intake Rate (TDI) of 2.2 mg/kg fresh weight. The selenium contribution from other ingestion pathways, including water, blueberries and Labrador tea, was negligible. No health effects are expected from the consumption of fish due to selenium. This is because the highest concentration of selenium in fish was less than half of the conservative CNSC screening level, and the selenium concentrations in all other samples analyzed (water, Labrador tea, blueberries) were well below the screening levels.

Furthermore, the highest concentration of selenium of 0.77 mg/kg fresh weight is equal to 3.9 mg/kg dry weight using the moisture content of the sample. This value, and all of the selenium concentrations in fish tissue on a dry weight basis, are below the United States Environmental Protection Agency's 2016 selenium criterion for fish muscle tissue of 11.3 mg/kg dry weight. This indicates that the fish are not affected by selenium at these concentrations and that the fish is safe to eat.

The regional background concentration of arsenic in fish ranges from 0.005 to 0.1 mg/kg (milligrams per kilogram) fresh weight. There were two exceedances of the arsenic screening level in lake whitefish samples from the Hidden Bay exposure station. The highest concentration was 0.08 mg/kg fresh weight. A concentration of 0.08 mg/kg fresh weight in fish is equal to 4% of the arsenic TDI of 0.7 mg/kg fresh weight. The arsenic contribution from other ingestion pathways, including water, blueberries and Labrador tea, was negligible. No health effects are expected from the consumption of fish due to arsenic. This is because the highest concentration of arsenic in fish was well below the conservative CNSC screening level, and the arsenic concentrations in all other samples analyzed (water, Labrador tea, blueberries) were well below the screening level.

As a result, the consumption of water, fish, Labrador tea and blueberries is not expected to result in any adverse health effects from radiological contaminants.

The Eastern Athabasca Regional Monitoring Program (EARMP; <https://www.earmp.ca/>; 2022/2023 Report available at [LINK](#)). In late 2022, community members provided 60 fish, 20 berry and 6 water samples for testing. The EARMP illustrates country foods are safe for consumption with chemical profiles similar to previous monitoring years and natural background levels. As such, the water and country foods continue to be safe for consumption.

Findings from Report Review

I have reviewed the CMD 23-M37 identifying questions and comments community members would likely have, taking into consideration my engagement with ERFN and the knowledge and understanding I have of the uranium industry and regulatory requirements. The review was completed in this manner to critically review the 2023 RoR in a concise and culturally aware manner.

Treated Effluent or Air Quality Concerns

Cigar Lake Operations - Arsenic in Seru Bay Declined from 2016 to 2021 in 2022 Again Elevated Above ERA Predictions

In 2016, the Cigar Lake Operation Environmental Performance Report (EPR) indicated an increasing arsenic trend in effluent released to Seru Bay. While below regulatory limits, arsenic concentrations were above environmental assessment predictions and above concentrations previously measured prior to achieving full ore production. Stated in the 2020 RoR (CMD 21-M34), the CNSC has verified that arsenic loadings to the environment have decreased steadily since 2016 and stated in the 2021 RoR (CMD 22-M36) CNSC staff have concluded adequate measures have been taken to protect the environment (pg 49 = pg 56/160). In 2022, however, arsenic levels in effluent are elevated compared to previous years and exceeded the expected and upper-bound benchmarks in the ERA. In 2022 arsenic loadings and mean concentrations were 42.2 kg and 0.108 mg/L as compared to 23.4 kg and 0.065 mg/L and 22.2 kg and 0.063 mg/L in 2021 and 2020, respectively. [Table 12 of Appendix A](#) summarizes arsenic annual average effluent concentration. Note: the concentration in 2022 is higher than it was in 2016.

Although above ERA predictions, concentrations in the receiving environment (i.e., Seru Bay) remain below Surface Water Quality Objective of 5 µg/L (0.05 mg/L). Cameco continue to implement operational changes to lower arsenic loadings to the environment. CNSC staff are satisfied that Cameco continues to monitor and take appropriate action to lower arsenic concentration in the effluent, and that the environment remains protected.

Consistent with this conclusion, the 2020 IEMP results for the Cigar Lake Operation ([LINK](#)), fish sample from Waterbury Lake near Seru Bay the arsenic concentration (0.01 mg/kg) was below the guideline/reference level (0.06 mg/kg). As described in the EARMP, Health Canada measures concentrations in grocery store food items; they report arsenic in freshwater fish is typically 0.4 µg/g (0.4 mg/kg) wet weight (ranging from 0.12 to 1.1 µg/g [0.12 to 1.1 mg/kg]). Although, no specific data provided, nor direct text speaking to arsenic levels, the writeup suggests that surface water samples from Seru Bay and within Waterbury Lake had measured levels of arsenic below guidelines.

McArthur River Operations – Molybdenum in Effluent Addressed In 2018 Care and Maintenance from 2018 to March 2022

Cameco implemented process changes prior to 2018 during active mining which reduced molybdenum concentrations in treated effluent. Since 2018, concentrations of molybdenum were further reduced by approximately 90% as a result of placing the facility into a state of care and maintenance. The operation in 2022 transitioned back into operation. CNSC staff reviewed the effluent treatment concentrations and confirmed that the McArthur River Operation continued to meet the discharge limits. The CNSC will continue to review effluent quality results to verify that effluent treatment performance remains effective.

Rabbit Lake Operation – Molybdenum in Effluent Identified in 2021 as Potentially Increasing

In 2021 RoR it was identified that although molybdenum concentrations did not exceed Action Level at anytime, concentrations at times were observed to be over the historical mean. Overall, the mean annual concentration (0.184 mg/L) remained relatively consistent with the 3-year historical mean (0.174 mg/L). In 2022, molybdenum concentrations did not exceed action levels at any time. CNSC staff will continue to review effluent quality results to verify that effluent treatment performance remains effective.

Key Lake Operation – None Care and Maintenance from 2018 to March 2022

Flow from the dewatering wells of the Gaertner and Deilmann pits are treated in the Reverse Osmosis Treatment Plant prior to discharge to Horsefly Lake (McDonald Lake system). Monitoring confirms that the effluent is within design specification and there were no Action Level exceedances. The treated mill effluent that is discharged to Wolfe Lake in the David Creek system (David Creek system) met all regulatory limits, and there were no Action Level exceedances.

Additional treatment components were installed from 2007 to 2009 to reduce molybdenum and selenium concentrations in the effluent. From 2017 to 2021, concentrations have been stable or declining demonstrating effective control of the discharge quality. In 2019, CNSC staff confirmed that the molybdenum and selenium follow-up program could cease, and monitoring requirements were added to the environmental monitoring program for the facility. In 2020, the ERP and 2015-2019 ERA were submitted to CNSC and Saskatchewan Ministry of Environment, results confirm levels are within those predicted in the ERA. CNSC staff concluded the environment remains protected.

McClellan Lake Operation - Selenium in McClellan Lake's East Basin

Additional context in 2022 RoR as compared to 2021 RoR is italicized for convenience

In the 2017 RoR, it was stated that the ERA (2016) showed that selenium levels in the vicinity of the discharge location into the East Basin (McClellan Lake) in the future would be above those predicted in the Environmental Impact Statement (EIS). An adaptive management plan was developed, and the 2017 RoR concluded that CNSC staff would continue to review reported selenium concentration in effluent through quarterly reports to verify that the receiving environment remained protected.

In 2020, one Action Level exceedance of selenium occurred in the effluent from the JEB WTP (March 28, 2020). In April 2020, the CNSC requested that Orano propose a long-term solution for sustainable reduction of selenium loading to the environment. September 2020, Orano submitted an update to the

selenium adaptive management plan. In October 2021, Orano submitted an implementation plan for ferrous sulphate treatment at the JEB WTP for enhanced selenium removal starting September 2022. In February 2022, Orano provided an updated forecast indicating that the predicted 12-month rolling average selenium loading will remain below the Environmental Based Reference Level (EBRL). The latest update provided by Orano in the 2022 annual compliance report indicated that 12-month rolling average selenium loading were expected to remain below the EBRL without ferrous sulphate treatment until end of September 2023. CNSC staff will continue to monitor to confirm the 12-month rolling average selenium loadings remain below the EBRL of 112 g/day.

Questions / Clarifications / Recommendations / Minor Editorial Items

Editorial Item #1 and Clarification #1

Is it an oversight that no ERP link is provided for McClean Lake Operation or was the last time an ERP was completed was prior to 2021?

At the Cigar Lake Operation EPR link provided in the 2022 RoR there are links for CNSC’s webpage and Cameco’s webpage, at the Cameco link the reader encounters “Page Not Found”. Unlike the other ERP Executive Summaries for Cigar Lake Operation a link to the full report is not provided. I’m guessing this is because Cigar Lake was review was completed in 2021, while the others were completed in 2022/2023.

Editorial Item #2

More so for documentation purposes (i.e., to clarify I’m not making typos as I update the tables provided in Appendix A), there were some minor (i.e., not meaningful) inconsistencies in reported effluent concentrations etc. among subsequent years (i.e., among the RoRs). My method of addressing is to defer to the most recent document.

Table 6: Annual Average Molybdenum Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClean Lake
2014	0.0303	0.2121	0.2820	0.16	0.0024
2015	0.0763	0.146	0.268	0.1	0.0024
2016	0.0369	0.1851	0.273	0.08	0.002



Table 6: Annual Average Molybdenum Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClean Lake
2014	0.0303	0.2121	0.2820	0.16	0.0024
2015	0.0763	0.146	0.268	0.1	0.0024



Table 7: Annual Average Selenium Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClean Lake
2014	0.0009	0.0017	0.0042	0.018	0.0007
2015	0.0041	0.0025	0.0042	0.018	0.0092
2016	0.0062	0.0037	0.0035	0.017	0.021



Table 8: Annual Average Uranium Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClean Lake
2014	0.0193	0.0097	0.046	0.006	0.0018
2015	0.131	0.0089	0.052	0.008	0.0042
2016	0.0063	0.0055	0.073	0.006	0.004
2017	0.0018	0.0056	0.07	0.011	0.004
2018	0.0005	0.0071	0.032	0.013	0.007
2019	0.0004	0.0086	0.027	0.0243	0.005
2020	0.0002	0.0084	0.021	0.0259	0.005
2021	0.0001	0.0082	0.018	0.0239	0.0098



Robin Kusch
2020 report 0.003

Table 9: Annual Average Radium-226 Concentration (Bq/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClean Lake
2014	0.008	0.04	0.01	0.05	0.007
2015	0.01	0.065	0.007	0.07	0.006
2016	0.007	0.082	0.007	0.05	0.006
2017	0.007	0.061	0.007	0.07	0.006
2018	0.006	0.079	0.006	0.07	0.006
2019	0.008	0.051	0.006	0.09	0.006



Robin Kusch
In 2020 report 0.005

Table 10: Annual Reportable Environmental Spills for Five Operations from 2014 to 2021

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClean Lake
	Reportable Environmental Spills				
2014	3	1	4	1	2
2015	10	0	2	1	6
2016	5	1	2	1	8
2017	5	2	1	3	3
2018	5	2	1	5	4
2019	3	4	1	8	0
2020	0	0	0	2	4
2021	4	0	4	4	5
2022	2	0	0	5	2



Robin Kusch
In 2021 report was 3

Clarification #2

On page 103 (pg 112/194), it is stated that at Key Lake Operation monitoring shows there is no significant difference in total lichen richness from 2011 to 2021. Overall epiphytic lichens were observed to be increasing in abundance and richness, a sign of a healthy epiphytic lichen community. As 2011 through 2021 would be considered mine-influenced, is there some qualify to substantiate the conclusion that the “epiphytic lichen community is healthy” versus “the community is recovering”? Further, is there some operational change to credit for this trend?

Recommendation #1

I was not surprised during engagement opportunities in 2023 how many community members voiced concern regarding cancer rates in their communities, but I was surprised by the association of this concern with uranium mining and milling in northern Saskatchewan. I was also surprised by the lack of connection being made between this concern and the operations and country food monitoring results. When I re-reviewed documents (RoR, IEMP, EARMP) from that perspective, I realized there is nothing to point to that identifies carcinogenic chemicals (e.g., arsenic, cadmium, radon, uranium) or links protective guidelines to avoiding increased cancer risk to fish, wildlife, workers or community members. As such, it isn't surprising that since the early 2000s there appears to have been little improvement in the perception of community members that they are being exposed to carcinogens due to uranium industry in northern Saskatchewan.

Reporting such as Canadian Uranium Workers Study that looks at health data from nearly 80,000 Canadian uranium mines, mill, processing and fabrication workers and follows up on causes of death from 1950 to present data and on their cancer data from 1970 to present day ([LINK](#)). I believe this report was expected to be final in 2023.

There is ample evidence that could be compiled, analyzed and presented appropriately to illustrate no / negligible risks to receptors, including community members. However, even directly speaking to how cancer risk is encompassed in the development of guidelines would be beneficial. Regardless as to whether or not the uranium industry poses a cancer risk to workers and community members a response to their concern would be advantageous. For example, supporting a radon testing campaign for northern Saskatchewan communities and compare results to areas within mining and milling operations.

Recommendation #2

When measured concentrations are reported as being above EA prediction, such as with arsenic in Seru Bay, it is helpful to provide more information to reassure the reader that adverse effects are still not predicted to occur nor occurring. As part of the IEMP, I could only find one fish and two water samples from within the Seru Bay area to illustrate effects are not occurring due to higher than predicted arsenic levels in effluent being discharged. As part of the IEMP, I could not find any samples related to elevated levels of selenium in McClean Lake. Community members understand that the EARMP is helpful in terms of addressing cumulative effects and direct effects to the area close to their communities; however, it does not help in terms of localized effects in the near-field.

Conclusion

From my review of the information provided there is no reason to object to the CNSC's conclusions in the 2022 RoR that the operations are being managed effectively in terms of the SCAs. The RoR concludes that adequate protections are in place to protect the environment and humans.

Sincerely,

A handwritten signature in blue ink, appearing to read "Robin Kusch", with a long horizontal flourish extending to the right.

Robin Kusch, M.Sc.
Environmental Scientist
108 Brookside Drive,
Warman, Saskatchewan
S0K 0A1

Appendix A: Summary Tables

Table 1: Financial Guarantees for the Five Operations from 2014 to 2021

Facility	2014	2015	2016	2017	2018	2020	2021	2022
Cigar Lake	49,200,000	49,200,000	49,200,000	49,200,000	49,200,000	61,790,000	61,790,000	61,790,000
McArthur River	48,400,000	48,400,000	48,400,000	48,400,000	48,400,000	42,100,000	42,100,000	42,100,000
Rabbit Lake	202,700,000	202,700,000	202,700,000	202,700,000	202,700,000	202,700,000	202,700,000	202,700,000
Key Lake	225,100,000	225,100,000	218,300,000	218,300,000	218,300,000	222,500,000	222,500,000	213,400,000
McClellan Lake	43,074,800	43,074,800	107,241,000	107,241,000	107,241,000	107,241,000	107,241,000	102,098,000

Table 2: Inspections at Uranium Mines

	2018	2019	2020	2021	2022
Number of Inspections	26	20	17	18	25
Instances of non-compliance	31	23	11	18	79
Orders	-	-	-	-	1

Table 3: Maximum Individual Radiation Dose per Year from 2014 to 2021

Facility	2014	2015	2016	2017	2018	2019	2020	2021	2022
Maximum Individual Radiation Dose (mSv)	Rabbit Lake 8.64	Rabbit Lake 9.15	McArthur River 7.02	McArthur River 5.73	Cigar Lake 7.28	McClellan Lake 4.7	McClellan Lake 4.28	Cigar Lake 6.03	McArthur River 7.14
% Annual Regulatory Limit	17	18	14	12	14	9	9	12	14

Table 4: Annual Average Individual Radiation Dose for the Five Operations from 2014 to 2021

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
	mSv				
2014	0.16	1.03	1.35	0.63	0.37
2015	0.45	1.00	1.36	0.55	0.89
2016	0.39	0.85	0.85	0.62	1.04
2017	0.34	0.79	0.4	0.66	0.91
2018	0.47	0.15	0.46	0.19	0.9
2019	0.57	0.33	0.75	0.27	0.93
2020	0.38	0.27	0.7	0.35	0.67
2021	0.32	0.25	0.57	0.52	0.79
2022	0.46	0.59	0.70	0.75	0.81

Table 5: Annual Lost-time Injuries for the Five Operations from 2014 to 2021

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
	Lost-time Injuries				
2014	1	1	1	0	3
2015	4	0	2	0	3
2016	1	1	1	2	3
2017	0	1	0	0	0
2018	0	0	0	0	1
2019	0	0	1	0	3
2020	0	0	0	0	2

2021	2	0	0	0	3
2022	0	0	1	1	3

Table 6: Annual Average Molybdenum Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
2014	0.0303	0.2121	0.2820	0.16	0.0024
2015	0.0763	0.146	0.268	0.1	0.0024
2016	0.0369	0.1851	0.273	0.08	0.002
2017	0.064	0.146	0.139	0.12	0.004
2018	0.103	0.0192	0.18	0.063	0.003
2019	0.1069	0.0084	0.159	0.049	0.002
2020	0.0756	0.0094	0.184	0.056	0.002
2021	0.0515	0.0089	0.213	0.038	0.003
2022	0.0506	0.0142	0.163	0.013	0.006

Table 7: Annual Average Selenium Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
2014	0.0009	0.0017	0.0042	0.018	0.0007
2015	0.0041	0.0025	0.0042	0.018	0.0092
2016	0.0062	0.0037	0.0035	0.017	0.021
2017	0.0042	0.0036	0.0024	0.015	0.011
2018	0.0044	0.0023	0.0026	0.01	0.021
2019	0.0041	0.0024	0.0023	0.01	0.037
2020	0.0034	0.0003	0.0026	0.011	0.042
2021	0.002	0.0003	0.0025	0.01	0.0211
2022	0.0037	0.0004	0.0024	0.009	0.0139

Table 8: Annual Average Uranium Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
2014	0.0193	0.0097	0.046	0.006	0.0018
2015	0.131	0.0089	0.052	0.008	0.0042
2016	0.0063	0.0055	0.073	0.006	0.004
2017	0.0018	0.0056	0.07	0.011	0.004
2018	0.0005	0.0071	0.032	0.013	0.007
2019	0.0004	0.0086	0.027	0.0243	0.005
2020	0.0002	0.0084	0.021	0.0259	0.005
2021	0.0001	0.0082	0.018	0.0239	0.0098
2022	0.0002	0.0103	0.019	0.0221	0.005

Table 9: Annual Average Radium-226 Concentration (Bq/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
2014	0.008	0.04	0.01	0.05	0.007
2015	0.01	0.065	0.007	0.07	0.006
2016	0.007	0.082	0.007	0.05	0.006
2017	0.007	0.061	0.007	0.07	0.006
2018	0.006	0.079	0.006	0.07	0.006
2019	0.008	0.051	0.006	0.09	0.006
2020	0.007	0.049	0.006	0.036	0.01
2021	0.007	0.029	0.006	0.017	0.01
2022	0.008	0.025	0.006	0.02	0.014

Table 10: Annual Reportable Environmental Spills for Five Operations from 2014 to 2021

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
	Reportable Environmental Spills				
2014	3	1	4	1	2
2015	10	0	2	1	6
2016	5	1	2	1	8
2017	5	2	1	3	3
2018	5	2	1	5	4
2019	3	4	1	8	0
2020	0	0	0	2	4
2021	4	0	4	4	5
2022	2	0	0	5	2

Table 11: Summary of Reportable Environmental Spills in 2021

No.	Operation	Spill Description
1	Cigar Lake	Negligible ammonia leak as a result of small pin hole leak along pipeline seam.
2	Cigar Lake	Uranium ore identified along Stockpile B ramp, material recovered and placed within stockpile.
3	Key Lake	240 L of propane released outdoors as a result of leak near tank flange.
4	Key Lake	12.8 m ³ of Gaertner dewatering well V water.
5	Key Lake	2000 L of Mineshop Bump Bay water to outdoors.
6	Key Lake	6 m ³ of water was released Neutral Thickener tank water.
7	Key Lake	8.1 m ³ of helium.
8	McClellan Lake	5 m ³ of tailings were released because of hole in Tails Thickener Tank to the mill terrace. The hole was repaired.
9	McClellan Lake	120 m ³ of partially treated Sue C pit water released to the environment because of a hole in pond liner. Water was removed by vacuum truck and returned to the pit and the hole was repaired.

Table 12: Annual Average Arsenic Concentration (mg/L) in Effluent

Year	Cigar Lake	McArthur River	Rabbit Lake	Key Lake	McClellan Lake
2014	0.003	0.0013	0.0056	0.007	0.0005
2015	0.0439	0.0029	0.004	0.006	0.0034
2016	0.0919	0.0011	0.0025	0.007	0.016
2017	0.075	0.0012	0.001	0.008	0.026
2018	0.0603	0.0009	0.0009	0.008	0.03
2019	0.0952	0.0009	0.0009	0.0075	0.058
2020	0.0627	0.0001	0.0090	0.0113	0.036
2021	0.0649	0.0001	0.0012	0.0109	0.044
2022	0.108	0.0001	0.00009	0.0019	0.0521