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Exposé oral

**Written submission from
Northwatch**

**Mémoire de
Northwatch**

In the Matter of the

À l'égard de

**Cameco Corporation,
Blind River Refinery**

**Cameco Corporation,
Raffinerie de Blind River**

**Application to renew licence for Cameco
Corporation's Blind River Refinery**

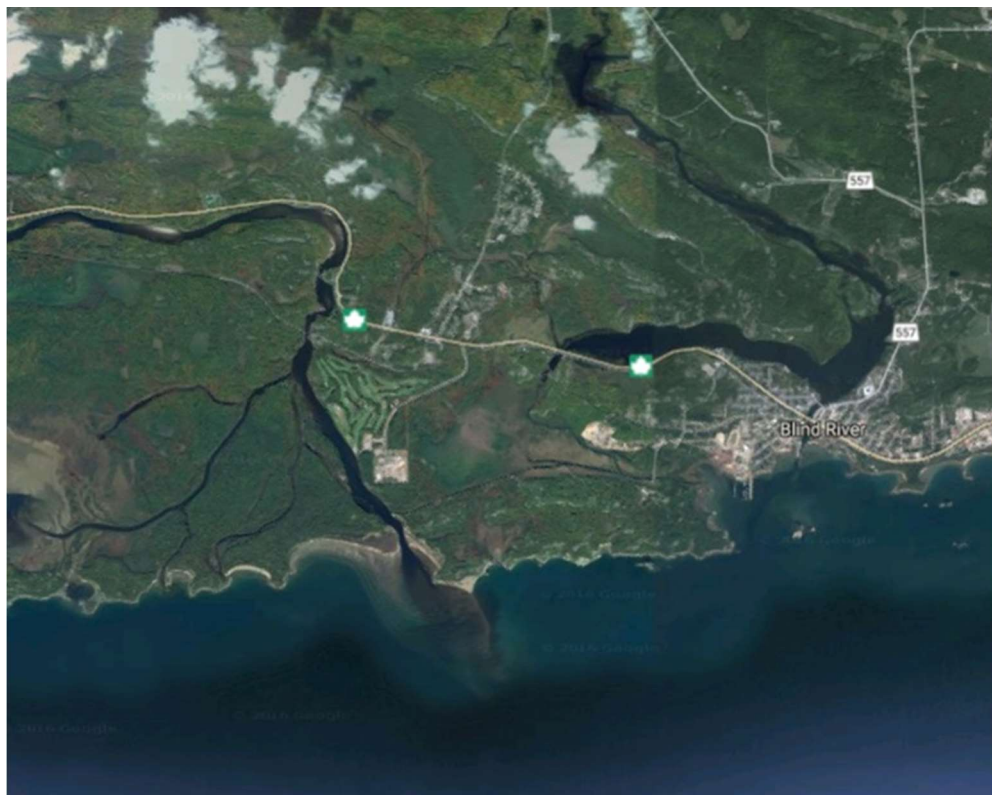
**Demande de renouvellement de permis pour
la raffinerie de Blind River appartenant à
Cameco Corporation**

Commission Public Hearing

Audience publique de la Commission

November 24, 2021

24 novembre 2021



NORTHWATCH

CAMECO CORPORATION'S REQUEST FOR LICENSE RENEWAL FOR THE BLIND RIVER URANIUM REFINERY



1. Northwatch's Interest

Northwatch is a public interest organization concerned with environmental protection and social development in northeastern Ontario. Founded in 1988 to provide a representative regional voice in environmental decision-making and to address regional concerns with respect to energy, waste, mining and forestry related activities and initiatives, we have a long term and consistent interest in the nuclear chain, and its serial effects and potential effects with respect to northeastern Ontario, including issues related to uranium mining, refining, nuclear power generation, and various nuclear waste management initiatives and proposals as they may relate or have the potential to affect the lands, waters and/or people of northern Ontario.

Northwatch's issues and concerns relate primarily to the performance of the refinery and the potential related adverse effects on workers and residents and on the natural environment in the vicinity of the refinery, including the North Shore of Lake Huron, the North Channel and – potentially – the islands in the North Channel of Lake Huron.

Since the beginning of operations there has been an accumulation of uranium in the soil and vegetation in the area, which is one indicator of releases as a result of the refinery's operations. During previous licensing exercises, Northwatch has noted that there were a number of performance issues which are of concern, particularly with respect to radiation protection, including those related to whole body and skin dose results, and exceedances of action levels.

Northwatch has previously intervened in license reviews for the Blind River facility, most recently in 2011. Northwatch has also commented on a number of related Regulatory Oversight Reports, including in 2016, 2017 and 2018.

2. Current License Review for Cameco Corporation's Blind River Uranium Refinery

On March 8th, 2021 the Canadian Nuclear Safety Commission (CNSC) announced that it will hold a two-day public hearing on the application by Cameco Corporation (Cameco) to renew its Fuel Facility Operating Licence for the Blind River Refinery located near the town of Blind River, Ontario. Cameco has requested a 10-year licence term.

The current licence, which expires in February 2022, authorizes Cameco to operate a Class IB facility to produce uranium trioxide from uranium concentrates. In its licensing renewal application, Cameco is not seeking any changes to the existing licensed activities and production rates but is requesting that the Commission accept its increased financial guarantee amount of \$57.5 million.

The facility, which has been in operation since 1983, refines uranium concentrates (commonly referred to as yellowcake) received from uranium mines worldwide to produce uranium trioxide (UO₃), an intermediate product of the fuel cycle. The primary recipient of the product is the Port Hope Conversion Facility in Port Hope, Ontario, which is also operated by Cameco under a Canadian Nuclear Safety Commission (CNSC) licence.

The current licence authorizes Cameco to produce up to 18,000 tonnes of uranium as UO₃ powder during any calendar year. In 2011 Cameco requested that the licence be amended to include an annual production increase of 6,000 tonnes of UO₃ powder, to 24,000 tonnes. The Commission granted conditional approval, but the conditions have not been met and production has not increased over the license period.

3. License Term

In Northwatch's submissions on the 2011 application by Cameco to renew the license we disagreed with extending the license period from five years to ten years, as had been requested by Cameco, and noted that we had also disagreed with the extension from a two year to a five year license in 2006. The reasons for our disagreement specific to the 2005 and 2011 relicensings related to uncertainties and changes the facility was facing at the time, including plans for expanded incineration, plans (not realized) for increased production, changes to the groundwater monitoring program, an incomplete flood assessment, and a change to a 24 hour workplace. More generally, we identified decreased transparency and opportunities for public engagement and an increase in discretionary decision-making in the absence of sufficiently frequent review milestones as negative attributes of a shorter license period.

The Commission issued a ten year license in early 2012. The current review is of the license period from 2012 to 2022, the outcome of that licensing decision.

In response to our September 2017 request for the mid-term performance reports we were told that "the Mid-Term Performance Report for Blind River is in the 2015 Regulatory Oversight Report (ROR)".¹

We reviewed and made submissions on that Regulatory Oversight Report, and commented that we were particularly disappointed in the quality and level of detail in the regulatory oversight report, given the CNSC staff position that the ROR was to serve as the mid-term performance report.

One of Northwatch's concerns with extending the licence length from two years to five years in 2007 was the length of time between between detailed reporting and between occasions for the interested public to provide comment on a licensee's operating performance. This concern was at least partly satisfied by the provision of mid-term performance reports, such as the 2009 mid-term performance report on the Blind River refinery.²

Those mid-term performance reports did, by our assessment, provide additional information to that included in the Regulatory Oversight Reports. For example, in the 2009 reports, the CNSC CMD described the uranium-contaminated by-products, their disposition, the wastes stream burned in the BRR incinerator, the storage of radioactively contaminated non-combustible wastes on-site, the storage and decontamination of scrap metals and their disposition, and the CNSC staff inspection against Cameco Blind River's Waste Management Plan. The Cameco CMD also very briefly described their management program for the two by-products including some volume estimates, management for recycling of uranium-contaminated metals, and their incineration. While neither of the 2009 CMDs were very detailed, they did at least contain more detail than is presented in the RORs.

At mid-point in the ten year license period we had expected a substantive and detailed mid-term performance report, commensurate in increased detail with the increased license term.

¹ Email subject line: RE: Document Request: Mid-Term Performance Report and Preliminary Decommissioning Plan for Cameco's Uranium Refinery, dated September 13, 2017

² CMD 09-M55 and CMD 09-M55.1

In their 2020 application, Cameco again requested a ten year license for the period of 2022 to 2032, and Canadian Nuclear Safety Commission staff have again recommended the ten year term to the Commission for Commission approval ³

Staff's rationale is that a periodic review every 5 years of the safety analysis report and the environmental risk assessment, continuous improvement through updates to BRR programs to comply with updated regulatory requirements, and Cameco's Annual Compliance Monitoring and Operational Performance Report suffice provide sufficient oversight. Staff further argue that CNSC staff report compliance performance of BRR to the Commission in public meetings, through the *Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities*, that ensures adequate oversight of the licensee.

Northwatch is not persuaded that the combination of the ten year license and the measures cited by CNSC staff are sufficient in terms of providing adequate oversight, accountability to the Commission, or public and Indigenous engagement.

Northwatch's perspective differs from that of staff on this matter for a number of reasons, all rooted in the experience of the current ten year license period. They include:

- As per our comments on various Regulatory Oversight Reports, these reports lack the depth and detail required to provide sufficient information sharing and transparency
- In addition to the above, the Regulatory Oversight Reports are difficult to locate on the CNSC web site, are largely repetitive in content from one year to the next, and lack references to supporting information and data
- The public comment opportunity is limited to a written submission, and the Commission is most frequently provided only a staff and licensee perspective in the Commission meetings where the reports are presented
- In the current license term, CNSC staff retroactively informed Northwatch that the 2015 ROR was the mid-term performance report (i.e. three years into a ten year term)
- Cameco's mid-term Environmental Risk Assessment was prepared in draft in 2016 but was not completed until 2020 and was not the subject of public comment

REQUEST: That a licence condition be added that Cameco produce a mid-term performance report of sufficient detail to allow performance assessment on core criteria (e.g. protection of the environment, protection of human health, waste and transportation)

REQUEST: That the mid-term performance report and review incorporate production and review of the Environmental Risk Assessment produced by Cameco and an Environmental Protection Report produced by CNSC staff

REQUEST: That the Commission direct staff to organize the CNSC [web page on Regulatory Oversight Reports](#) to provide a complete listing of Regulatory Oversight Reports, including draft reports, and a calendar identifying upcoming comment opportunities on the same page.

³ CMD 21-H-09, page 8

4. Uranium Concentrations in Soil

In October 2016 Northwatch reviewed the matter of uranium concentrations in soil in the vicinity of the Blind River refinery in commenting on CNSC’s “Regulatory Oversight Report for Nuclear Processing, Small Research Reactor and Class IB Accelerator Facilities: 2015”.

That regulatory oversight report⁴ included a single brief paragraph about the monitoring of uranium concentrations in soils in the vicinity of the Blind River refinery. In that single paragraph, the report conveyed a very small amount of information about the monitoring results, and makes a fairly large assertion about why Cameco collects soil samples on an annual basis. Allegedly, it is to “*demonstrate that there are no long-term effects of air emissions since there is no accumulation of uranium in soil in the vicinity of the BRR facility.*” The report further asserted that “*the results in 2015 remained consistent with the uranium soil concentrations detected in previous years*”.

A comparison was possible based on CNSC-provided information, of maximum uranium concentrations over a ten year period, using Table 13 from CMD 11-H18 and Table F-3 from the 2015 Regulatory oversight report.

The 2006 to 2010 annual averages show values that vary a great deal, and not in a manner that shows an overall trend (although Northwatch’s review in 2011⁵ found that there were upward trends with specific sample stations). However, the values for 2006 to 2010 (8.4, 8.7, 5.4, 3.0 and 4.0 respectively) were significantly different – and lower – than the values for 2011 to 2015 (18.0, 12.1, 16.4, 7.2 and 9.7). While the lowest maximum concentrations from 2011 to 2015 were generally similar to the highest maximum concentrations from 2006 to 2010, the increase from 4.0 in 2010 to 18.0 in 2011 is noteworthy.

While these are averaged annual values and so of only limited value in understanding site conditions, they are helpful in evaluating a statement in the 2015 Regulatory Oversight Report, ie. that “*Essentially, uranium soil concentrations do not appear to increase in the area surrounding the facility. This confirms that current BRR operations have no effects on soil quality.*” In brief, that statement has no basis.

Table 13: Soil Sampling Results¹

Parameter	2006	2007	2008	2009	2010
Minimum Uranium Concentration (µgU/g)	0.8	0.2	0.4	0.2	0.2
Maximum Uranium Concentration (µgU/g)	8.4	8.7	5.4	3.0	4.0

1. The results for 2011 will be available in early 2012.

⁴ Regulatory Oversight Report for Nuclear Processing, Small Research Reactor and Class IB Accelerator Facilities: 2015

⁵ 11-H18.37 Written Submission from Northwatch, 11-H18.37a and 11-H18.37b, supplementary submission

Table F-3: Blind River Refinery-soil monitoring results

Parameter	2011	2012	2013	2014	2015	CCME Guidelines (µg/g)*
Minimum uranium concentration (µg/g)	0.2	0.1	0.1	0.1	0.1	23
Average uranium concentration (µg/g) (within 1000 m, 0-5 cm depth)	4.8	3.3	4.3	2.7	3.8	
Maximum uranium concentration (µg/g)	18.0	12.1	16.4	7.2	9.7	

*Canadian Council of Ministers on the Environment (CCME) Soil Quality Guidelines for the Protection of Environment and Human Health (for residential/parkland land use).

Cameco’s 2015 monitoring report provided much of the same information as included in the CNSC regulatory oversight report. However, we were astounded by the statement in the Cameco monitoring report that as a result of the construction of a berm “*some historic Cameco soil sampling locations in the vicinity of the fence line were compromised. This means a few new sampling locations will need to be selected in 2016. The locations selected will preferably be in open areas, not under tree canopies, and in areas where the soil has been undisturbed by human activity.*”

This shows what we consider to be a reckless disregard for the long term monitoring program. We note that Cameco did not indicate which sampling locations were lost, only saying that they were in the vicinity of the fence line. We further note that three of the four sampling locations with the highest concentration of uranium in the soil in the Ministry of the Environment’s 2007 report (Sites 1, 2 and 4) were also in the vicinity of the fence line, and the two sites that showed the highest concentration of uranium in the soil in the sampling done for Northwatch by the Elliot Lake Field Station in late 2011 (Sites 2 and 4) were also in the vicinity of the fence line. Those two sampling sites had shown increases of 149% and 96% concentrations between 2007 and 2011.

It is a challenge to ensure that long-term soil monitoring plots are not disturbed or otherwise compromised.
Soil and Tree Foliage Survey in the Vicinity of Cameco’s Blind River Refinery, Blind River, Ontario (2012)” 2012 Report, MOE

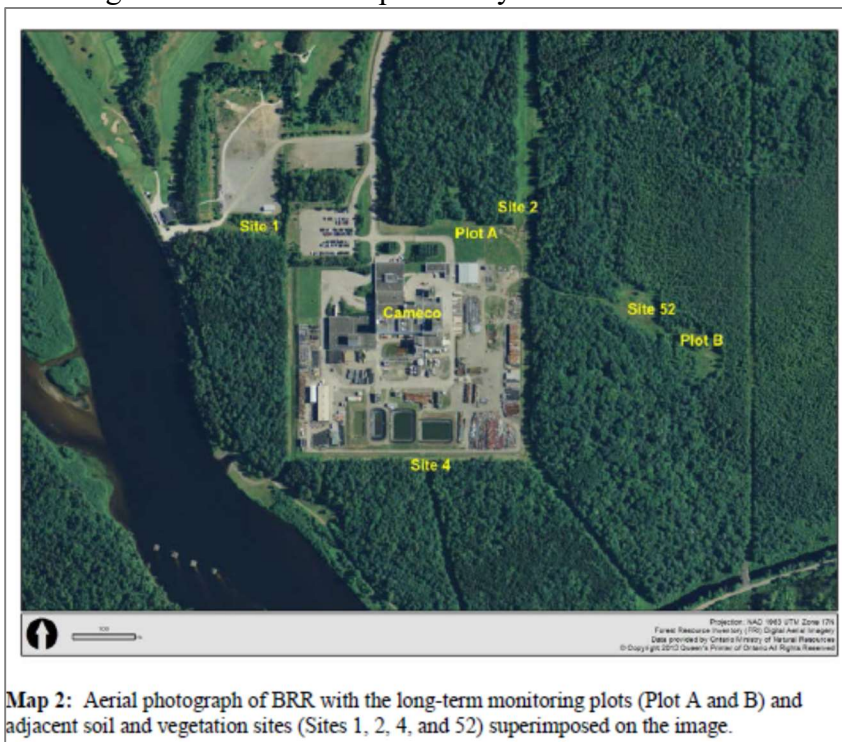
In December 2013 the Ontario Ministry of the Environment released a Technical Memorandum titled “*Soil and Tree Foliage Survey in the Vicinity of Cameco’s Blind River Refinery, Blind River, Ontario (2012)*” which set out the results of the Ministry’s 2012 soil and vegetation monitoring at the Blind River refinery.

The MOE report in 2007 stated:

Despite the fact that Sites 2 and 4 are within forested areas and exhibit variable year-to-year concentrations, there are strong indications that uranium concentrations have increased during the operating period of the Cameco facility. These sites are located at the fence line surrounding Cameco's process area. At Site 3, which is more distant, uranium concentrations have remained constant over time.

As with the Ministry's 2007 report and Northwatch's 2011 report, in the Ministry of the Environment's 2012 report a small number of the sampling sites showed increased concentrations; others remained relatively constant and a few showed decreases.

The MOE 2012 report indicated that the highest soil uranium concentrations in 2012 were reported at sites within 500 m of BRR (Sites 4, 2, 1, 52, and 8), consistent with MOE soil uranium data since 2000. As in the Northwatch 2011 report, Sites 2 and 4 results show the highest concentration of uranium, and MOE noted that in 2012 soil uranium concentrations were much higher at Site 2 than in previous years.



Map 2: Aerial photograph of BRR with the long-term monitoring plots (Plot A and B) and adjacent soil and vegetation sites (Sites 1, 2, 4, and 52) superimposed on the image.

Figure 2 from the MOE 2012 report is reproduced below; the entire report was included as Appendix 2 to Northwatch's 2016 review of the 2015 Regulatory Oversight Report.

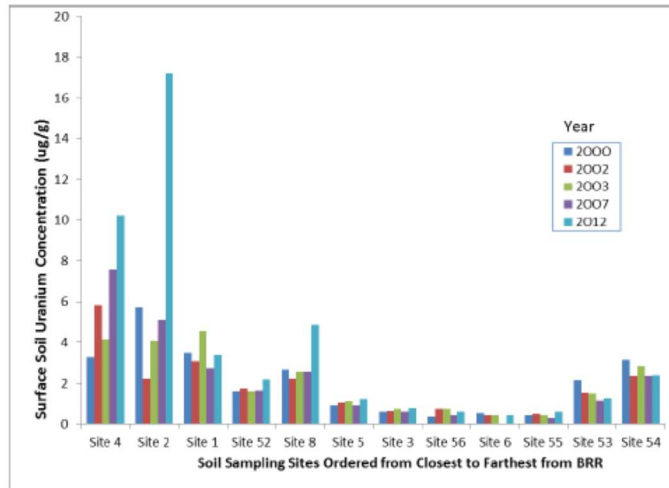


Figure 2: Uranium concentrations in surface soil (0-5 cm) collected in 2000, 2002, 2003, 2007, and 2012 from 12 sampling sites located in the vicinity of BRR

While the Ministry of the Environment does not, in their 2012 report, identify that the increased concentrations of uranium in the soil are having a measureable and adverse environmental effect, the sampling results do quite clearly show that the uranium refinery was to that point in time continuing to have a measurable impact in the form of increasing uranium concentrations in a majority of the sampling locations, as depicted in MOE’s Figure 2.

2021 License Review

For the 2021 review of Cameco’s application to extend its licence for an additional ten years, CNSC staff and Cameco presented minimal information about uranium concentrations in the soil and monitoring results for the second half of the licencing period.

Most notably:

- Neither the CNSC CMD nor the Cameco application nor the Cameco CMD included a map showing the monitoring locations
- The CNSC CMD’s Table 13 presented only annual averages; the CNSC Environmental Protection Report’s Table 3.4 presented both average and maximum uranium concentrations
- Actual monitoring results were not included in the CMDs, application, Environmental Risk Assessment or Environmental Protection Report

Northwatch directly requested that Cameco share actual monitoring results, but the request was denied. Cameco responded as follows:

Blind River collects soil samples at designated locations on an annual basis. The program currently includes 7 locations within 1 km of the refinery and 2 locations further than 1 km from the refinery. Ten cores are taken at each location and the ten core segments are combined in the laboratory to create a composite sample. This is a standard sample collection practice. As there is natural variability in soil structure and composition, the composites are used to ensure that the soil collected adequately represents the soil present at the location. The only reporting that is done with this data is the annual compliance reports I provided last week, where we present the

number of samples, the average and the range of uranium concentration. The most restrictive applicable regulatory criteria is the Canadian Council of Ministers of the Environment (CCME) guideline of 23 µg U/g for residential or parkland use. The summary data is screened against this criteria. All samples collected during the licence period were well below this criteria.

It's important to point out that in consultation with the CNSC, the soil program did change over the licensing period to focus on the shallow depth (0-2 inches) as this is where any uranium deposition from air emissions would be. For this reason, the only way to compare the data year over year, is through the summary data provided in the annual reports, which is the format the data is provided to the CNSC and MECP. There are no standalone soil reports issued as the annual reports provided to you meets our regulatory requirements.⁶

We find the absence of actual monitoring data to be problematic, and CNSC staff interpretation provided of the limited information they present in CMD 21-H-09 to be equally so.

CMD 21-H-09 briefly describes the monitoring program, references Table 13 as showing the average uranium in soil results, and states that “the 2020 soil monitoring data are in the background range for Ontario (up to 2.5 µg/g) and below the respective concentrations detected in previous years. This means that uranium soil concentrations did not increase in the area surrounding the facility”.⁷

Table 13: Average uranium in soil results, 2012 -20

Parameter	Uranium (µg/g)	
	Sampling sites within 1000 m	Sampling sites outside 1000 m
Depth	0 – 5 cm	0 – 5 cm
2012	3.3	0.7
2013	4.3	0.4
2014	2.7	0.6
2015	3.8	1.4
2016	1.5	0.5
2017	1.6	0.6
2018	2.0	0.7
2019	2.1	1.0
2020	1.4	0.7
Guideline	23 ¹	

¹ Reference: Canadian Council of Ministers of the Environment, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health*, 1999.

Table 13: 21-H-09, p 56⁸

In Northwatch’s assessment, CNSC are overstating their case. For one, consideration of the average concentrations – as presented by CNSC – over a ten year period show year-to-year variability. A decrease from 2019 to 2020 does not constitute a trend. And while the information CNSC staff presents in the CMD does indicate an overall decrease in average concentrations – which is very welcome news – a comparison to the range of concentrations presented in Table 3.4 in the Environmental Protection Report shows that the maximum concentrations are considerably higher.

⁶ Email dated 12 October 2021

⁷ 2021- H-09 p 55

⁸ Table 13: 21-H-09, p 56

Table 3.4: Soil monitoring results of uranium concentrations (µg/g) at the BRR facility (0–5 cm depth) [2-6]

Parameter	2015	2016	2017	2018	2019	CCME guidelines [41]
Average uranium concentration within 1,000 m	3.8	1.5	1.6	2.0	2.1	23
Average uranium concentration outside 1,000 m	1.4	0.5	0.6	0.7	1.0	
Maximum uranium concentration	9.7	2.9	2.8	3.7	3.8	

CNSC staff CMD also states that “Overall, the soil monitoring data demonstrate that the current BRR operations do not contribute to accumulation of uranium in surrounding soil, and that no adverse effects to relevant human and environmental receptors are expected.” This is a statement that they have not supported with sufficient data, or with actual studies of human health and/ or localized environmental effects of the uranium concentrations.⁹

REQUEST: That the Commission direct CNSC staff to include a complete data set for soil monitoring at the Blind River refinery in future Regulatory Oversight Reports and licencing Commission Member Documents

REQUEST: That a licence condition be added requiring Cameco to include a map of soil monitoring locations in their Annual Compliance Report

REQUEST: That a licence condition be added requiring Cameco to provide results of monitoring for uranium concentrations in soil in their Annual Compliance Report, in addition to their current practice of providing average and range of results.

⁹ 21-H-09 p 55

5. Environmental Performance

A key area of concern for Northwatch in the last two license reviews has been the environmental performance at the Blind River refinery, and the potential adverse consequences of poor performance on human health and the environment.

Given these concerns, Northwatch retained expert assistance from Hutchinson Environmental Sciences Ltd to support our review of the 2022 -2032 license application. A full copy of the Hutchinson Environmental Science Ltd's letter of advice is attached as Appendix A, but in summary, the review identified the following concerns:

- Surface water monitoring and reporting in Lake Huron for nitrate around the effluent diffuser for the Refinery to confirm the results of a Plume Dispersion Study. Nitrate concentrations in effluent exceed applicable Canadian Council of Ministers of the Environment (CCME) guidelines, and a nitrate monitoring program in Lake Huron should be developed and included as a condition of the license;
- The absence of surface monitoring in the Mississagi River to assess possible aquatic impacts from a stormwater ditch outfall from the Refinery that drains to the river. The concern was identified in the review for the current license (HESL, 2011) and does not appear to have been addressed. A monitoring program for the ditch outfall should be developed and included as a condition of the license;
- The absence of spatial-temporal trend analyses for parameters in groundwater related to the Refinery, to identify potential concerns with groundwater chemistry over time. A trend analysis of groundwater quality during the current license period should be completed and reviewed by CNSC prior to license renewal;
- CNSC's independent (off-site) monitoring program appeared to be based primarily on "community areas of concern" (as identified by CNSC), and not on air dispersion and aquatic transport and fate modelling. CNSC's independent program may not therefore, detect actual impacts from the Refinery (if any) on surrounding areas. For the next licensing period, CNSC should supplement its current independent monitoring program with monitoring in deposition areas identified by air dispersion and aquatic transport and fate modelling; and,
- CNSC documents did not confirm that the Commission had reviewed and was satisfied with the methods and source data for the various monitoring programs that Cameco conducts, although Cameco results and conclusions were accepted. CNSC should confirm that it reviewed the methods and source data that supported Cameco's monitoring conclusions for the record, with substantiating evidence, during the upcoming Commission Public Hearing for the license renewal.

6. Waste Management

A particular area of concern with Cameco's operations in Blind River is the generation of waste and its management. We raised these concerns during the last license review and the one prior to that, and they persist. In summary:

- the discussion of waste generation, waste volumes and characteristics and of waste disposition in both the Cameco and CNSC staff CMDs are overly generalized and fail to provide adequate information about the waste management approach and program and its outcomes; we repeat this comment verbatim from 2011
- Prior to the 2012 license hearing approvals had already been granted to transfer wastes from the Port Hope facilities in southern Ontario to the Blind River refinery on the north shore of Lake Huron for incineration; this practice has been ongoing, but is not described in the CNSC or Cameco CMDs, with the exception of a rather cryptic reference: "Cameco also transports equipment and materials between licensed Cameco sites in order to reduce, re-use, recover and recycle items to the extent practicable."¹⁰

The *General Nuclear Safety and Control Regulations* require that an application for a licence include, under paragraph 3(1)(j), include "*the name, quantity, form and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste.*"¹¹

The Cameco application wholly fails to meet the requirement described above.

On Page 2 of the Application, Cameco includes this description:

*Cameco also receives and processes small quantities of scrap natural uranium-bearing materials such as uranium dioxide (UO₂) and natural uranium metal. Other materials such as natural uranium metal scrap and natural uranium-bearing scraps such as wet filter cake are processed periodically and are packaged in a manner appropriate to the type and quantity of material.*¹²

It is unclear from that statement the degree to which these received materials are product versus waste. The application goes on to state:

The refining process produces two recoverable uranium products: (1) regeneration product, which is produced in the solvent treatment circuit; and (2) calcined product produced in the denitrated raffinate. The calcined product is stored in steel drums and the regeneration product is stored in plastic drums. Both products are recycled via re-milling for uranium recovery at a licensed facility, though regeneration product could also be incinerated in the BRR incinerator, if required.

The option of incinerating the regeneration product indicates that it falls within the waste category, but no description, volume or defined disposition strategy is provided.

¹⁰ 21-H-09 p 6

¹¹ 21- H-09 p 100

¹² Cameco Application, Page 2

The application describes the shipments from Cameco's Port Hope facilities as follows:

*Cameco ships equipment and materials (i.e. natural uranium scrap, calcined product and contaminated combustible material) between licensed Cameco sites in order to reduce, reuse, recover and recycle items to the extent practicable. All shipments to and from the refinery are made in accordance with applicable regulations (as per section 1.4) as described in the FSD Packaging and Transportation Program (FSD-PGR-TRN-01). Piloting work for various Cameco projects is also done at this facility on an as-required basis and may involve Cameco employees from other operations.*¹³

This statement confirms that the practice is ongoing, but does not provide a description or inventory of the wastes, report waste volumes, or describe the disposition plan.

In various sections of their application, Cameco describes radioactive waste either generated or being managed on site, including the following information points:

- Waste materials contaminated with uranium will be stored onsite until appropriately managed.
- Contaminated combustible waste materials from BRR, PHCF and CFM are stored in designated locations around the site until processed through the on-site incinerator.
- Drums containing contaminated solid material are stored in yard areas, pending disposal at an appropriately licensed facility in the United States or decontamination of the material for recycle.
- Drums containing contaminated liquid wastes are either stored inside a bermed area in the construction office or can be transferred to bulk liquid storage tanks contained inside the dyked area of the tank farm. These materials require further processing prior to uranium recovery and/or disposal at an appropriately permitted facility.¹⁴
- Approximately 24,000 drums or marginally contaminated materials were disposed of at a permitted hazardous waste landfill site in the United States between 2012 and 2020.
- Over the same period approximately 256,000 scrap drums were decontaminated and released as clean scrap metal.
- The refinery routinely shipped secondary products (calcined and regeneration product) to licenced facilities for uranium recovery. In the current licensing period, approximately 40,000 drums of secondary products have been shipped.
- Receipt of material from CFM began in 2014. Approximately 755,000 kg of CCM has been processed in the incinerator in the current licence period.¹⁵

While we did not go back to the 2011 application to make a detailed comparison, we have a general impression that this is more information than Cameco has provided in previous applications about the radioactive waste stream at the Blind River refinery. However, it still fall very short of meeting the General Nuclear Safety and Control Regulation requirements to

¹³ Cameco Application page 10

¹⁴ Cameco Application, pages 48 and 49

¹⁵ Cameco Application, pages 48 and 49

include “the name, quantity, form and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste”.

We note that the *2012-2019 Operational Performance Report and Forward Outlook in Support of the Renewal of Blind River Refinery Operating Licence* includes the following description of the incinerator which operates on the site of the Blind River refinery:

The BRR incinerator is considered a central processing operation for the FSD and processes contaminated combustible materials (CCM) from PHCF, CFM and BRR. Receipt of material from CFM for incineration at BRR began in 2014. Over 720,000 kg of CCM has been processed in the incinerator in the current licence period.¹⁶

We agree that the incinerator at Blind River serves as a waste management facility for other operations, and that raises the question as to why the incinerator is not separately and specifically licensed as a radioactive waste management facility.

REQUEST: That the Commission require Cameco to meet the requirements of General Nuclear Safety and Control Regulations under paragraph 3(1)(j), and include “the name, quantity, form and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste”; this information should be provided prior to any further consideration of the Cameco application

REQUEST: That the Commission invite independent legal opinion on the issue of whether the incinerator at Blind River should be separately and specifically licensed as a radioactive waste management facility and invite public and Indigenous comment on licensing options for the waste incinerator

¹⁶ 2012-2019 Operational Performance Report and Forward Outlook in Support of the Renewal of Blind River Refinery Operating Licence FFOL-3632.00/2022, pg 31

7. Decommissioning Plans

The CNSC staff CMD describes Cameco's decommissioning plans in very general terms: Cameco has selected a prompt decommissioning strategy, buildings and equipment will be dismantled and removed from the site, and the site will be remediated back to a state similar to its natural state.

But while the opening paragraph describes removing the structures from the site and remediating it to a natural state, somewhat incongruously the document then goes on to describe Cameco's strategy for dealing with what will no doubt be at least in large part radioactive waste is to "construct a long-term waste management facility to contain the remaining contaminated soil and building rubble in a properly designed and secure facility occupying a small area on the site."¹⁷

Cameco's application to renew their license is even less informative, saying only that the Blind River refinery has a Preliminary Decommissioning Plan, and that plan "outlines the general requirements for returning the site to the status of unrestricted use and outlines the controls required for the protection of the environment during the decommissioning process." It does, at least indicate that a technical summary of the PDP is available on Cameco's community website.¹⁸

It's in that Preliminary Decommission Plan that Cameco's strategy goes from bad to worse – very much worse – describing their "common assumption that waste from the Port Hope Conversion Facility (PHCF), Cameco Fuel Manufacturing (CFM) and Blind River Refinery (BRR) would be consolidated at a low level radioactive waste management cell at the Blind River site."

The rationale provided is that "this location is proposed because the licensed facility in Blind River has available land, an excellent operating record and strong community support."¹⁹

Northwatch objects in the strongest of terms to Cameco's "strategy" of creating a massive radioactive waste facility on the shore of Lake Huron and transferring the decommissioning wastes from the Port Hope conversion facility and the Cameco Fuel Manufacturing facility in Port Hope to northeastern Ontario.

REQUEST: That the Commission immediately direct Cameco to investigate alternative strategies for the management of decommissioning wastes from their Ontario fuel division facilities.

¹⁷ 2021-H-09, page 66

¹⁸ Cameco Application, page 49

¹⁹ Blind River Refinery Preliminary Decommissioning Plan, Cameco Fuel Services Division Technical Reports | Public Summary, page 2

8. Jurisdictional Comparisons

In 2011, Northwatch retained expert assistance to support our review of the 2012 -2022 license application and assist in evaluating it against international norms. For the 2022-2032 license review we commissioned an update on that review.

A full copy of the report “**Review of International Licensing Standards and Norms for Uranium Processing Facilities**”, prepared by Morten Siersback can be found in Appendix B. The 2011 report, prepared by Laura Bowman (Iler Campbell LLP, Barristers and Solicitors) is included in Appendix C, as the 2021 report updates but does not repeat the content of the 2011 report.

Key findings include:

- There are challenges to comparing standards and licensing requirements across jurisdictions for a number of reasons, including that the Blind River Refinery is the only facility in the world that only converts yellowcake to UO₃ accordingly; that licensing information was available only for a limited number of facilities and complete licensing information for non-Canadian facilities was not readily available, and no information was available specific to incineration practices at UO₂ or UF₆ facilities.
- The use of 1 mSv as an annual public dose limit is accepted in most countries as a radiation protection standard, but the US EPA where it is involved in regulation, tends to use 0.04 mSv per year rather than 1 mSv per year, and many countries have adopted the US EPA approach of using 0.04 mSv per year rather than 1 mSv per year.⁵
- Unlike Canada the US NRC has regulations that contain standard effluent requirements; concentration limits are specified and in many cases the best available technology is required to be applied to discharges.
- Overall in comparison to Canada the United States has developed more specific preventative-design and release criteria for radionuclides from nuclear facilities and these include a range of hard, measurable quantitative requirements and more definitive benchmarks than ALARA.

9. Conclusions

In closing, we want to acknowledge some positive developments related to the Blind River refinery, namely:

- There appears, based on the documentation, to be a greater level of acknowledgement of Mississaugi First Nation as both the rights holders and the nearest neighbours to the Blind River refinery
- There appears, based on the limited information made available, to be potentially some reduction in the concentrations of uranium in the soil in the vicinity of the refinery; additional data would be helpful in making this determination over time

That said, we continue to have numerous concerns related to this operation, including and additional to those outlined in this submission. Our concerns include but are not limited to:

- worker exposure, in terms of both radiation and toxicity
- environmental burden to air, water, soil, wildlife and vegetation
- transfer of radioactive wastes to the Blind River refinery site and proximity
- transportation impacts, under normal and upset conditions
- the opaqueness of the information systems related to oversight and reporting on the Bind River refinery operations

Further to our review, we make the following requests of the Commission:

REQUEST: That a licence condition be added that Cameco produce a mid-term performance report of sufficient detail to allow performance assessment on core criteria (e.g. protection of the environment, protection of human health, waste and transportation)

REQUEST: That the mid-term performance report and review incorporate production and review of the Environmental Risk Assessment produced by Cameco and an Environmental Protection Report produced by CNSC staff

REQUEST: That the Commission direct staff to organize the CNSC [web page on Regulatory Oversight Reports](#) to provide a complete listing of Regulatory Oversight Reports, including draft reports, and a calendar identifying upcoming comment opportunities on the same page

REQUEST: That the Commission direct CNSC staff to include all complete data set for soil monitoring at the Blind River refinery in future Regulatory Oversight Reports and licencing Commission Member Documents

REQUEST: That a licence condition be added requiring Cameco to include a map of soil monitoring locations in their Annual Compliance Report

REQUEST: That a licence condition be added requiring Cameco to provide results of monitoring for uranium concentrations in soil in their Annual Compliance Report, in addition to their current practice of providing average and range of results.

REQUEST: That the Commission require Cameco to meet the requirements of General Nuclear Safety and Control Regulations under paragraph 3(1)(j), and include “the name, quantity, form and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste”; this information should be provided prior to any further consideration of the Cameco application

REQUEST: That the Commission invite independent legal opinion on the issue of whether the incinerator at Blind River should be separately and specifically licensed as a radioactive waste management facility and invite public and Indigenous comment on licensing options for the waste incinerator

REQUEST: That the Commission immediately direct Cameco to investigate alternative strategies for the management of decommissioning wastes from their Ontario fuel division facilities.

Appendices

- Appendix A Letter of Advice on Environmental Performance, Blind River Refinery License Review, prepared by David Leeder, P. Geo., Senior Environmental Scientist, Hutchinson Environmental Sciences, Ltd, 2021
- Appendix B “Review of International Licensing Standards and Norms for Uranium Processing Facilities”, prepared by Morten Siersbaek, Siersbaek Law P.C.2021
- Appendix C “Review of International Licensing Standards and Norms for Uranium Processing Facilities”, prepared By Laura Bowman (Iler Campbell LLP, Barristers and Solicitors, 2011

APPENDIX A

October 25, 2021

Project No. 210127

Brennain Lloyd
Project Co-ordinator
Northwatch
1450 Ski Club Rd, North Bay, ON
P1B 8E6

Dear Ms. Lloyd,

Re: Review of Cameco's Corporation, Application to Renew the Licence for the Blind River Refinery

INTRODUCTION AND SUMMARY OF FINDINGS

Hutchinson Environmental Sciences Ltd. (HESL) conducted a review of information related to the application for the Renewal of Operating Licence FFOL-3632.0/2022 for Cameco Corporation's Blind River uranium refinery (the Refinery). The review was conducted on behalf of Northwatch to assess whether the Refinery's environmental performance was sufficient to reasonably protect human health and the environment in surrounding areas, and whether the license conditions and the associated monitoring programs were adequate to detect potential adverse effects to human health and the environment.

In summary, the review identified the following concerns:

- Surface water monitoring and reporting in Lake Huron for nitrate around the effluent diffuser for the Refinery to confirm the results of a Plume Dispersion Study. Nitrate concentrations in effluent exceed applicable Canadian Council of Ministers of the Environment (CCME) guidelines, and a nitrate monitoring program in Lake Huron should be developed and included as a condition of the license;
- The absence of surface monitoring in the Mississagi River to assess possible aquatic impacts from a stormwater ditch outfall from the Refinery that drains to the river. The concern was identified in the review for the current license (HESL, 2011) and does not appear to have been addressed. A monitoring program for the ditch outfall should be developed and included as a condition of the license;
- The absence of spatial-temporal trend analyses for parameters in groundwater related to the Refinery, to identify potential concerns with groundwater chemistry over time. A trend analysis of groundwater quality during the current license period should be completed and reviewed by the Canadian Nuclear Safety Commission (CNSC) prior to license renewal;
- CNSC's independent (off-site) monitoring program appeared to be based primarily on "community areas of concern" (as identified by CNSC), and not on air dispersion and aquatic transport and fate modelling. CNSC's independent program may not therefore, detect actual impacts from the Refinery (if any) on surrounding areas. For the next licensing period, CNSC should supplement its

current independent monitoring program with monitoring in deposition areas identified by air dispersion and aquatic transport and fate modelling; and,

- CNSC documents did not confirm that the Commission had reviewed and was satisfied with the methods and source data for the various monitoring programs that Cameco conducts, although Cameco results and conclusions were accepted. CNSC should confirm that it reviewed the methods and source data that supported Cameco's monitoring conclusions for the record, with substantiating evidence, during the upcoming Commission Public Hearing for the license renewal.

The review was limited by a short project timeline, and potential effects to human health and the environment may exist that the review was not able to identify. A lack of substantiation and rationale for conclusions in the CNSC and Cameco documents supporting the application, further limited the ability of the review to identify concerning human health and environmental conditions (if any).

The documents reviewed were key information sources for the upcoming Commission Public Hearing, and in most cases were too summary in nature to provide defensible surety of the results and conclusions presented. Often, one or two additional sentences, or references to easily accessible supporting reports within the document text, would have allowed a more comprehensive review, and provided assurance of the operating condition at the Refinery. As presented, the documents were not "stand-alone". While additional supporting information was available, it commonly required substantial effort to cross-reference with the claims in the documents, and did not facilitate an accessible review. HESL provided recommendations for improving the accessibility of third-party reviews for CNSC licences and performance/monitoring reports in general, previously (HESL, 2011; HESL, 2018¹), but little improvement was noted in this particular review.

Detailed review comments and recommendations for monitoring and reporting additions/improvements to include in the Refinery's upcoming license conditions, as well as recommendations for general reporting, are provided below.

INFORMATION REVIEWED

The information provided by Northwatch was reviewed. CNSC materials for the Licence Renewal Commission Public Hearing (CNSC, 2021a) was the first document reviewed to provide a background and summary of the 2022 license renewal application, and identify potential concerns to investigate further in other documents:

- Canadian Nuclear Safety Commission (2021a). Written submission from Cameco Corporation in the Matter of the Blind River Refinery Application to renew licence for Cameco Corporation's Blind River Refinery, Commission Public Hearing, November 24 to 25, 2021. August 20, 2021.

Pertinent information in the following documents was then reviewed in further detail:

¹ Hutchinson Environmental Sciences Ltd. (2018). Technical review of the Canadian Nuclear Safety Commission's "Regulatory Oversight Report on Uranium Mines, Mills, Historic and Decommissioned Sites in Canada" (2017) and associated information. November 19, 2018.



- Cameco Corporation Fuel Services Division (2020a). 2022 LICENCE RENEWAL APPLICATION FOR THE BLIND RIVER REFINERY. September 30, 2020.
- Cameco Corporation (2020b). Refinery Licensing Manual, Blind River Refinery. August, 2020.
- Cameco Corporation Fuel Services Division (2021). Blind River Refinery Derived Release Limits. July, 2021.
- Canadian Nuclear Safety Commission (2021b). A Licence Renewal, Cameco Corporation, Application to Renew Licence for the Cameco Blind River Refinery, Commission Public Hearing Scheduled for November 24 to 25, 2021. Submitted by CNSC Staff. August 13, 2021.
- Canadian Nuclear Safety Commission (2021c). Environmental Protection Review Report: Blind River Refinery. 2021.
- Canadian Nuclear Safety Commission (2021d). Independent Environmental Monitoring Program: Blind River Refinery. 2021.

The review conducted by HESL of Cameco's previous licence application for Blind River (2012), provided a reference of past concerns and basis to assess if concerns were addressed:

- Hutchinson Environmental Sciences Ltd. (2011). Submission to the Canadian Nuclear Safety Commission, Serpent River First Nation Comments on the Cameco Corporation Uranium Refinery 2012 License Renewal, Blind River, Ontario. December 19, 2011.

BACKGROUND

Summary of the Refinery

A description of the Refinery's features pertinent to potential environmental concerns is provided below, summarized from the documents reviewed.

The Refinery is located 5 km west of Blind River in Algoma District, Ontario. The property that the Refinery is located on is owned by Cameco and is approximately 253 hectares (ha) in size with the Refinery's licensed operating area covering approximately 11 ha. Cameco has a lease on an additional 195 ha of land to the east of its owned property. The nearest residence is approximately 1 km northeast of the Refinery. The Mississagi River is 50 m west of the Refinery and Lake Huron is approximately 800 m south of the Refinery.

The refinery was built on a greenfield site in the early 1980s. The uranium trioxide (UO₃) plant, plant services and administration are located in a central building with a number of smaller auxiliary buildings which support refinery operations. The licensed Refinery is surrounded by a shallow ditch to divert rainwater and runoff around the outside of the Refinery to the Mississagi River.

The Refinery processes natural uranium ore into UO₃. The ore is received from mines world-wide, and Cameco also receives small quantities of scrap natural uranium-bearing materials such as uranium dioxide (UO₂), uranium-containing metals and wet filter cake, which are processed periodically.



In the refining process, nitric acid is added to uranium ore concentrate to produce uranyl nitrate solution. Impurities are removed from the solution using a solvent extraction process with tributyl phosphate (TBP) in a kerosene diluent as the solvent. Purified uranyl nitrate is then heated and concentrated, producing a nuclear-grade uranyl nitrate hexahydrate (UNH) liquid. The UNH is thermally decomposed to form UO_3 powder which is stored and shipped to Cameco's Port Hope Refinery in specially designed bulk containers which hold approximately 9.5 tonnes of powder each. Powder is also shipped to other regulated customers, in much smaller quantities. Shipping is licensed and regulated by the Nuclear Safety and Control Act, and Transportation of Dangerous Goods regulations; HESL did not review shipping of material from the Refinery for environmental concerns in this review.

The Refinery recovers oxides of nitrogen generated in the refining process in a nitric acid recovery circuit. The TBP and kerosene solvent is also recovered and recycled in the Refinery.

The refining process produces two products which can be recycled: regeneration product, which is produced in the solvent treatment circuit; and calcined product, produced in the denitrated raffinate. Both products contain recoverable uranium and can be recycled via re-milling for uranium recovery at a licensed Refinery, or disposed via incineration in the Refinery's incinerator.

Bulk chemicals stored at the Refinery include nitric acid, phosphoric acid and kerosene. Other chemicals used at the Refinery include laboratory reagents, water treatment chemicals and lubricants.

Discharges to the environment from the Refinery include:

- Treated wastewater from the on-site treatment plant to Lake Huron via the effluent pipe and a diffuser located approximately 500 m offshore;
- Surface runoff via the ditch to the Mississagi River and runoff infiltration to the sub-surface;
- Air emissions from the refinery process stacks and heating ventilation air-conditioning system (HVAC); and,
- Air emissions from the incinerator.

Application for License Renewal

Cameco is seeking a license renewal of the Class 1B Nuclear Fuel Facility Operating Licence FFOL-3632.0/2022 for the Blind River Refinery for a term of 10 years with no changes to the authorized activities or approved production rates as set out in the application and referenced documents. The current license for the Refinery is valid until February 28, 2022 and authorizes Cameco to produce uranium trioxide (UO_3) at the Refinery.

Only natural uranium compounds are handled, processed and produced at this facility. In its decision for the current FFOL, the Commission authorized an annual production capacity of 18,000 tonnes uranium as UO_3 , with approval to increase the annual production rate to 24,000 tU as UO_3 subject to the following conditions:



- a) The proposed modifications of the facility as specified in Cameco's letter dated June 28, 2011² (not provided for this review), are completed and commissioned;
- b) A final commissioning report on the proposed modifications specified in Cameco's letter dated June 28, 2011, is submitted to the Commission or a person authorized by the Commission for review and acceptance; and
- c) The final commissioning report specified in (b) above is accepted in writing by the Commission or a person authorized by the Commission.

The application for license renewal was summarized from Cameco (2020a).

Cameco also requested the Approval of the proposed financial guarantee of \$57.5 million, based on the 2020 update to the Preliminary Decommissioning Plan (PDP; CNSC, 2021a). Review of final guarantees was beyond the scope of this technical review, and comment on the financial guarantees was not made.

A change to the "Derived Release Limits (DRLs) were updated in the license supporting programs, to meet the requirements of CSA N288.1-14 "Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities". The study was accepted by CNSC staff in 2019 (Cameco, 2020a).

REVIEW FINDINGS

Format

The findings of the review relating to potential human health and environmental effects from the Refinery's operation are presented by the document reviewed.

Document Review Findings

CNSC (2021a). *Written submission from Cameco Corporation in the Matter of the Blind River Refinery Application to renew licence for Cameco Corporation's Blind River Refinery, Commission Public Hearing,*

CNSC (2021a) is a submission by Cameco to CNSC. The submission provided a brief overview of the Refinery, a summary of the proposed license renewal elements, and a summary of Cameco's evaluation of the Refinery's performance relative to its existing license terms. In Section 1 of the document, Cameco asserted that the Refinery's "*strong performance in this licence period... demonstrates that Cameco is qualified to carry on the activity that the requested licence will authorize Cameco for*". Cameco committed to the following: "*Cameco will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.*"

² Cameco Responses to Third-Party Recommendations in Production Increase Engineering Assessment Report – June 28, 2011.



The document contains summary descriptions of Cameco's performance evaluation metrics including its Management System (Section 3.1), Human Performance (Section 3.2), Operating Performance (Section 3.3), Safety Analysis (Section 3.4), Physical Design (Section 3.5), Fitness for Service (Section 3.6), Radiation Protection (Section 3.7), Conventional Health and Safety (Section 3.8), Environmental Protection (Section 3.9), Emergency Management and Fire Protection (Section 3.10), Waste Management (Section 3.11), Security (Section 3.12), and Safeguards (Section 3.13). Additional sections describe Cameco's business, ancillary licenses and approvals, Third Party engagement/consultation, and insurance. The Radiation Protection and Environmental Protection sections were particularly pertinent to this review, and were reviewed in detail. Other sections were scanned for relevant information; none was identified that warranted comment.

Radiation Protection (Section 3.7)

The Radiation Protection section discusses radiation exposure to workers and the public from the Refinery during the current licensing period. Cameco assesses radiation protection performance through annual targets, annual internal audits and an annual management review, as well as exposure monitoring and comparison to CNSC limits. The review focussed on radiation monitoring results relative to CNSC limits.

Internally, Cameco reported that there were fifteen reported radiation protection action levels exceeded during the current license period for workers. Twelve occurred in the 2012 to 2014 period. Four were for exceeding the monthly whole body exposure action level, one for exceeding the quarterly whole body exposure action level, six for exceeding the monthly skin exposure action level and one was related to an elevated uranium in urine. Cameco stated that investigations were conducted for all events and corrective actions taken as appropriate, but details on the corrective action(s) were not provided.

Internal performance reportedly improved after 2014, with one action level exceedance in each of 2017, 2019 and 2020 that were related to a whole body or skin dose result. In each case, Cameco reported that investigation revealed that the exposure was non-personal in nature and CNSC accepted Cameco's proposed dose adjustment for the individual. Copy of the CNSC acceptance was not included.

In all cases, it was not clear what the internal action level was, or what the response was. However, based on Figures 4, 5, 7, 8 and 9 of the section (provided by Cameco), average and maximum doses to workers from 2012 to 2020 were well below Regulatory Limits for total effective doses, external skin doses, external whole body doses, internal whole body doses (by urine proxy) and internal whole body doses (by lung count), respectively.

Externally, the dose to the public from the refinery was calculated from the derived release limit (DRL) for the Refinery, based on three components: dose to the public from air emissions, dose from water discharges and dose from gamma radiation. Cameco reported that for the Refinery, the dose to the public from air and water emissions was a small fraction of the public dose limit, typically <0.001 mSv for each component, and that the gamma component represented virtually all the estimated public dose, although rationale for the conclusion was not provided. The public dose remained low, typically < 1% of the Regulatory Limit (which is 1 mSv).



The Refinery's performance appeared to be good based on the summary and data in the section, but limited substantiation was provided (e.g., references to annual reports and monitoring results, CNSC communication, explanation of conclusions). The summary information may be available for public review, but in the context of the document which informs a Commission Public Hearing, the absence of references and simple additional substantiation of the conclusions, reduced confidence in the results, did not provide for a reasonable level of transparency, and inadequately informed the public of monitoring and reporting rigour and/or possible shortcomings of the same. In the case of this review, limitations did not allow the validity of the results presented by Cameco to be confirmed.

In most cases, one or two additional sentences describing the rationale for conclusions, and reference(s) to source data/communication would improve the document's transparency and rigour, and improved substantiation should be included in future reports to improve confidence and trust in Cameco. HESL identified and recommended improvements for substantiation in other reviews of CNSC licensing and regulatory oversight submissions (HESL, 2011; HESL, 2018) and CNSC should require its licensees to improve reporting in support of Commission Public Hearings, so that supporting documents can "stand alone" and not require extensive background verification.

Environmental Protection (Section 3.9)

Cameco provided the following background on their environmental protection measures:

- The Refinery maintains an appropriate environmental protection program that meets the requirements of the ISO14001 standard and Cameco's corporate requirements;
- Environmental protection is regulated by both federal and provincial regulators. Provincial approvals are in place for the effluent and air emissions;
- The Refinery monitors effluent and air emissions and compares the results to provincial and federal requirements;
- Air emissions monitoring consists of source and ambient monitoring. Uranium emissions from the two process stacks, the DCEV and Absorber, as well as the incinerator stack, are sampled continuously during operations using a TSI sampler. The Absorber stack is also continuously sampled for oxides of nitrogen (NOx) using an on-line analyzer. Additional monitoring from the incinerator stack as required by the Environmental Compliance Approval (ECA) includes continuous emissions monitoring for oxygen, carbon monoxide and nitrogen oxides;
- The ambient air program measures the quality of the air surrounding the facility using high volume samplers (uranium). This supports Refinery operations in the event of an upset condition, to validate existing air dispersion models and for periodic review of the Environmental Risk Assessment (ERA) which informs the adequacy of the Refinery's environmental monitoring;
- Liquid effluent from the process and powerhouse, as well as treated effluent from the onsite sewage treatment plant (STP), is collected and transferred to a lagoon system. There is a stormwater collection lagoon for surface water run-off from the paved areas on the Refinery site. Once the effluent has been monitored and deemed to meet release criteria, the water from the lagoon system is discharged to the north channel of Lake Huron via an outfall pipe and diffuser. The diffuser is designed to achieve a minimum 100-fold dilution at the point of entry into the lake. Effluent pumped



to the lake is sampled as it is discharging by a flow proportional sampler. There is no stormwater collection and treatment system for runoff from unpaved areas on and around the Refinery site;

- In 2015, a Plume Modelling, Delineation and Sediment Study was carried out which confirmed the effectiveness of the liquid effluent outfall diffuser in Lake Huron and also confirmed that there is no adverse impact on sediment concentrations in the Lake as a result of refinery operations;
- The ambient water quality program is intended to collect data to monitor the impact of the aqueous discharges into offsite receiving waters; and
- There are 35 environmental borehole and monitoring well locations, inside and outside of the perimeter fence line, used for groundwater monitoring.

Cameco identified that:

- All air emissions monitoring results were well below the emissions limits set by CNSC under the current license. Figures 12 to 16 showed all maximum and average emissions were below the limits for the DCEV, Absorber, Incinerator and combined stack emissions;
- Ambient air and terrestrial monitoring programs had results well below applicable provincial limits. Figures 17 and 18 showed average annual uranium concentrations in air were below Ontario provincial limits at all sample locations; Figure 19 showed all uranium concentrations in soil were below the CCME soil quality guideline in the upper 5 cm of soil (all years – 2012 to 2020) and 5 to 15 cm soil depth (2012 to 2017; not monitored after 2017);
- Uranium, nitrate, radium-226 and pH remained below license limits in the liquid effluent, shown on Figures 19 to 24; and,
- Uranium in groundwater water remained by below Ontario Table 2 Standards (20 µg/L) except for one borehole in 2018 where the concentration was 27 µg/L; this was shown on Figure 25, which presented the average and total uranium concentrations observed in groundwater from 2012 to 2020.

The following concerns were identified with environmental monitoring, listed in the order of the information Cameco presented:

- Overall, the environmental monitoring information was brief and included limited to no substantiation of the conclusions presented, limited descriptions of monitoring methods, no identification of the professionals that conducted the monitoring, and no reference to monitoring source materials. The presentation did not allow for a technical review of the monitoring results to verify correct methods or data interpretation. Additional information on monitoring program structure, methods and reporting requirements was available in supporting documents (e.g., Cameco 2020a, 2020b). However, brief summaries of substantiating information should be included in the primary document providing information to the Commission Public Hearing, and references to appropriate supporting documents should be provided with the presented results, to allow for an accessible review in future license renewal applications and updates;
- To clarify, the ISO14001 standard is an environmental management system standard, and does not confirm that appropriate environmental monitoring was conducted to the Standard of Care required of environmental professionals in the province of Ontario;



- The results of the ERA conducted to confirm the adequacy of the environmental monitoring program, were not presented, although a reference to the ERA via Cameco's website was listed. The ERA could not be examined within the time limits of this review; its results and substantiating report were reportedly reviewed and accepted by CNSC in their EPR;
- No supporting information or reference was provided to support the conclusion of the 2015 Plume Modelling, Delineation and Sediment Study; its results and substantiating report were reportedly reviewed and accepted by CNSC as part of their EPR;
- No surface water quality results from receiving water bodies were presented for nitrate, radium-226 or pH. For pH and radium-226, this is not a concern, because pH in effluent was within Provincial Water Quality Objective (PWQO) upper and lower limits, and radium-226 in effluent was below PWQO. However, the maximum concentrations of nitrate in effluent exceed the CCME long term nitrate guideline for protection of aquatic life (13 mg/L) in all years (2012 to 2020) and the average concentration exceeded the guideline in all years except 2016. There is no PWQO for nitrate. Nitrate monitoring in ambient surface water should be added as a condition to the new license to confirm the results of the Plume Modelling, Delineation and Sediment Study and ensure no adverse environmental effects; and,
- No groundwater monitoring spatial-temporal trends or sample locations were presented to allow evaluation of potential changes to groundwater over time. At a minimum, a summary of these trends should be presented to describe long term monitoring results and identify concerning trends in uranium migration (if any). These results should be reviewed and accepted by CNSC prior to the license being renewed.

In addition to the concerns identified above, it does not appear that routine sampling of surface runoff discharging to the Mississagi River via a ditch was conducted. Monitoring in the Mississagi River for potential groundwater effects was identified as a monitoring program element in Cameco 2020b, but the results of this program were not presented in the current report and they may not effectively monitor effects from the ditch outfall point source.

Monitoring for potential surface water effects from the ditch was recommended to be incorporated in the 2012 to 2021 license period (HESL, 2011) to screen for materials related to the Refinery (e.g., uranium, radium-226) and industrial operations in general (e.g., total and dissolved metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, total phosphorus and total nitrate). A monitoring program for the ditch, to be incorporated for after three or more runoff events after rainfall, should developed by a qualified professional and included as a 2022 license condition.

Cameco (2020a). 2022 LICENCE RENEWAL APPLICATION FOR THE BLIND RIVER REFINERY.

The 2022 Licence Renewal Application document describes in reasonable detail the conditions at the Refinery, Refinery elements that require licensing, and Refinery monitoring and reporting practices and requirements, that are relevant to license renewal. Results of the monitoring and reporting were not included, and appeared to be beyond the scope of the document. Overall, the review found no concerns with the document, other than the environmental monitoring program concerns identified in the CNSC 2021a review (above).



Cameco (2020b). Refinery Licensing Manual, Blind River Refinery.

The Refinery Licensing Manual contains details on implementing and reporting many of the elements in Cameco 2020a. The document does not include monitoring results. Overall, the review found no concerns with the document, other than the environmental monitoring program concerns identified in the CNSC 2021a review (above).

Cameco (2021). Blind River Refinery Derived Release Limits.

The Blind River Refinery Derived Release Limits report is a public summary describing how the release limits for the Refinery were derived, and where and how the potential exposures are monitored. The summary includes a simplistic Conceptual Site Model showing the pathway and fate of air and water emissions from the Refinery to human and select ecological receptors, as well as 2D diagrams showing the extent of the Refinery and buffers around it and nearby features and receptors. The document included a summary of water and air emission monitoring results, and provided examples of how the conditions could affect receptors relative to the associated regulatory limits.

The document is written in plain language, and the review found it to be a good, high-level general public information resource. References to Cameco's emission monitoring reports would be a good addition to the document, to allow interested members of the public to review the reports for more in-depth information, if desired.

CNSC (2021b). A Licence Renewal, Cameco Corporation, Application to Renew Licence for the Cameco Blind River Refinery, Commission Public Hearing Scheduled for November 24 to 25, 2021.

The purpose of the License Renewal findings report was to provide the results of CNSC staff's assessment of Cameco's application, including conclusions and recommendations, to inform the Commission decision on Cameco's request to renew its operating licence. The following sections of the report were pertinent to this review, and were reviewed: Section 1 (Overview), Section 2.1 (Environmental Review), Section 3.7 (Radiation Protection) and Section 3.9 (Environmental Protection).

Section 1 (Overview)

The overview provided a summary of the Refinery's layout and setting, processes and requests for the license renewal. These elements were summarized and discussed briefly above (CNSC, 2021a), and no additional information that warrants comment was presented. At the end of the overview, CNSC "determined that the application complies with the regulatory requirements and concluded that Cameco's performance during the licensing term was satisfactory and met regulatory requirements" and CNSC recommended that the Commission accept the 10 year license renewal application, accept the proposed increased in annual production to 24,000 tonnes of uranium as UO₃ contingent upon a final commissioning report that is acceptable to the Commission, and accept the financial guarantee of \$57.5 million.

This basis for CNSC's conclusions and recommendations, were discussed in subsequent sections of the report, and were reviewed (below).



Section 2.1 (Environmental Review)

CNSC reported its staff conducted an EPR “to ensure the protection of the environment and the health of persons. CNSC staff’s assessment included a review of Cameco’s licence renewal application, supporting documents (e.g., Environmental Risk Assessment [ERA] and annual compliance monitoring reports), and past environmental performance.”

CNSC staff concluded that “the environment (terrestrial, aquatic and air) around the BRR [the Refinery] is adequately protected; Cameco has and will continue to implement and maintain an effective environmental protection program to adequately protect the environment and the health and safety of persons. Through ongoing licensing, compliance activities and reviews, CNSC staff will continue to verify and ensure that the environment and the health and safety of persons are protected.”

Additional information to support the CNSC conclusions was presented in Section 3.9 of the document, and is discussed below.

Section 3.7 (Radiation Protection)

The section provided an overview of CNSC’s oversight activities of Cameco’s radiological and dose monitoring. A summary of Cameco’s monitoring and its results was provided, which was consistent with Cameco’s submitted information in CNSC, 2021a. Cameco conducts a combination of internal and third party monitoring for workers, and external (off-site) monitoring by third parties, all subject to CNSC audits. CNSC audits during this license period consisted of desktop reviews of annual and other regulatory reports, and four scheduled on-site audits. CNSC summarized areas for improvement identified by the audits as having low safety significance, and corrective actions were reportedly completed to the satisfaction of CNSC and closed. Based on CNSC audits and the results of Cameco’s monitoring, CNSC concluded “overall performance for this SCA [Safety Control Area] is satisfactory and that Cameco is qualified to carry out the authorized activities at BRR [the Refinery] in this SCA”.

Although it appears that Cameco’ monitoring, report and radiation exposure control was acceptable in the current licensing period, it was difficult for this review to investigate the wide range of materials supporting CNSC’s report and be assured that CNSC conducted a thorough third-party review of the methods and source data presented by Cameco to ensure its monitoring was conducted and interpreted appropriately. CNSC provided a description of their evaluation that attempted to balance brevity and detail, but explanation of how methods and source data were confirmed by CNSC was not provided. This is a shortcoming of the CNSC report. In the future, additional detail to substantiate the CNSC review process should be provided. As part of the Commission Public Hearing, CNSC should confirm that they reviewed the methods and source data that supported the Cameco monitoring results.



Section 3.9 (Environmental Protection)

Pertinent to this review, the section summarized CNSC's oversight activities of Cameco's air emissions and effluent environmental monitoring, as well as its soil and groundwater monitoring. A high-level summary of Cameco's monitoring and its results was provided, which was consistent with Cameco's submitted information in CNSC, 2021a. In the current license period, CNSC oversaw Cameco's environmental monitoring via desktop reviews and 5 focused environmental protection inspections. CNSC summarized findings from the oversight as having low safety significance, identified that correction actions were completed to the satisfaction of CNSC, and concluded that Cameco's environmental monitoring meets CNSC's regulatory requirements and expectations. CNSC also conducted independent environmental monitoring around the Refinery (external), and found no concerns. Rationale for the findings were not provided in the report, but were provided by a web link.

Similar to the review comments for Section 3.7 (Radiation Protection), detail on CNSC's review and assurance of appropriate study design, sampling methods and data interpretation by Cameco was not provided. This is particularly concerning in the case of surface water, where ambient surface water monitoring results were not summarized by CNSC, a potential gap in surface water sampling in the Mississagi River to identify potential concerns from ditch drainage exists (discussed above), and nitrate in effluent to Lake Huron exceeds CCME guidelines. As part of the Commission Public Hearing, CNSC should confirm if it reviewed surface water quality monitoring data, and any concerns with it, including with study design, methods and data interpretation.

The study design for CNSC's independent environmental monitoring (reviewed via <http://nuclearsafety.gc.ca/eng/resources/publications/reports/brr/index.cfm#sec3-1-2>; last accessed October 22, 2021) was poorly described, and was based on areas of interest by local communities, rather than air dispersion, and aquatic fate and transport models. While the results may be meaningful for local communities, they may not be sufficiently robust to demonstrate that the communities and greater environment are protected. CNSC should revisit the independent environmental monitoring program, and adopt a study designs that include monitoring local areas of interest as well as deposition areas supported by scientific modelling.

CNSC (2021c). *Environmental Protection Review Report: Blind River Refinery.*

The EPR was conducted by CNSC to ensure the protection of the environment and the health of persons, from the Refinery. The report summarized the environmental protection, monitoring and assessment measures at the Refinery and concluded that *"the potential risks from the radiological and hazardous releases to the atmospheric, terrestrial, aquatic, geological, hydrogeological and human environments are negligible. The potential risks to the environmental from the releases are not distinguishable from background and the potential risk to humans is similar to health outcomes in the general public."*

The report presents similar material to CNSC 2021a,b, and provides additional information on the environmental setting and context of the Refinery, as well as an assessment of potential radiological effects on humans. Radiological effects assessment is beyond the professional experience of the reviewer, and



was not assessed. Regarding the environmental aspects of the report, the review identified similar shortcomings to CNSC 2021a,b including:

- Lack of substantiating information: additional in-text references and/or one two additional sentences to more fully describe the rationale for approaches or conclusions/recommendations would increase document usefulness, transparency and rigour;
- Absence of groundwater monitoring spatial-temporal trend analyses; the analyses should be added to identify concerning trends before an environmental effect occurs (if any);
- Absence of surface water quality ambient monitoring results, and gaps in surface water quality monitoring study design should be addressed by improving result presentation and surface water monitoring study design; and,
- Concerns with the study design of CNSC's independent monitoring program should be addressed by considering air dispersion and aquatic transport and fate models, to more comprehensively assess potential effects areas.

The review found that soil effected by the Refinery did have concentrations of uranium above natural background conditions, contrary to CNSC's interpretation: uranium concentrations in Refinery-effected soils (maximum annual concentration 2.8 to 9.7 µg/g) were above the Ontario Provincial background concentration (2.5 µg/g) but below CCME guidelines (23 µg/g). No background references for uranium or other Refinery-related materials were provided for surface water or groundwater, from which to compare monitored concentrations. CNSC should ensure it is interpreting data correctly to accurately evaluate potential Refinery impacts, and maintain public confidence in its regulatory oversight role.

CNSC (2021d). *Independent Environmental Monitoring Program: Blind River Refinery.*

The report provided summary data and interpretation of CNSC's independent monitoring, which was also reviewed via the web link cited in the CNSC 2021b review (above). In summary, CNSC concluded that *"results from 2020, 2018, 2017, 2014 and 2013 indicate that the public and the environment in the vicinity of BRR [the Refinery] are protected and that there are no expected health impacts. These results are consistent with the results submitted by Cameco, demonstrating that the licensee's environmental protection program protects the health and safety of people and the environment."*

While it is recognized that the report was a summary, it lacked reasonable substantiation for its conclusion similar to preceding comments and recommendations. The presentation undermined the usefulness of the report and confidence in its results, and minimal addition detail could improve its rigour.

CLOSING

Thank you for the opportunity to conduct this review for Northwatch. If you have any questions or concerns, please contact David Leeder at your earliest convenience.



Sincerely,
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David Leeder

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APPENDIX B

Cameco Blind River Refinery
Licence Renewal Application

Updated Review of International Licensing Standards and Norms for Uranium Processing Facilities

Prepared for Northwatch by Morten Siersbaek
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October 2021

Updated review of international licensing standards and norms for uranium processing facilities

1. Scope of Review

This review provides an update to Northwatch's 2011-review of international licensing standards and norms that apply to uranium processing facilities that convert U₃O₈ (yellowcake) into Uranium Oxide. The scope of this update is the same as the 2011-review, and focuses on facilities in the United Kingdom, the United States and France.

The purpose of this update is to provide current information to aid in the consideration of Cameco's Blind River Refinery Licence Renewal Application.¹ As such, the goal is not to repeat information already provided in the 2011-review, but examine whether the information provided then is still up to date. This review should thus be read as a supplement to the 2011-review, and where the information has changed, or additional information has been found, this review provides the updated or additional information.

2. Public dose regulation in the US, UK and France

2.1. United States

In addition to the general 1 mSv annual public dose limit mentioned in Northwatch's 2011-review, the Code of Federal Regulations requires that licensees' radiation protection programs achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA), and specifies that the total effective dose received by members of the public shall not exceed 0.1mSv per year from air emissions:

[...] a constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, shall be established by licensees other than those subject to § 50.34a [nuclear power reactors], such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem (0.1 mSv) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in § 20.2203 and promptly take appropriate corrective action to ensure against recurrence.²

¹ 2022 Licence Renewal Application for the Blind River Refinery, Cameco Corporation Fuel Services Division, September 30, 2020. Online at: <https://nuclearsafety.gc.ca/eng/the-commission/pdf/Cameco-BRR-LicenseRenewalApplication-FFOL3632.0.2022-Sept30-2020.pdf>.

² 10 CFR 20.1101(d). Online at: <https://www.ecfr.gov/current/title-10/chapter-I/part-20#p-20.1101>.

As mentioned in the 2011-review, the US EPA tends to use 0.04 mSv per year rather than 1 mSv per year. This is indeed reflected in the current version of the National Primary Drinking Water Regulations, which provide as follows:

The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.³

The 2011 observation remains valid that - overall - the United States has developed more specific preventative-design and release criteria for radionuclides from nuclear facilities than Canada, which include a range of hard, measurable quantitative requirements and more definitive benchmarks compared to the ALARA-principle.

2.2. United Kingdom

New independent regulator

Since 2013, the independent Office for Nuclear Regulation (ONR) has been responsible for the regulation of nuclear facilities including fuel processing and conversion facilities.⁴

The Environment Agency (EA), the Scottish Environment Protection Agency (SEPA) and Natural Resources Wales (NRW) remain responsible for environmental protection matters, including authorising discharges of radioactive waste from nuclear licensed sites. ONR must consult these agencies before granting, revoking or varying licences, to the extent that that this affects the creation, accumulation or disposal of radioactive waste.⁵

Tolerable risk is not equal to acceptable or estimated risk

With regards to the concept tolerable risk, Northwatch would like to offer additional information to supplement the 2011-review. As such, the mentioned risk levels are not regulatory limits, but are rather the upper limits of what is deemed (in)tolerable by members of the public.

As such, 1 in a 1000 risk of death is not the estimated (or generally accepted) risk level for nuclear workers. Tolerability simply refers to what is generally thought to be the highest risk level that may be tolerated by a select few members of society who are willing to take up work in industries that are this dangerous, such as in the mining industry.

³ 40 CFR 141.66(d)(1). Online at: [https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-141#p-141.66\(d\)\(1\)](https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-141#p-141.66(d)(1)).

⁴ *Licensing Nuclear Installations*, Office for Nuclear Regulation, 2019, page 8. Online at: <https://www.onr.org.uk/licensing-nuclear-installations.pdf>.

⁵ *Ibid.*, page 22.

It is also worth noting that the actual average dose to nuclear workers in the United Kingdom is estimated at 1 mSv per year, and thus significantly lower than what this tolerability level would suggest.⁶

Furthermore, the level of risk deemed acceptable when it comes to members of the public is as follows:

We propose to maintain our existing position that a risk of 1 in 10^4 per annum to any member of the public is the maximum that should be tolerated from any large industrial plant in any industry with, of course, the ALARP principle applying to ensure that the risk from most plant is in fact lower or much lower. But, in accordance with Barnes' findings, we propose to adopt a risk of 1 in 10^5 per annum as the benchmark for new nuclear power stations in the UK, recognising that this is, in the case of a new station, broadly achievable and measurable.⁷

And, further to this point, the estimated average risk to people living in the vicinity of a nuclear plant in the United Kingdom has previously been assessed to be as follows:

If however we were to add up the risks to the range of people living near a plant both from ordinary operation (paragraph 174) and from an accident (paragraph 176), we might conclude that most people in the vicinity are at or near the 1 in 1 million level and well below the benchmark of 1 in 100 000 (1 in 10^5) per annum. Some people might be near to the benchmark, while a handful could be a little above that level. The risk from such a plant to the average person living elsewhere in the UK would be very much below these levels.⁸

In other words, the actual assessed level of risk to the general public is estimated to be several orders of magnitude lower than what is deemed to be the limit of what is considered (in)tolerable.

2.3. France

The annual effective dose limit for members of the public is 1 mSv (excluding medical treatments), while the annual effective dose limit for exposed (nuclear) workers is 20 mSv.⁹

The maximum calculated impact of the Malvési Plant on reference groups is estimated to be 0.025 mSv/year, based on sampling around the site.¹⁰ However, an agricultural worker

⁶ *The Tolerability of Risk from Nuclear Power Stations*, Health and Safety Executive (HSE), 1992, Page 18. Online at: <http://www.onr.org.uk/documents/tolerability.pdf>.

⁷ Ibid., page 30.

⁸ Ibid., page 31.

⁹ ASN Report on the state of nuclear safety and radiation protection in France in 2020, pages 109 and 110. Online at: <http://www.french-nuclear-safety.fr/Information/Publications/ASN-s-annual-reports/ASN-Report-on-the-state-of-nuclear-safety-and-radiation-protection-in-France-in-2020>.

¹⁰ *Rapport d'information du site Orano Malvési*, 2020, page 42. Online at: https://www.orano.group/docs/default-source/orano-doc/groupe/publications-reference/tsn-orano-malvesi_vf.pdf.

who works all year round in the immediate vicinity of the site (2000 hours/year), is estimated to receive a much higher annual effective dose of 0.47 mSv.¹¹

3. Comparable fuel-cycle facilities

In the 2011-review, three uranium emitting fuel-cycle facilities were examined for comparative purposes: Springfields (UK), Malvési (FR), and Metropolis (US). These three facilities have been revisited in this review leading to the following observations.

3.1. Springfields

While Springfields previously received UO₃ from Blind River, Cameco ended its agreement with Springfields at the end of 2014, due to a weakened market for UF₆ conversion as well as the ability to carry out this conversion at Cameco's Port Hope Conversion Facility.¹²

As such, while it appears that Springfields is no longer producing UF₆, but instead relies on other sources of UF₆ for its fuel manufacturing, Springfields still makes various fuel types as well as intermediate products and carries out uranium recovery as described below.¹³

Advanced Gas-cooled Reactor Fuel

Springfields makes AGR fuel from UO₂ powder. The process starts with UF₆ arriving at Springfields where it is converted to UO₂ powder in a kiln using the so-called 'Integrated Dry Route'-process. This process changes UF₆ into a ceramic grade UO₂ powder, in a single stage by mixing it with steam and hydrogen. Springfields then processes the UO₂ powder into fuel pellets, which are stacked inside fuel tubes that are put together in a graphite 'sleeve' to form an AGR fuel assembly.¹⁴

Light Water Reactor Fuel

The fuel for Light Water Reactors is a type of oxide fuel, which uses the same manufacturing process as AGR fuel.¹⁵

Uranium Recovery

Springfields carries out uranium recovery, including pre-processing services, such as sampling, material sorting, size reduction, de-canning and re-drumming.¹⁶

¹¹ Ibid., page 44.

¹² <https://www.cameco.com/media/news/cameco-ends-toll-conversion-agreement-with-springfields-fuels-ltd>.

¹³ <https://www.westinghousenuclear.com/springfields/products>.

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ Ibid.

Intermediate Products, including UF₆

As well as making nuclear fuel, Springfields also produces intermediate uranium products such as enriched UO₂ powder, granules and pellets. While it does not appear to be taking place currently, Springfields still has the capability to produce UF₆, and is presumably licenced to do so. This is done by using UF₄ that has been chemically processed from natural uranium ore concentrates as feed material for Springfields UF₆ production.¹⁷

3.2. Metropolis

The Metropolis facility was idled in early 2018, due to lower demands for UF₆, but intends to resume full production again in early 2023.¹⁸ As such, the plant sought and was recently granted a licence renewal.¹⁹

The Metropolis facility now has 53 individual stacks,²⁰ but retains the same primary processing steps as before.²¹

The reactor off-gas is filtered and scrubbed with water, then scrubbed with potassium hydroxide solution before release to the atmosphere. The spent scrubber liquid is processed through the environmental protection facility (EPF) for neutralization and recovery of fluorine as calcium fluoride. The uranium tetrafluoride solids filtered from the off-gas are combined with the uranium tetrafluoride product stream for transfer to fluorination reactors.²²

Each distillation column is fitted with temperature and pressure indicators, a relief valve, and a rupture disk to prevent accidental release of uranium hexafluoride. Gaseous effluents from the distillation process are fed back to the fluorination system and treated with the fluorination off-gas.²³ It is no longer specified whether any liquid effluent stream is produced by the reduction process.

Stack emissions are sampled and analyzed for alpha radioactivity either once or twice per 24 hours, depending on the process being monitored and as informed by historical data.²⁴

¹⁷ Ibid.

¹⁸ <https://www.powermag.com/honeywell-to-reopen-sole-u-s-uranium-conversion-plant/>.

¹⁹ *NRC Approves License Renewal for Honeywell Uranium Conversion Facility*, NRC News, Office of Public Affairs, Headquarters, March 25, 2020. Online at: <https://www.nrc.gov/reading-rm/doc-collections/news/2020/20-018.pdf>.

²⁰ *Environmental Assessment for the Proposed Renewal of Source Material License SUB-526 Metropolis Works Uranium Conversion Facility (Massac County, Illinois)*, Accession No. ML19273A012, page 2-7. Online at: <https://www.nrc.gov/docs/ML1927/ML19273A012.pdf>.

²¹ Ibid., page 1-4, 2-5,

²² Ibid., page 2-5.

²³ Ibid., page 2-6.

²⁴ Ibid., page 2-11.

3.3. Malvési

Since the 2011-review, Orano’s Malvési plant has changed operations slightly and now only converts uranium ore concentrates into UF₄, while the next step in the conversion – UF₄ to UF₆ – takes place at Orano’s Tricastin plant.^{25 26}

4. Licensing norms for uranium release limits at other uranium processing facilities

4.1. Air emissions

a. *Blind River Refinery*

Unlike the previous reliance on Derived Release Limits (DRL’s), Cameco’s current licence application relies on Exposure-Based Release Limits (EBRL), which are “concentration-based release limits that are based on meeting endpoint parameters which consider radiotoxicity, chemical toxicity, and protection of aquatic life.”²⁷

The licence application’s proposed annual release limits for Uranium air emissions are as follows:

Source	g/h
Absorber Stack	21
DCEV Stack	93
Incinerator	29 ²⁸

The proposed action levels for airborne Uranium emissions are as follows:

Source	Action Level	Frequency and Averaging period
Absorber Stack	0.5g/h	Daily, 24 hours
DCEV Stack	2.2g/h	Daily, 24 hours ²⁹

²⁵ <https://www.world-nuclear-news.org/Articles/New-uranium-conversion-plant-to-be-built-in-France>.

²⁶ Orano’s Tricastin plant is not examined in this updated review.

²⁷ 2022 Licence Renewal Application for the Blind River Refinery, Cameco Corporation Fuel Services Division, September 30, 2020. page 42. Online at: <https://nuclearsafety.gc.ca/eng/the-commission/pdf/Cameco-BRR-LicenseRenewalApplication-FFOL3632.0.2022-Sept30-2020.pdf>.

²⁸ Ibid.

²⁹ Ibid., page 43, Table 7.

The Ontario ambient air quality criterion for uranium (set by the Ontario Ministry of the Environment) mentioned in the 2011-review remain the same,³⁰ except that the half hour standard appears to have been phased out as of February 1, 2020.³¹

b. Springfields

The annual release limit for Uranium at Springfields remains the same, namely 5.3×10^{-3} TBq. The actual discharges observed in 2019 were 1.2×10^{-5} TBq, or less than a quarter of a percent of the annual release limit.³²

c. Metropolis

The limit established by the Nuclear Regulatory Commission (NRC) for the proposed license renewal of the Metropolis plant is an estimated annual total effective dose equivalent to the maximally exposed individual of 0.01 mSv/year. The releases are primarily uranium, although the facility also releases relatively small amounts of thorium-230 and radium-226.³³

Other than this requirement, no specific licence conditions in connection with the licence renewal have been identified. As such, the release limits for Uranium-natural contained in the Code of Federal Regulations remain the same.³⁴

d. Malvésí

It is unclear what limits apply to atmospheric emissions from the Malvésí plant, beyond the general public dose limit of 1 mSv/year from human activities. As mentioned in Section 2.3., the maximum calculated impact of the Malvésí Plant on reference groups is estimated to be 0.025 mSv/year. This includes, but is not limited to, atmospheric emissions.

³⁰ *Human Toxicology and Air Standards Section*, Technical Assessment and Standards Development Branch, Ontario Ministry of the Environment, Conservation and Parks (MECP). 2020. Ambient Air Quality Criteria. MECP, Toronto, ON, Canada, page 41. Online at: <https://files.ontario.ca/mecp-ambient-air-quality-criteria-list-en-2020-05-01.pdf>.

³¹ O. Reg. 419/05: Air Pollution - Local Air Quality, Section 19(1) and Schedule 2. Online at: <https://www.ontario.ca/laws/regulation/050419>.

³² *Radioactivity in Food and the Environment*, 2019, 25th edition, November 2020, Centre for Environment, Fisheries and Aquaculture Science, Appendix II, page 240. Online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/932885/Radioactivity_in_food_and_the_environment_2019_RIFE_25.pdf.

³³ *Environmental Assessment for the Proposed Renewal of Source Material License SUB-526 Metropolis Works Uranium Conversion Facility (Massac County, Illinois)*, Accession No. ML19273A012, page 4-19. Online at: <https://www.nrc.gov/docs/ML1927/ML19273A012.pdf>.

³⁴ Nuclear Regulatory Commission, 10 CFR Part 20 Appendix B. Available online at: <http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-appb.html>.

Sampling carried out at the Malvési plant showed that “*aerosols emitted by the nuclear site (uranium releases in the atmosphere by stacks and 230Th-rich particles emitted from artificial ponds collecting radioactive waste mud) accounts for the high activities recorded in the plant samples close to the site.*”³⁵

Yearly uranium atmospheric releases from Malvési conversion plant between 2007 and 2013 were as follows: 102kg in 2007, 103kg in 2008, 44kg in 2009, 39kg in 2010, 18kg in 2011, 41kg in 2012, and 27kg in 2013.³⁶ While these numbers only show the size of actual releases, not what is permitted, they do indicate the size of releases that can be expected from, and are permitted for, a facility of this type.

e. Commentary – Uranium air emissions

What was noted in the 2011-review still applies. In particular, the limits are still not easily comparable, with other jurisdictions using radioactivity measurements which cannot readily be converted to release rates or ambient concentration amounts.

4.2. Liquid releases

a. Blind River Refinery

The licence application’s proposed release limit for Uranium liquid effluent is as follows:

EBRL	Frequency
1.7 mg/L	Weekly composite ³⁷

The proposed action level for liquid effluent is as follows:

Action Level	Frequency and averaging period
0.2 mg/L	Weekly composite ³⁸

³⁵ *Environmental consequences of uranium atmospheric releases from fuel cycle facility: II. The atmospheric deposition of uranium and thorium on plants.* Pourcelot, L & Masson, Olivier & Renaud, P & Cagnat, Xavier & Boulet, Beatrice & Cariou, N & de Vismes Ott, A.. (2014). Journal of environmental radioactivity. 141C. 1-7. 10.1016/j.jenvrad.2014.11.018. Online at:

<https://www.sciencedirect.com/science/article/pii/S0265931X14003567?pes=vor>.

³⁶ Ibid., page 4.

³⁷ 2022 Licence Renewal Application for the Blind River Refinery, Cameco Corporation Fuel Services Division, September 30, 2020, page 42, Table 6. Online at: <https://nuclearsafety.gc.ca/eng/the-commission/pdf/Cameco-BRR-LicenseRenewalApplication-FFOL3632.0.2022-Sept30-2020.pdf>.

³⁸ Ibid., page 43, Table 8.

b. Springfields

Springfields retains the same annual uranium (liquid) discharge limits, namely 4×10^{-2} TBq, with the liquid discharges of uranium in 2019 totalling 21 % of this annual limit.³⁹

c. Metropolis

No specific licence conditions in connection with the licence renewal have been identified.

The environmental standards for the uranium fuel cycle during normal operation, for alpha emissions with half lives <1 year, are as follows:

Operations covered by this subpart shall be conducted in such a manner as to provide reasonable assurance that:

(a) The annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials, radon and its daughters excepted, to the general environment from uranium fuel cycle operations and to radiation from these operations.

(b) The total quantity of radioactive materials entering the general environment from the entire uranium fuel cycle, per gigawatt-year of electrical energy produced by the fuel cycle, contains less than 50,000 curies of krypton-85, 5 millicuries of iodine-129, and 0.5 millicuries combined of plutonium-239 and other alpha-emitting transuranic radionuclides with half-lives greater than one year.⁴⁰

In addition to reverse osmosis, lime softening, and coagulation/filtration, the BAT requirements imposed by the EPA for achieving compliance with the maximum contaminant levels for uranium now also include ion exchange.⁴¹

³⁹ *Radioactivity in Food and the Environment, 2019*, 25th edition, November 2020, Centre for Environment, Fisheries and Aquaculture Science, Appendix II, page 245. Online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/932885/Radioactivity_in_food_and_the_environment_2019_RIFE_25.pdf.

⁴⁰ 40 CFR Part 190.10 *Standards for normal operations*. Online at: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-F/part-190>.

⁴¹ 40 CFR Part 141.66, Table B. Online at: <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-141>.

d. Malvésí

The discharge limits for uranium in water at Malvésí have increased from 0.5mg/L to 0.8mg/L of effluent. This limit is still accompanied by a limit of 10kg/day, as well as the same total annual discharge limit of 131kg/year.⁴²

In 2020, the Malvésí plant uranium discharged 0.02mg/L of uranium in effluent, and a total of 0.01kg/day.⁴³

Sampling of water is carried out in the area surrounding the Malvésí plant. No reference is made to a specific limit set by the French authorities; instead, reference is made to the W.H.O. reference level for Uranium in water of 0.030 mg/l.⁴⁴

In 2020, the sampling found uranium levels of 0.002 mg/l at the outer boundary of the site, 0.001mg/l in a private irrigation well near the site, and 0.0019mg/l in the Tauran Canal, near the discharge point of the Malvésí plant into this canal.

e. Commentary – Uranium liquid discharges

The proposed Blind River release limit of 1.7mg/L is still more than double the limit at Malvésí, even after the release limit increase at Malvésí from 0.5mg/L to 0.8mg/L.

Furthermore, the actual release at Malvésí was a relatively low 0.02mg/L of effluent, which is comparable to the 0.01-0.02mg/L liquid effluent Uranium averages at Blind River from 2012 to 2019.⁴⁵ With this in mind, a lowering of the release limit to at least match the limit set at Malvésí is worth considering.

5. Licensing terms

The new licencing term for the Metropolis plant in the United States is 40 years, with the licence expiring on March 24, 2060.⁴⁶ For the Springfields and Malvésí facilities, no specific licensing terms have been identified.

⁴² *Rapport d'information du site Orano Malvésí*, 2020, page 41. Online at: https://www.orano.group/docs/default-source/orano-doc/groupe/publications-reference/tsn-orano-malvesi_vf.pdf.

⁴³ Ibid.

⁴⁴ Ibid., page 44.

⁴⁵ *2012-2019 Operational Performance Report and Forward Outlook in Support of the Renewal of Blind River Refinery Operating Licence FFOL-3632.00/2022*, page 24 of 35 (page 106 of PDF containing the *2022 Licence Renewal Application for the Blind River Refinery*), Cameco Corporation Fuel Services Division, September 30, 2020. Online at: <https://nuclearsafety.gc.ca/eng/the-commission/pdf/Cameco-BRR-LicenseRenewalApplication-FFOL3632.0.2022-Sept30-2020.pdf>.

⁴⁶ *NRC Approves License Renewal for Honeywell Uranium Conversion Facility*, NRC News, Office of Public Affairs, Headquarters, March 25, 2020. Online at: <https://www.nrc.gov/reading-rm/doc-collections/news/2020/20-018.pdf>.

By comparison, a 10-year licence renewal is sought for the Blind River Refinery.

6. Public Information Program Requirements

6.1. United Kingdom

In the UK, the Radiation (Emergency Preparedness and Public Information) Regulations (REPPIR 2019),⁴⁷ which contain public information requirements related to emergency preparedness, were recently updated. The revised regulations came into force on 22nd May 2019, replacing the previous REPPIR 2001 regulations. They include new requirements for emergency planning in particular, defining a radiation emergency, establishing a different basis and responsibilities for determining emergency planning zones, including the addition of so-called 'Outline Planning Zones'.⁴⁸

Compared to REPPIR 2001, the updated REPPIR 2019 has removed references to 'reasonably foreseeable' radiation emergencies and has instead introduced a stricter requirement for operators to assess 'all hazards' that have the potential to cause a radiation emergency. It furthermore shifts responsibility for both determining the detailed emergency planning zone and the distribution of prior information to the local authority. Additionally, it strengthens the requirement for all local authorities to have in place arrangements to obtain and supply information to the public in the event of a radiation emergency, including those relating to transport of nuclear or radioactive material.⁴⁹

As indicated above, REPPIR 2019 distinguishes between so-called 'Detailed Emergency Planning Zones' and 'Outline Emergency Planning Zones' – both of which exist at the Springfields plant.^{50 51}

In detailed emergency planning zones, prior information should be supplied without the public having to request it (so far as reasonably practicable), while in outline emergency planning zones, prior information should merely be available to the public. In both cases,

⁴⁷ The Radiation (Emergency Preparedness and Public Information) Regulations 2019. Online at: <https://www.legislation.gov.uk/ukxi/2019/703/made>.

⁴⁸ The Radiation (Emergency Preparedness and Public Information) Regulations 2019 Approved Code of Practice and guidance, HSE, 2020. Online at: <https://www.onr.org.uk/documents/2020/reppir-2019-acop.pdf>.

⁴⁹ Ibid., page 6.

⁵⁰ Information on these zones surrounding the Springfields plant can be found on Lancashire County Council's website, including examples of maps and information leaflets: <https://www.lancashire.gov.uk/council/strategies-policies-plans/emergency-planning/emergency-plans/reppir-plans/>.

⁵¹ *Springfields Fuels Limited – Advice and information for those living and working in the Detailed Emergency Planning Zone*, Lancashire County Council. Online at:

the information should be provided to members of the public in an appropriate manner and in an accessible format.⁵²

According to REPPIR 2019, Schedule 8, it is the following information which should be provided to the public in accordance with Regulation 21:

SCHEDULE 8
Prior information for members of the public

PART 1
Information in relation to detailed emergency planning zones

1. Basic facts about ionising radiation and its effects on persons and on the environment.
2. The various types of radiation emergency identified and their consequences for the general public and the environment.
3. Protective action envisaged to alert, protect and assist the general public in the event of a radiation emergency.
4. Appropriate information on protective action to be taken by the general public in the event of a radiation emergency.
5. The authority or authorities responsible for implementing the protective action referred to in paragraphs 3 and 4 above.
6. The extent of the detailed emergency planning zone.

PART 2
Information in relation to outline planning zones

7. Where the information set out at paragraphs 1 to 5 can be obtained.
8. The extent of the outline planning zone.
9. The factors which would cause the plan in respect of the outline planning zone to be triggered, and whether there are any areas of detailed planning within the outline planning zone as defined at paragraph 4 of Part 2 of Schedule 6.⁵³

Regarding the difference between these two zones, the following is said in the 'Radiation (Emergency Preparedness and Public Information) Regulations 2019 Approved Code of Practice and guidance':

Where a site has a detailed emergency planning zone [...], outline planning operates at distances beyond the detailed emergency planning zone but can also be undertaken in the detailed emergency

⁵² The Radiation (Emergency Preparedness and Public Information) Regulations 2019 Approved Code of Practice and guidance, HSE, 2020, page 102. Online at: <https://www.onr.org.uk/documents/2020/reppir-2019-acop.pdf>.

⁵³ Ibid.

planning zone [...]. The presence of an outline planning zone should assist the local authority in planning for extremely unlikely but more severe events. [...] Outline planning is about identifying what protective actions may be needed at a strategic level, where those capabilities could be obtained from and the anticipated time frame over which they will become available, rather than having them in place ready to mobilise without delay.⁵⁴

With regards to *The Environment Agency public participation statement and regulatory guide 6 (Determinations involving sites of high public interest)*, which is mentioned in the 2011-review, this guide was initially updated in 2015, but then withdrawn on February 1, 2016, as it had been reclassified as *internal* Environment Agency guidance. This happened as a result of the so-called *Smarter Guidance review*,⁵⁵ which appears to be something akin to a deregulation effort in the realm of regulatory guidance documents. The current (internal) status of this document, including any possible updates, is unclear.

6.2. United States

Appendix E to Part 50 of the NRC Regulations sets out requirements for preliminary safety reports for licence applicants. This includes the following requirements regarding what must be addressed in these reports, including requirements regarding public notifications etc.:

C. Protective measures to be taken within the site boundary and within each EPZ to protect health and safety in the event of an accident; procedures by which these measures are to be carried out (e.g., in the case of an evacuation, who authorizes the evacuation, **how the public is to be notified and instructed**, how the evacuation is to be carried out); and the expected response of offsite agencies in the event of an emergency.

[...]

G. A preliminary analysis that projects the time and means to be employed in the notification of State and local governments and the **public** in the event of an emergency.

H. [...] a preliminary analysis reflecting the role of the onsite technical support center and the emergency operations facility in assessing information, recommending protective action, **and disseminating information to the public**.⁵⁶ (emphasis added)

It also sets out specific requirement regarding the contents of emergency plans, including the following requirements that deal in part with involving and notifying the public:

1. Administrative and physical means for notifying local, State, and Federal officials and agencies and agreements reached with these officials and agencies for the **prompt notification of the public and**

⁵⁴ Ibid., page 53.

⁵⁵ <https://www.gov.uk/government/publications/rgn-6-determinations-involving-sites-of-high-public-interest>.

⁵⁶ NRC Regulations Title 10, Part 50, Appendix E, Section II. *The Preliminary Safety Analysis Report*. Online at: <https://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-appe.html>.

for public evacuation or other protective measures, should they become necessary, shall be described. [...]

2. Provisions shall be described for **yearly dissemination to the public** within the plume exposure pathway EPZ **of basic emergency planning information**, such as the methods and times required for public notification and the protective actions planned if an accident occurs, general information as to the nature and effects of radiation, and a listing of local broadcast stations that will be used for dissemination of information during an emergency. Signs or other measures shall also be used to disseminate to any transient population within the plume exposure pathway EPZ appropriate information that would be helpful if an accident occurs.

3. A licensee shall have the capability to notify responsible State and local governmental agencies within 15 minutes after declaring an emergency. The licensee shall demonstrate that the appropriate governmental authorities have the capability to make a **public alerting and notification decision** promptly on being informed by the licensee of an emergency condition. [...] ⁵⁷ (emphasis added)

The requirements in Appendix E cover emergency planning and preparedness for production facilities as well as utilization facilities, although some parts appear to be aimed more so at power plants. As such, Appendix E also provides the following clarification, which suggests that the requirements may be varied to better suit fuel production facilities:

The potential radiological hazards to the public associated with the operation of research and test reactors and fuel facilities licensed under 10 CFR parts 50 and 70 involve considerations different than those associated with nuclear power reactors. Consequently, the size of Emergency Planning Zones¹ (EPZs) for facilities other than power reactors and the degree to which compliance with the requirements of this section and sections II, III, IV, and V of this appendix as necessary will be determined on a case-by-case basis.⁵⁸

6.3. Commentary

The additional information provided in this updated review does not significantly impact the conclusion in the 2011-review that the public information requirement in the proposed Blind River Refinery licence is more general and appears to apply in more situations than the standards in other countries.

With that being said, the UK and US examples show that regulatory requirements do exist, which require the provision of some essential information, albeit with a narrower focus on emergency response.

7. Conclusion

While this review has uncovered some requirements that deviate from those that apply in Canada, and which could serve as helpful model, for the most part no major changes have

⁵⁷ Ibid., Section IV. *Content of Emergency Plans*.

⁵⁸ Ibid., Section I, subsection 3.

been found in the licence conditions or regulatory requirements compared to the 2011-review.

In terms of comparisons of the Blind River Refinery to other facilities, this review concluded – as did the 2011 review - that it is difficult to directly compare these varying facility types, as well as their regulatory and licence requirements, which are often based on different measurements, units and/or calculation methods.

Taking into account the limits of this review, Canada's approach generally appears to be consistent with international conversion facility practices with respect to public information, licensing and general regulatory requirements

As in 2011, Northwatch finds that the U.S. Code of Federal Regulations which requires that licensees' radiation protection programs achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA), and specifies that the total effective dose received by members of the public shall not exceed 0.1mSv per year from air emissions is a significant difference, and should be given immediate consideration by the Commission.

APPENDIX C

Northwatch

Re: Cameco Blind River Refinery
Relicensing Hearing

Review of International Licensing Standards and Norms for Uranium Processing Facilities

Prepared By Laura Bowman
Iler Campbell LLP
Barristers and Solicitors

12/14/2011

Review of international licensing standards and norms for uranium processing facilities

1. Scope of the review:

This review examines facilities that convert U_3O_8 (yellowcake) to Uranium Oxide. The Blind River Refinery facility in Blind River Ontario is the only facility in the world that only converts yellowcake to UO_3 ¹ accordingly; facilities that convert yellowcake to UO_2 or UF_6 were examined, as well as other uranium processing and conversion facilities. Licensing information was available only for a limited number of facilities and complete licensing information for non-Canadian facilities was not readily available. No information was available specific to incineration practices at UO_2 or UF_6 facilities.

Where available, this review compares licensing conditions for uranium emissions, public information programs and licence duration. This review focuses on OECD countries with transparent regulatory processes. Of these, the UK and United States provided easy access to more licensing information and some information from other countries was compiled by the OECD or accessible publicly through licensee annual reports.

2. Overview of public dose regulation in the US and UK

2.1 United States

The use of 1 mSv as an annual public dose limit is accepted in most countries as a radiation protection standard. In the US this is found in the Code of Federal Regulations (Title 10, part 20) and is set by the National Council on Radiation Protection (NCRP).² The US EPA has adopted the BEIR I³ report which estimates that an individual risk of fatal cancer from a lifetime of total body dose rate of 0.04 mSv per year was in the range (2.5 million to 0.5 million) considered negligible by the US EPA (1 in a million).⁴ Accordingly, the US EPA, where it is involved in regulation, tends to use 0.04 mSv per year rather than 1 mSv per year. Many countries have adopted the US EPA approach of using 0.04 mSv per year rather than 1 mSv per year.⁵

In the US the Nuclear Regulatory Commission (NRC) regulations govern design objectives for radioactive release control equipment in some types of nuclear facilities. This includes routine operational effluents and requires specifically that the design must be demonstrated to keep effluent levels as low as reasonably achievable. Unlike Canada the US NRC also has regulations that contain

¹ IAEA, IAEA-TECDOC-1613. *Nuclear Fuel Cycle Information System A Directory of Nuclear Fuel Cycle Facilities 2009 Edition* (Vienna: IAEA, April 2009) at 54.

² National Council on Radiation Protection, *Recent Applications of the NCRP Public Dose Limit Recommendation for Ionizing Radiation*, NCRP Statement No. 10, (Bethesda: NCRP, December 2004). Online: http://www.ncrponline.org/Publications/Statements/Statement_10.pdf.

³ The Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation (formerly called the Committee on the Biological Effects of Ionizing Radiation (BEIR)) of the National Research Council of the National Academies, does periodic reviews of the effects of ionizing radiation that are influential for standard setting bodies. The BEIR VII report is the most recent report in the series.

⁴ *Safe Drinking Water Act*, 43 USC s/s 300f et seq. The EPA has issued drinking water standards for radionuclides, which include dose limits of 0.04 mSv/year (4 mrem/year) for man-made sources of beta and gamma emitters. EPA also sets limits on several alpha emitters in drinking water, such as radium and radon.

⁵ CNSC, *Standards and Guidelines for Tritium in Drinking Water* (Ottawa, Minister of public Works and Government Services Canada 2008) at 18, 26. Online: http://nuclearsafety.gc.ca/pubs_catalogue/uploads/info_0766_e.pdf.

standard effluent requirements. Concentration limits are specified and in many cases the best available technology is required to be applied to discharges. The US Environmental Protection Agency and the US Army Corps of engineers have imposed requirements under the *Clean Water Act*. The *CWA* itself prohibits the discharge of high-level radioactive waste into navigable waters.⁶ Under section 404(b)(1) of the *CWA* the Corps require that the applicant demonstrate that there are no practicable alternatives to water fill discharges that would have less environmental impact. This provision applies primarily to flow and navigation impairments.

Under the *Safe Drinking Water Act* the EPA may regulate radionuclides in drinking water. These standards include maximum contaminant level goals that represent the level below which there is no known or expected risk to health and maximum contaminant levels defining the allowable level for drinking water. According to the EPA, these are set as close to the safe level as feasible using the best available treatment and cost.⁷ The US *Clean Air Act* requires the EPA to regulate airborne emissions of hazardous air pollutants and may be subject to technology requirements.⁸ These standards are based on an effective dose equivalent of up to 10 mrem/year for radionuclides other than radon.

Notably the responsibility for setting limits on any routine discharges rests primarily with the EPA, which issues National Pollution Discharge Elimination System permits, often through state delegates.⁹ 40 CFR 61.92 contains an emissions standard for Department of Energy facilities of an effective public dose of 10 mrem/yr. The National Emission Standards for Hazardous Air Pollutants (NESHAPS) require that the off-site dose from airborne effluents be equivalent to 10% of the 1 mSv ICRP public dose.¹⁰ This contrasts with Canada where the full public dose of 1 mSv is historically the basis for calculating release limits.

Overall in comparison to Canada the United States has developed more specific preventative-design and release criteria for radionuclides from nuclear facilities and these include a range of hard, measurable quantitative requirements and more definitive benchmarks than ALARA. The imposition of *Clean Water Act* requirements has been beneficial in that it has resulted in clear dose constraints that account for cumulative effects of all radionuclides combined, using specific methodologies for dose calculation and a higher standard than ALARA for some types of environmental impact. There are also standardized regulatory release limits, in contrast to the case-by-case approach used in Canada. Of particular note is that the EPA imposes a negligible risk level standard over and above the ICRP level, resulting in a much lower public dose limit of 0.4 mSv.

2.2 United Kingdom

In the UK nuclear facilities including fuel processing and conversion facilities are licensed by the Health and Safety Executive under the *Nuclear Installations Act*.¹¹ The Environment Agency is responsible under the *Environmental Permitting Regulations* under the *Environmental Protection Act*, 1990 for regulating all disposals of radioactive waste on and from nuclear licensed sites in England and

⁶ 33 U.S.C. §1251 et seq. (1972), s.301(f).

⁷ EPA, "Drinking Water Contaminants" online: <http://water.epa.gov/drink/contaminants/index.cfm#List>

⁸ *Clean Air Act*, § 101-131; USC § 7401-7431.

⁹ These are issued under 40 CFR Part 122, this includes storm water discharges. Also see 40 CFR Part 403 and 40 CFR parts 700-716 dealing with waste effluents and toxic chemicals.

¹⁰ C14 and tritium IAEA 2004, *supra* note X at 8-9.

¹¹ *Nuclear Installations Act*, s.2.

Wales. “Disposals” of radioactive waste include discharges into the atmosphere, discharges into the sea, rivers, drains or groundwater, disposal to land, and disposals by transfer to another site.¹² The HSE has developed a standard set of 36 conditions which are attached to all nuclear site licences.¹³ Licence conditions are standardized and found in the licence condition handbook.¹⁴

The HSE considers a risk of death of 1 in 1000 per annum as the “tolerable level” for nuclear workers and equates this with other “high-risk” occupations. For the general public, the HSE uses 1 in 10,000 per annum.¹⁵ The non-precautionary risk threshold is 1 in 1 million deaths per annum.¹⁶

Like the US the UK references 1 in a million as the negligible risk level although it does not require negligible risk to the public. In the UK the release limits for radionuclides are set well below the 1 mSv annual dose to the public set by the ICRP. For example the total critical effective doses to the public are usually based on doses of less than 100 µSv.¹⁷

3. Comparable fuel-cycle facilities

Three facilities were examined for comparative purposes relating to conditions imposed on uranium effluent: Springfields (UK), Malvési (FR), and Metropolis (US). They were chosen because they are uranium emitting fuel-cycle facilities for which relevant information was readily available. The Blind River Refinery is the only operational yellowcake to UO₃ processing facility. There are several yellowcake to UO₂ facilities. Of these, insufficient information was available about applicable licencing regimes for all but the Malvési and Metropolis facilities. The Springfields facility in the UK is not a UO₂ facility.

The IAEA has produced a safety standards guide to conversion and enrichment facilities that describes safety features of yellowcake processing as follows:

Process area	Structures, systems, components	Events	Parameters for defining operational limits and conditions
Receipt and storage of yellowcake	Powder containers	Release of uranium	Mass, enrichment, concentration
Dissolution of yellowcake	Dissolver facilities for off-gas treatment	Release of uranium and nitrogen oxide	Concentration of nitrogen in gaseous effluent
Reduction	Rotary kiln or flowing bed reactor	Release of uranium	Pressure of kiln /room

¹² Environment Agency, Environmental Permitting Regulations England and Wales (2010), at 5, Online: <http://www.environment-agency.gov.uk/static/documents/Business/GEHO0310BSGF-E-E.pdf>.

¹³ HSE, *The licensing of nuclear installations*, at 7-9, Online: <http://www.hse.gov.uk/nuclear/notesforapplicants.pdf>.

¹⁴ HSE Office for Nuclear Regulation, *Licence Condition Handbook*, (October 2011). Online: <http://www.hse.gov.uk/nuclear/silicon.pdf>.

¹⁵ IAEA, Technical reports series no. 421, “Management of Waste Containing Tritium and Carbon-14” (Vienna: 2004) at 98. Online: http://www-pub.iaca.org/MTCD/publications/PDF/TRS421_web.pdf.

¹⁶ *Ibid.*, at 107-109.

¹⁷ *Ibid.*, at 10.

Reduction	Reduction furnace; in-line oxygen monitor and H ₂ detection devices	Explosion Release of uranium powder	Oxygen amount, H ₂ concentration, pressure. ¹⁸
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The IAEA also requires that a facility controls and minimizes the generation of radioactive waste of all kinds, to ensure that radioactive releases to the environment are as low as reasonably achievable, to facilitate the handling and disposal of waste, and to facilitate the decommissioning of the facility.¹⁹

The Springfields facility takes UO₃ from the Blind River Refinery and further processes it into either uranium metal for use in Magnox reactors or to UF₆ as well as other processes. The facility differs significantly from the Blind River Refinery. This facility was chosen because it is a uranium emitter and information on UK licensing practices is readily available.

The Metropolis Facility in Illinois has 52 individual stacks and exhaust fans for the release of radioactive material. Metropolis converts yellowcake into UF₆. The primary processing steps for licensed material are feed ore sampling and preparation, U₃O₈ reduction, uranium oxide (UO₂) hydrofluorination, uranium tetrafluoride (UF₄) fluorination, and UF₆ distillation (product purification). The initial step in the conversion process is reduction of U₃O₈ to UO₂, which is accomplished by contacting feed U₃O₈ with hydrogen gas in a fluidized bed reactor at 565°C (1050°F). The reactor offgas is cooled, filtered, and incinerated to oxidize residual hydrogen and sulfur compounds before release to the atmosphere. The reduction reactor is fitted with relief valves, alarmed hydrogen analyzers, a rupture disk, and pressure sensors to prevent and mitigate the effects of potential explosive conditions. The uranium solids are filtered from the reactor offgas and recycled to the ore preparation system. No liquid effluent stream is produced by the reduction process. Gaseous uranium emissions are continuously monitored at the fence line of the facility and stack samples are collected twice every 24 hours.²⁰

Malvési converts yellowcake to UO₂ and ultimately UF₆. Very little information is available about the operation at Malvési as it was only recently regulated by the French nuclear authorities.

¹⁸ IAEA, Safety Standards Series No. SSG-5, *Safety of Conversion Facilities and Uranium Enrichment Facilities* (Vienna: IAEA, 2010) at 56-57

¹⁹ IAEA, Safety Standards Series No. NS-R-5, *Safety of Nuclear Fuel Cycle Facilities*, (Vienna: IAEA, 2008), at 45 (Effluent) Online: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1336_web.pdf.

²⁰ Complete details about Metropolis are available from U.S. Nuclear Regulatory Commission Office of Nuclear Material Safety and Safeguards Division of Waste Management and Environmental Protection, Docket No. 40-3392, *Environmental Assessment for Renewal of NRC License No. SUB-526 for the Honeywell Specialty Materials, Inc. Metropolis Works (MTW) Facility Final Report*, at 28. Online: <http://pbadupws.nrc.gov/docs/ML0617/ML061780260.pdf>

4. Licensing norms for uranium release limits at other uranium processing facilities

4.1 AIR

a. The Blind River Refinery Facility

Uranium (Air)	Unit	Averaging	Limit	Basis of limit	Comments
DRL (Absorber and DCEV stacks)	g/h	Weekly	100	0.05 mSv/yr public dose	Enforceable license condition (proposed)
DRL incinerator	g/h	Daily	10	0.05 mSv/yr public dose	Enforceable license condition (proposed)
Action Level Absorber stack	g/hr	Daily	1	Action level: loss of control	Action level
Action Level DCEV stack	g/hr	Daily	10		
Action level incinerator stack	g/hr	Daily	1.5		
DAC insoluble	µg/m ³		0.5	1 mSv/yr public dose	
DAC soluble	µg/m ³		0.4	Chemical toxicity	
OMOE Ambient Air Quality Criterion Uranium PM ₁₀	µg/m ³	Annual	0.03	Chemical kidney toxicity over a 50 year exposure period	Annual was accepted for 5-year phased-in adoption in O. Reg. 419/05 (June 2011) ²¹ Ministry will develop screening values for short-term assessment of elevated exposure ²² Applies to stationary sources only.
		24 hour	0.15	As above, applied conversion factor	
		½ hour	0.45	As above, applied conversion factor	
OMOE Ambient Air Quality Criterion Uranium Total Suspended Particulate (TSP)	µg/m ³	Annual	0.06	TSP value relates only to soil deposition	TSP-based AAQC is guideline only, recommended for use where soil deposition is of concern.
		24 hour	0.30		

²¹ Ontario Ministry of the Environment, *Ontario Air Standards For Uranium And Uranium Compounds*, (June 2011), online: http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2011/010-7192.pdf.

²² The site-specific standard setting process is set out in section 32 of O. Reg. 419/05.

Health Canada Tolerable daily intake(ingestion) per kg of body weight per day (soluble)	$\mu\text{g}/\text{m}^3$	Annual average	0.06 (total)	Adults and Children at 1 mSv/yr, 10% of kidney exposure allocated to air. (equivalent to a limiting dose of 0.1 mSv.)	Recommendation. ICRP kidney concentration of 0.1 $\mu\text{g U} / \text{g kidney}$ based on epidemiological study (drinking water) nephrotoxicity rat ingestion study
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b. Springfields UK fuel conversion facility

Uranium (Air)	Unit	Averaging	Limit	Basis of limit	Comments
Uranium	TBq	Annual	5.3×10^{-3}	unknown	Actual license (2008) may specify a limit based on shorter time period. ²³

c. Comurhex Malvési conversion facility (converts yellowcake to UF_6)

Uranium (Air)	Unit	Averaging	Limit	Basis of limit	Comments
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No gaseous limit was available for uranium emissions. It is unclear whether Malvési is required to monitor or report gaseous radioactive emissions from this facility.²⁴

²³ Centre for Environment, Fisheries and Aquaculture Science, *Radioactivity in Food and the Environment, 2009- Appendix 2 – Disposals of Radioactive Wastes* (October 2010) at 230, 235. online: <http://www.food.gov.uk/multimedia/pdfs/publication/rife2009.pdf>.

²⁴ Comurhex, *Rapport environmental, social et societal 2009*, at 22. Online: http://www.aveva.com/activities/liblocal/docs/BG%20amont/monde/enrichissement/Comurhex%20Malv%C3%A9si/rapportESSMalvesi2009_bd.pdf.

d. Metropolis facility (yellowcake to UF₆)

Licence conditions were not available for uranium emissions to air. There are no release or discharge limits specified in the Metropolis Nuclear Regulatory Commission licence.²⁵ However the facility is subject to the following standards under the applicable Code of Federal Regulations:

Uranium (Air) natural ²⁶	Unit	Averaging	Limit	Basis of limit	Comments
Air effluent concentration U-230 class D	µCi/ml mBq/L	No time period specified. ²⁷	3 x 10 ⁻¹²	Represents concentration that if inhaled or ingested continuously produce a total effective dose equivalent of 0.02 mSv/hr or 0.5 mSv/yr ^{28,29}	Measured at boundary of unrestricted facility area. ³⁰ Must demonstrate compliance under 10 CFR Part 20, "Standards for Protection Against Radiation," § 20.1302(b) prohibits a licensee from releasing radioactive materials to an unrestricted area in concentrations that exceed the limits. ³¹
Air effluent concentration U-230 class W	µCi/ml mBq/L		111 x 10 ⁻³		
Air effluent concentration U-230 class Y	µCi/ml mBq/L		9 x 10 ⁻¹³		
			333 x 10 ⁻⁴		
			9 x 10 ⁻¹⁴		
			333 x 10 ⁻⁵		

²⁵ NRC License No. SUB-526 for the Honeywell Specialty Materials, Inc. Metropolis Works (MTW) Facility.

²⁶ Nuclear Regulatory Commission, 10 CFR Part 20 Appendix B, online: <http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-appb.html>.

²⁷ U.S. Nuclear Regulatory Commission, *Regulatory Guide 4.16: Monitoring And Reporting Radioactivity In Releases Of Radioactive Materials In Liquid And Gaseous Effluents From Nuclear Fuel Processing And Fabrication Plants And Uranium Hexafluoride Production Plants* (1985), Online: http://adamswebsearch2.nrc.gov/idmws/DocContent.dll?library=PU_ADAMS^pbntad01&LogonID=e8c7d867d93cb282fdb480b63f7ca483&id=003957058.

²⁸ NRC, *Regulatory Guide 8.37, ALARA Levels for Effluents from Materials Facilities* (July 1993). Online: <http://www.nrc.gov/reading-rm/doc-collections/reg-guides/occupational-health/rg/8-37/>.

²⁹ *Ibid.*

³⁰ *Ibid.*

³¹ U.S. Nuclear Regulatory Commission, *Regulatory Guide 4.16: Monitoring And Reporting Radioactivity In Releases Of Radioactive Materials In Liquid And Gaseous Effluents From Nuclear Fuel Processing And Fabrication Plants And Uranium Hexafluoride Production Plants* (1985), Online: http://adamswebsearch2.nrc.gov/idmws/DocContent.dll?library=PU_ADAMS^pbntad01&LogonID=e8c7d867d93cb282fdb480b63f7ca483&id=003957058.

National Ambient Air Quality Standards (NAAQS) Illinois	-	-	-	-	Does not include uranium. ³²
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e. Commentary – Uranium air emissions

Only the Blind River Refinery expresses a limit for uranium air emissions as a gram per hour limit in regulatory criteria. Other Canadian criteria are guideline concentrations, not measurements of radioactivity. Other jurisdictions use radioactivity measurements which cannot readily be converted to release rates or ambient concentration amounts. Jurisdictions also differ greatly in the dose assessment, with each using a different public dose endpoint and assumptions about exposure. There appear to be no internationally consistent practices related to expressing, monitoring or reporting uranium air emissions.

4.2 LIQUID RELEASES

a. Blind River Refinery

Uranium (liquid)	Unit	Averaging	Limit	Basis of limit	Comments
Action level	mg/L	Monthly	0.2	Action level	
Release Limit	mg/L	Monthly	2	Unclear – appears to be based on installed control technology	Proposed enforceable licence condition.
OMOE Interim Provincial Water Quality Objective (Uranium)	µg/L		5	Aquatic health	
CNSC design objective for new facilities	mg/L		0.1	Based on potential treatment design. ³³	Also used as optimization screening objective for existing facilities.
Canadian Environmental	µg/L	Daily	33	Aquatic life protection	

³² U.S. Nuclear Regulatory Commission Office of Nuclear Material Safety and Safeguards Division of Waste Management and Environmental Protection, Docket No. 40-3392, *Environmental Assessment for Renewal of NRC License No. SUB-526 for the Honeywell Specialty Materials, Inc. Metropolis Works (MTW) Facility Final Report*, at 28. Online: <http://pbadupws.nrc.gov/docs/ML0617/ML061780260.pdf>.

³³ Canadian Nuclear Safety Commission and Environment Canada, “2008 Annual Report on Uranium Management Activities”, at 5, online: http://publications.gc.ca/collections/collection_2011/ccsn-cnsc/CC171-9-2008-eng.pdf.

Quality Guidelines for the Protection of Aquatic Life		Monthly	15		
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b. Springfields UK fuel conversion facility

Uranium (liquid)	Unit	Averaging	Limit	Basis of limit	Comments
Discharge Limit (Environment Agency)	TBq	Annual	4×10^{-2}	Unknown	Actual limit may not be annual average. ³⁴

c. Comurhex Malvési conversion facility³⁵ (converts yellowcake to UF₆)

Uranium (liquid)	Unit	Averaging	Limit	Basis of limit	Comments
Limit (from annual report)	mg/L		0.5		
Limit	Kg/d		10		Derived from annual limit of 131 Kg

d. Honeywood Metropolis Illinois facility (yellowcake to UF₆)

There are no licence conditions specifying liquid release limits in the Metropolis NRC licence. However, the following general standards apply:

Uranium (liquid)	Unit	Averaging	Limit	Basis of limit	Comments
Uranium Class D Effluent Concentration	µCi/ml		3×10^{-7}		10 CFR 20 Appendix B ³⁶
Uranium Class D releases to sewers concentration	µCi/ml	Monthly	3×10^{-6}		
EPA Maximum contaminant level goal			0		National primary drinking water regulations

³⁴ CEFAS, *supra* at 235

³⁵ Comurhex, *Rapport environmental, social et societal 2009*, at 22. Online: http://www.aveva.com/activities/liblocal/docs/BG%20amont/monde/enrichissement/Comurhex%20Malv%C3%A9si/rapportESSMalvesi2009_bd.pdf

³⁶ Nuclear Regulatory Commission, 10 CFR Part 20 Appendix B, online: <http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-appb.html>

(radionuclide) Safe Drinking Water Act					40 CFR 141 Subpart C, Appendix A ³⁷
EPA maximum contaminant levels for radionuclides (uranium) ³⁸	µg/L		30	Some people who drink water containing uranium in excess of the MCL over many years may have an increased risk of getting cancer and kidney toxicity. Based also on BAT available for control.	Exposure from erosion of deposits. Applies only to community water systems ³⁹ Public notification requirement (Tier 10) for violation under Sections 1414(c)(1) and (c)(2) of the SDWA, notification of violation of NPDWRs. Part 40 CFR 141
Environmental standards for uranium fuel cycle (normal operation) (alpha emissions with half lives < 1 yr)	mCi	Total per Gigawatt-year	5		40 CFR 147.3011
Maximum concentration for groundwater protection	pCi/L		30		40 CFR 192 combined uranium-234 and 238
NRC total effective annual dose	rem/yr		0.1		10 CFR 20.1301 for licensed operation
Safe Drinking Water Act US	mrem/yr		4	Beta emitting radionuclides in drinking water Based on 0.04 mSv/yr public dose or one in	40 CFR 141 SDWA mandates risk levels as noted.

³⁷ *Ibid.*

³⁸ EPA, National Primary Drinking Water Regulations (Radionuclides) Final Rule at 3, 306. Online: <http://www.federalregister.gov/articles/2000/12/07/00-30421/national-primary-drinking-water-regulations-radionuclides-final-rule#p-3>

³⁹ *Ibid.*

				then thousand to one in one million risk	
US Safe Drinking Water Act best available technology, treatment techniques, or other means available for achieving compliance					A State shall require community water systems to install and/or use any treatment technology identified in the rule. ⁴⁰

It should also be noted that EPA permit programs under the *Clean Water Act* identify uranium as a Table V toxic substance and apply approved analysis methodology and best available technology requirements. The BAT requirements imposed by the EPA are reverse osmosis, lime softening, and coagulation/filtration.⁴¹

e. Commentary on uranium liquid discharges

Given the differences in the ways the liquid discharge limits are calculated and expressed, it is challenging to draw comparisons between these standards. It is notable that the Malvésí facility appears to have a lower release limit than the Blind River Refinery. The Malvésí facility reports uranium emissions in the range of 0.01-0.1 mg/L over the last few years.⁴² It seems that the Blind River Refinery emission history is similar (0.01-0.02 mg/L).⁴³ Potential differences in the monitoring locations or averaging of these measurements are unknown.

Springfields and Metropolis facilities both express their uranium limits in units of radioactivity, which is not done in the proposed Blind River Refinery licence.

⁴⁰ *Ibid.*, at 617.

⁴¹ 40 CFR 141.66 (EPA 2010)

⁴² Comurhex, *Rapport environmental, social et societal 2009*, at 22. Online: http://www.aveva.com/activities/liblocal/docs/BG%20amont/monde/enrichissement/Comurhex%20Malv%C3%A9si/rapportESSMalvesi2009_bd.pdf

⁴³ CMD 11-H181 at 37.

5. Licensing terms

The following facilities (with the exception of Springfields) are OECD yellowcake reduction facilities that convert yellowcake to UO₂.

Facility	Location	Licensing term
Blind River Refinery	Blind River, ON Canada	Proposed 10 year term
Metropolis	Illinois, USA	10 year term
Springfields	Lancashire, UK	Indefinite
Malvésí	France	Indefinite
Kaeri	Korea	Indefinite

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Throughout the OECD Nuclear Energy Agency member countries there is no standard practice for licensing uranium conversion or processing facilities. No jurisdictions were found that utilized a licensing period of less than 10 years for fuel cycle facilities in the OECD with the exception of American enrichment facilities. However, no information was available on license terms for yellowcake purification facilities in India (Hyderabad), Argentina (Cordoba), Pakistan (Islamabad), or Romania (Feldioara).

6. Public Information Program Requirements

Most Countries with conversion and reduction facilities have at least some public participation or information requirements through environmental assessment processes.⁴⁵ Canada appears to be unusual in requiring public information programs as a license requirement.⁴⁶

The UK has a detailed stakeholder engagement regime for licensees. The Health and Safety Executive Office of Nuclear Regulation has published a number of stakeholder engagement documents. There is a public information regulatory requirement related to emergency preparedness.⁴⁷ The Regulations place obligations on the licensee to produce an emergency plan for dealing with any reasonably foreseeable radiation emergency, as well as providing prior information to the population around the site. The local authority is also required to ensure that relevant information is supplied to the affected population in the event that a radiation emergency should occur.⁴⁸ The Environment Agency public participation statement and regulatory guide 6 (Determinations involving sites of high public interest) describe the UK policy on public consultation for nuclear facilities. The Environment Agency is required to advertise and consult on all applications for new permits except for those aspects where national security or commercial confidentiality restrictions apply. There is discretion to conduct additional consultation, for example

⁴⁴ OECD Nuclear Energy Agency, *International Practices With Respect To Licence Periods/Terms For Nuclear Facilities In NEA Member Countries*, (NEA, 2002), online: <http://www.oecd-nea.org/nsd/docs/2002/cnra-r2002-1.pdf>

⁴⁵ OECD Nuclear Energy Agency, Nuclear Regulation Building, *Measuring and Improving Public Confidence in the Nuclear Regulator* (2004).

⁴⁶ The Blind River Refinery facility proposed licence condition is: 2.6 The licensee shall implement and maintain a public information program for the facility, including a public disclosure protocol.

⁴⁷ Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPPIR)

⁴⁸ HSE, *Licensing of Nuclear Installations*, at 10, online: <http://www.hse.gov.uk/nuclear/notesforapplicants.pdf>.

on a draft decision having regard to the environmental impact and the degree of public interest. The Environment Agency does not consult on applications for the transfer or surrender of permits.⁴⁹

In the US, the public information program and its implementation is a part of the licensee's and the State and local governments' Radiological Emergency Plans. The NRC has oversight responsibility for the licensee's public information program and the Federal Emergency Management Agency (FEMA) has oversight responsibility for the State and local governments' public information program and its implementation. FEMA has the lead for the review of emergency information provided to the public. Licensee changes to its public information program need to be reviewed by FEMA in concert with the NRC.⁵⁰ Regulations require annual dissemination to the public within emergency protection zones including specifying methods and times of public notification.⁵¹ In-addition to this, the relevant portions of the NRC regulations require extensive public dissemination activities and consultations as part of the decommissioning process.⁵² The licensee must explain how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and incorporated into the license termination plan.⁵³ The public information requirement in the proposed Blind River Refinery licence is more general than the above standards but also appears to apply in more situations and is an enforceable licence requirement.

7. Conclusion

The Blind River Refinery is a unique facility and is exceptionally difficult to compare with other facilities that do not have incineration facilities and do not exclusively produce UO₃. Moreover, there does not appear to be a set of international standards or norms for monitoring, reporting or releasing uranium in air and water. The inconsistent manner in which uranium emissions are reported and expressed internationally makes it challenging to identify best practices and standards. Canada appears to be consistent with international conversion facility practices with respect to public information and licensing terms.

⁴⁹ Environment Agency, Environmental Permitting Regulations England and Wales (2010), at 12. Online: <http://www.environment-agency.gov.uk/static/documents/Business/GEHO0310BSGF-E-E.pdf>.

⁵⁰ NRC, *Emergency Preparedness Position (Eppos1) On Emergency Planning Information Provided To The Public*, (December 2002) at 2, Online: <http://pbadupws.nrc.gov/docs/ML0230/ML023040492.pdf>

⁵¹ Section IV.D.2 of Appendix E to 10 CFR Part 50 cited in NRC, *supra* note 24 at 1.

⁵² 10 CFR Part 20 Subpart E Section 20.1403d(2).

⁵³ *Ibid.*