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Designating Radionuclides as a Chemical of Mutual Concern under the Canada-United States Great Lakes Water Quality Agreement: Moving Towards Greater Oversight, Environmental Protection and Transparent, Open-sourced Science

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Abstract In March 2016, 110 advocacy groups submitted an application under the binational Great Lakes Water Quality Agreement to designate radionuclides as "Chemicals of Mutual Concern" (CMCs) under Annex 3 of that Agreement.[2] Environment and Climate Change Canada and the U.S. Environmental Protection Agency sent that application to each country's nuclear regulatory agency (U.S. Nuclear Regulatory Commission and the Canadian Nuclear Safety Commission) for comment. Both countries' nuclear regulatory agencies reported back to the environment agency for their country in 2017. Both the Canadian and the U.S. nuclear regulatory agencies recommended that radionuclides not be designated as CMC's under the GLWQA**.** One of the reasons the nuclear agencies gave is that radionuclides are adequately regulated by the nuclear agencies to protect the Great Lakes. The groups who nominated radionuclides to become CMC's asked the Canadian Environmental Law Association (CELA) to assess the adequacy of the CNSC's regulatory system to protect the Great Lakes from radionuclides. The following are their findings on this topic.

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[1] Canadian Environmental Law Association. CELA is a non-profit, public interest law organization. CELA is funded by Legal Aid Ontario as a speciality legal clinic to provide equitable access to environmental justice for individuals, groups or communities unable to afford legal representation . For nearly 50 years, CELA has used legal tools to advance the public interest, through advocacy and law reform, in order to increase environmental protection and safeguard communities across Canada. CELA has engaged in detailed research and advocacy related to the improvement of public safety and environmental protection of Canada's nuclear sector and frequently appears before the industry's regular, the Canadian Nuclear Safety Commission (www.cela.ca).

[2] *See*, CELA, "Radionuclides as Chemical of Mutual Concern in the Great Lakes Basin" (February 2016), online: http://www.cela.ca/publications/radionuclides-chemical-mutual-concern-great-lakes-basin

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Executive Summary

The Canadian Nuclear Safety Commission ("CNSC"), in its Assessment of the Relevance of the Inclusion of Radionuclides as a Chemical of Mutual Concern under Annex 3 of the Canada-United States Great Lakes Water Quality Agreement ("CNSC Assessment"),[3] concludes that "when the comprehensive nature of the current regulatory framework and national monitoring and research network is considered, it is clear that activities are already in place federally which would satisfy all Annex 3 commitments for designated CMCs."[4] The CNSC has also stated that "[b]ased on an assessment using the best available science, there is no evidence to indicate radionuclides currently within the Great Lakes are posing an unreasonable risk to the environment, or human health."[5] In the CNSC's estimation, this conclusion discharges Canada's need to "identify and designate, on an ongoing basis, CMCs in the Great Lakes, which originate from anthropogenic sources and that … may be harmful to the environment or human health."[6]

This report will demonstrate that:

1. The CNSC is mistaken in its criteria for determining whether chemicals are potentially harmful to human health or the environment. That is, there is in fact evidence to indicate radionuclides currently within the Great Lakes are posing an unreasonable risk to the environment, and/or human health;
2. The CNSC's finding in 1, above, must be read in light of demonstrated shortcomings in its:
    a. Regulatory oversight, and
    b. Monitoring programs;
3. The authors of the CNSC Assessment - CNSC Staff – are the inappropriate federal body to undertake an adequacy analysis of its own regulatory oversight and monitoring programs.

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[3] CNSC, "Assessment of the Relevance of the Inclusion of Radionuclides as a Chemical of Mutual Concern under Annex 3 of the Canada-United States Great Lakes Water Quality Agreement," <online: http://nuclearsafety.gc.ca/eng/resources/health/radionuclides-chemical-of-mutual-concern.cfm> **[CNSC Assessment]**

[4] *Ibid*, p 58

[5] *Ibid*, p i.

[6] CNSC Assessment, Executive Summary at pg. I; The requirement under Annex 3 of the GLWQA as articulated by the CNSC is paraphrased from Annex 3 of the 2012 Great Lakes Water Quality Agreement:

> The Parties shall identify chemicals of mutual concern that originate from anthropogenic sources. The Parties shall mutually determine those chemicals that are potentially harmful to human health or the environment by:
>
> 1. establishing and implementing a process by which the Great Lakes Executive Committee may recommend chemicals of mutual concern to the Parties. The recommendation shall include a review of available scientific information supporting the recommendation; and
> 2. considering recommendations of the Great Lakes Executive Committee and jointly designate chemicals as chemicals of mutual concern for the purposes of this Agreement.

On this basis, it can be concluded that Environment Canada has not been provided with a sufficient evaluation by the CNSC which merits rejecting the designation of chemicals of mutual concern that originate from anthropogenic sources as required under Annex 3 of the Great Lakes Water Quality Agreement ("GLWQA").

1. The Inadequate Regulatory Oversight of the CNSC

1.1 Audit of the Canadian Commissioner of the Environment and Sustainable Development

The CNSC Assessment asserts that "Canada's regulatory framework remains current and consistent with the best science"[7], and that "assuring compliance with legislation, regulations and licensing requirements is one of the CNSC's core business processes and is carried out through compliance verification and enforcement"[8], and the "comprehensive nature of current regulatory framework and national monitoring"[9].

Despite the CNSC's portrayal of its monitoring program, there is demonstrable concern about its adequacy. The Commissioner of the Environment and Sustainable Development ("CESD") produced a report in 2016 that was highly critical of the CNSC's inspection program for nuclear power plants. The audit covered the 2013–14 and 2014–15 fiscal years. In its report, the CESD concluded that the CNSC could not demonstrate it had an adequate, systematic, risk-informed process for planning site inspections at nuclear power plants and did not always follow its own inspection procedures when carrying out and documenting inspections of nuclear power plants.[10]

The CESD Audit findings regarding nuclear power plant effluent monitoring is of particular relevance:

> ...an inspection of the effluent control and monitoring program of each nuclear power plant is to be conducted about twice in five years. Among other things, this would verify whether the nuclear power plant regularly calibrates its monitoring equipment. However, CNSC officials told us that the five-year plan had been changed to a plan covering all possible site inspections. We found that, as a result, the CNSC had not systematically determined the minimum number of site inspections required to assure itself that nuclear power plants were complying with regulatory and licensing requirements.[11]

[7] CNSC Assessment, p 44.
[8] *Ibid*, p 45.
[9] *Ibid*, p 57.
[10] Commissioner of the Environment and Sustainable Development, Report 1 – Inspection of Nuclear Power Plants – Canadian Nuclear Safety Commission (Ottawa: CESD, 2016), online: https://www.oag-bvg.gc.ca/internet/English/parl_cesd_201610_01_e_41671.html, paras. 1.13, 1.36, & 1.62.
[11] *Ibid*, para 1.21

In response, the CNSC agreed to the CESD audit findings and resolved to implement its recommendations.[12] However, as of the release date of the CNSC Assessment, the measures implemented by the CNSC have not yet been vetted by the CESD to determine whether the CNSC has adequately addressed the findings of the audit.

The 2016 CESD audit reviewed CNSC inspection programs for four nuclear reactors (Bruce, Pickering, Darlington, and Point Lepreau); the audit did not address whether the CNSC inspection regime adequately inspected effluent control and monitoring at other types of nuclear facilities, such as nuclear mines or waste facilities. Considering that reactors at nuclear power plants arguably pose the most significant risk to the environment and human health, it is likely that the CNSC inspection regime at these sites is the most robust amongst Canadian nuclear facilities.

While it is possible that the CNSC inspection regime has improved at nuclear power plants and other regulated facilities, there is no objective third-party based evidence to support such a claim. Without an external audit by the CESD verifying any improvement, the latest CESD evaluation of the CNSC inspection program remains the best evidence of the effectiveness of the CNSC to ensure compliance with regulatory requirements for effluent control and monitoring programs in the Canadian nuclear industry. Lacking evidence to substantiate any improvement, the CNSC's inspection program remains wanting.

1.2 Failure to Meet Nuclear Regulatory Requirements is no Barrier to Licensing

The CNSC is vested with a statutory mandate to oversee Canada's nuclear sector and ensure the protection of health, safety, security, and the environment.[13] CELA is aware of at least one instance in which a nuclear facility has been licensed for operation by the CNSC, despite the licensee's failure to meet its regulatory requirements and licensing conditions under Canadian and international law. Chalk River Laboratories ("CRL") nuclear research and test establishment operating licence since 2011 has stipulated under its Fitness for Service Safety Control Area ("SCA") licence condition, that "The licensee shall develop, implement and maintain documented programs of maintenance, testing, surveillance, and inspection of structures, systems and components important to safety to ensure that their availability, reliability, and functionality remain in accordance with the design over the lifetime of the facility."

The CRL site's Fitness for Service SCA, since the introduction of SCAs as licensing condition in 2011, has been "Below Expectations" ("BE") for every year as assessed by CNSC staff.[14]

[12] *Ibid*, at paras. 1.33, 1.35, 1.48, 1.50, and 1.61.
[13] *Nuclear Safety and Control Act*, SC 1997, c 9, s 9
[14] CMD: 18-H2.1, Submission from CNL on Application for Licence Renewal for Chalk River Laboratories (e-Doc 5390079), p 65; CMD: 16-H2, Submission from CNSC Staff on a Licence Renewal for Canadian Nuclear Laboratories Limited at Chalk River Laboratories (e-Doc 4929171), p 18.

According to CNSC staff, however, as of April 2017, this SCA has finally attained a rating of "Satisfactory" ("SA").[15] Previously, the CNSC staff continued to rate this SCA as Below Expectations due to the aging and legacy issues of structures, systems and components ("SSC") at CRL, particularly the National Research Universal ("NRU") reactor.[16] While shut down in 2016, the NRU reactor had been operational at CRL since 1957 and, as a consequence of its age, required managing of the aging of SSCs. According to CNSC regulatory document REGDOC-2.6.3, *Aging Management*, "Managing the aging of a reactor facility means to ensure the availability of required safety functions throughout the facility's service life, with consideration given to changes that occur over time and with use. This requires addressing both physical aging and obsolescence of SSCs where this can, directly or indirectly, have an adverse effect on the safe operation of the reactor facility"[17] These requirements are consistent with the IAEA guidelines, as well as the Organisation for Economic Cooperation and Development ("OECD"), Nuclear Energy Agency, Glossary of Nuclear Power Plant Ageing.[18]

In its submission to the CNSC on CNL's 2016 license renewal application, CNSC Staff concluded that "CNL continues to progress in the implementation of effective programs to ensure fitness for service at CRL in accordance with regulatory requirements. CNL continues to make progress toward a 'satisfactory' performance rating."[19] This conclusion was drawn despite the CNSC Staff's own assessment that "[m]any of the challenges that were presented in the previous performance report … are still applicable to CNL...".[20]

This surprising course of action deserves repeating: the CNSC Staff recommended awarding an operating licence to an entity that CNSC Staff explicitly acknowledged had failed to meet its regulated safety requirements for (at the time) over four years. The reason for this exceptional treatment was the apparent progress made by CNL towards compliance. This apparent relaxing of regulatory oversight is unusual for most licencing bodies in Canada. The courtesy extended to CNL by the CNSC is not generally available to Ontario Environmental Compliance Approval (ECA) applicants, who are not awarded ECAs on their progress toward a 'satisfactory' ECA application. For example, ECA applicants, as part of an application, are required to submit site-specific conditions, potential environmental impacts, and proposed environmental protection measures to meet current regulatory requirements. Failure to provide this information results in the denial of an ECA. To do otherwise would render nugatory the ECA application and approval process. The CNSC, by its own admission, would hold nuclear operating licence applicants to a

[15] CMD: 18-H2, Submission from CNSC Staff for CRL Licence Renewal (e-Doc 5373261), p 65
[16] CNSC, CNSC Staff Report on the Performance of CNL's Nuclear Sites and Projects: 2013 (e-Doc 4528291), p 15.
[17] CNSC, REGDOC-2.6.3, Aging Management, p 1.
[18] *Ibid*, p 2.
[19] *Supra* note 15, p 20.
[20] *Ibid*, p 19.

lower standard than the Ontario Ministry of Environment and Climate Change does ECA applicants.

The corollary of awarding a license despite a Fitness for Service rating of Below Expectations is that an improvement to a SA rating is rendered meaningless. The decision to award a license despite findings of material noncompliance leaves the significance of a SA rating for other licensing conditions unclear and more significantly, erodes confidence in the ability of the CNSC to competently assess license applications. What is demonstrably apparent, however, is that a failure to meet regulatory requirements under both Canadian and international law has not prevented the authorization of nuclear activities under the CNSC.

2. Insufficient Comprehensive and Cumulative Environmental Monitoring

The CNSC Assessment concludes that "data on the quantities of radionuclides monitored within the Great Lakes have been summarized" and as a result, there is "no evidence to suggest that the radionuclides pose an unreasonable risk to environment, health or safety within the Great Lakes basin ecosystem."[21] This statement, unfortunately, disregards the inherent limitations to the environmental monitoring programs required under the *Nuclear Safety and Control Act* (NSCA).[22]

First, licensee's environmental protection plans overseen by the CNSC can be widely divergent and conditions ensuring their enforcement lax; second, the CNSC does not engage in a cumulative assessment of all licensee environmental impact or emissions; and lastly, CNSC's approach to environmental monitoring is not conducive to studying effects on non-human biota and ecological systems.

The CNSC's RegDoc 2.9.1 *Environmental Protection: Environmental Principals, Assessment and Protection Measures* serves as a basis for licensee's environmental programming and monitoring. However, as this document contains both mandatory (i.e., a licensee shall design and implement an effluent monitoring program) and guidance provisions (i.e., the results of environmental monitoring should be periodically reviewed for adequacy of testin), the ultimate scope of what *must* be achieved is narrowed. There are also varying levels of compliance among Canada's nuclear power plant licensees as its relates to RegDoc 2.9.1, with some licencees – such as Bruce Power - not required to be in compliance until December 2020.[23]

Furthermore, the scope of the environmental programming among licensees is also wide ranging and can be amended during the span of a licence. For instance, in the context of the upcoming

[21] CNSC Assessment, p 57
[22] *Nuclear Safety and Control Act*, SC 1997, c 9.
[23] CMD: 18-H4, Submission from CNSC Staff for Bruce Nuclear Generating Station A and B Licence Renewal (e-Doc 5292456), p 100

licence renewal for the Pickering Nuclear Generating Station, the CNSC notes in its review of licensee environmental programming that a "stormwater sampling program was conducted in 2015 in order to characterize the current quality of stormwater …released directly to Lake Ontario".[24] However, as point of discharge concentrations were within water quality guidelines, "stormwater was not assessed further" and the program discontinued.[25] In another recent relicensing application, CNSC "closed" the environmental monitoring which was put in place as a condition following a federal environmental assessment for Bruce Power's proposal to refurbish its Bruce A reactors. Unfortunately, as the refurbishment of nuclear power plants or reactors no longer constitutes a trigger for environmental assessment under the *Canadian Environmental Assessment Act, 2012,* there is no opportunity to develop a similarly detailed environmental monitoring program going forward.[26]

Secondly, the scope of hearings for the re-licensing of nuclear power plants under the NSCA - which typically occur every 5 to 10 years – focus largely on technical issues rather than environmental planning considerations and do not provide an opportunity for a cumulative review of nuclear operation and project effects. Even in the CNSC's oversight of environmental assessments for decommissioning projects, the hearings are too narrowly scoped to allow for an in-depth cumulative effects analysis which considers the combined impact of multiple nuclear projects. For instance, the CNSC's review of the Canadian Nuclear Laboratories environmental assessments for the decommissioning of the Nuclear Power Demonstration Reactor and the construction of a radioactive waste Near Surface Disposal Facility Project, which are proposed within 20 kilometers of each other, did not consider the projects combined environmental effects.

Lastly, while non-human biota considerations are increasingly becoming part of radiological protection, the human-centric origins of radiation monitoring continues to impede the study of radiological effects on non-human biota and ecological communities. [27] This limitation is recognized in the CNSC's proposed licence for Bruce Power, as it exempts the licensee from compliance with RegDoc 2.9.1 to the extent that "there is currently no industry 'best practice' for the assessment of risks related to non-human biota."[28] As recent findings from the International Union of Radioecology conclude, radiation effects on non-human biota and the environment is still a bourgeoning field:

[24] CMD: 18-H6, Submission from CNSC Staff for Ontario Power Generation Inc. Pickering Nuclear Generating Station (e-Doc 5177626), p 39
[25] *Ibid*
[26] CELA, "Canada's Impact Assessment Act – A Public Interest Perspective" (26 July 2019), online: https://cela.ca/canadas-impact-assessment-act-a-public-interest-perspective/
[27] Francois Bréchignac et al. (2016). Addressing ecological effects of radiation on populations and ecosystems to improve protection of the environment against radiation: Agreed statements from a Consensus Symposium, *Journal of Environmental Radioactivity*, 158 -159, p 21 -29
[28] CMD: 18-H4, Submission from CNSC Staff for Bruce Nuclear Generating Station A and B Licence Renewal (e-Doc 5292456), p 376

> [W]hile there is increasing awareness of the need to embrace not only the individual level but also population, community and ecosystem impacts, radiation protection institutions are only starting to engage the range of expertise that can conceptualize and conduct the relevant research. A new consensus on the need and means to achieve an ecocentric approach might stimulate dialogue, foster a more integrated research program, and facilitate national and international efforts to work toward a more comprehensive system of protection.[29]

Other studies examining the effects of radionuclides on non-human biota are also limited in scope and depth of investigation. For instance, a 2006 assessment by Environment Canada that studied the effects of radionuclide releases on non-human biota limited its examination to uranium and did not include all radiological materials from nuclear facilities.[30] The study also noted that "uncertainties and some conservative assumptions associated with risk" complicated their interpretation.[31]

As a result, the CNSC lacks the basis to conclude that anthropocentric sources of radionuclides do not pose unreasonable risk to the Great Lakes. This is primarily due to:

- commonly recognized uncertainties relating to the study of radiation impacts on non-human organisms; and
- environmental monitoring data that is licensee specific and does not take into account cumulative impacts of releases over time and cumulatively for the many licensees in the Great Lakes basin.

3. Inappropriate Review Methodology to Evaluate Possible CMCs

3.1 Environment and Climate Change Canada finds Uranium from mines and mills toxic

The CNSC's Assessment has attempted to establish that radionuclides are not suitable for classification as CMCs, based on recent evidence showing radionuclides are present below current drinking water and aquatic protection standards. This is a misunderstanding of the requirements to be met for a chemical to be identified and designated as a CMC: namely, that they originate from anthropogenic sources and pose a potential threat to the environment or human health.

In 2006, Environment Canada (now Environment and Climate Change Canada or "ECCC") completed an ecological science assessment of releases of radionuclides from five operating

[29] *Supra* note 27
[30] Environment and Climate Change Canada, (2016) "Release of radionuclides from nuclear facilities (impact on non-human biota)" **[ECCC Study]**
[31] *Ibid*

uranium mines and mills, two uranium refineries and conversion plants, three stand-alone waste management facilities and five nuclear power plants. Based on the available data at the time concerning effects from exposure to uranium, Environment Canada concluded that releases of uranium and uranium compounds contained in effluent from uranium mines and mills were entering the environment in quantities or concentrations or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity. Therefore, it was concluded that releases of uranium and uranium compounds contained in effluent from uranium mines and mills are "toxic" as defined by the *Canadian Environmental Protection Act, 1999* ("CEPA 1999").

It is important to note that Environment Canada's assessment only studied uranium releases; no other radionuclides relevant to the nuclear industry were assessed. The basis for restricting the assessment to uranium releases was because, as indicated by the report, "uranium is the only radionuclide examined that has greater potential to cause chemical rather than radiological toxicity…[and] [t]here is relatively little evidence that exposure to ionizing radiation resulting from current releases of radionuclides from nuclear facilities is causing environmental harm."[32] It should be noted that the half-life of uranium-238, the most abundant isotope of uranium, is about 4.5 billion years.[33] Restricting the study to uranium is unfortunate considering Environment Canada also noted "…there is potential for biota to be harmed from exposure to radiation … as a consequence of current releases. However, uncertainties and some conservative assumptions associated with risk estimates for ionizing radiation, complicate their interpretation."[34] Considering Environment Canada found that the only radionuclide it assessed was toxic, it is not unreasonable to assume that had the ecological science assessment been expanded to include other radionuclides, additional radionuclides would have been identified as toxic.

The CNSC responded to the specific ECCC conclusions by stating that the releases of uranium have been addressed and that procedures are now in place to ensure uranium does not pose a problem in the future. Additionally, in the opinion of the CNSC, since the sites evaluated were in northern Saskatchewan, they never posed a risk to the Great Lakes basin. In reaching these conclusions, the CNSC made several assumptions. Most notably, the CNSC assumes, without credible evidence, that releases from Ontario uranium mines near the Great Lakes are less likely to occur than from mines in Saskatchewan and that uranium that has already been released does not pose a threat. These assumptions are dispelled by the CNSC Assessment itself when addressing Ontario uranium mines at Elliot Lake near Lake Huron. On the basis of its monitoring program for uranium mining near the region, the CNSC Assessment concluded: "it is clear that Elliot Lake activities have little influence if any on radionuclide activity levels in Lake Huron"

[32] *Ibid*
[33] Uranium: Its Uses and Hazards, Institute for Energy and Environmental Research online: <https://ieer.org/resource/factsheets/uranium-its-uses-and-hazards/>.
[34] *ECCC Study*, *supra*, note 26.

because “at no point in time have uranium concentrations at these locations exceeded the drinking water guideline nor the guideline for the protection of aquatic life and concentrations are currently at natural background levels.”[35] To buttress its argument the CNSC Assessment indicates a similar conclusion was reached by Joshi (1991).[36] While the uranium levels might have been low, the Joshi article is at odds with the CNSC Assessment’s with respect to the impact of radionuclides. According to Joshi (1991), as of 1991, the Lake Huron watershed had been receiving radionuclide loadings since 1955 and “...results showed that mining activities had led to some impairment of the radiological water quality in the river basin with respect to ^{226}Ra.”

The CNSC Assessment makes a similarly contradictory conclusion for Port Hope Harbour. CNSC’s own monitoring data demonstrated that as recently as 2006-2010, the annual maximum for uranium exceeded both drinking water and aquatic life protection guidelines. Nevertheless the CNSC concluded this was not a concern because of the decreasing trend in the average harbor uranium concentration.[37] The CNSC explained this contradiction by stating that the harbour is not used as a source of drinking water and “[w]ith the removal of the primary source terms... in the future, uranium in harbour waters can be expected to further decrease.”[38] The CNSC has concluded there is no evidence supporting a finding that radionuclides from anthropogenic sources pose a risk to the environment or human health despite the CNSC own monitoring data demonstrating, and the ECCC concluding, otherwise.

3.2 CNSC Utilizes Outdated Studies of Radionuclide Levels in the Great Lakes

In addition to minimizing its own monitoring evidence and the conclusions of ECCC, the CNSC Assessment has referenced four studies published over twenty-five years ago, in 1983, 1987, and 1991 to provide external verification of current low radionuclide levels in the Great Lakes.[39] On the basis of these dated studies, the CNSC has buttressed its argument to dispense with the need to designate anthropogenic radionuclides as CMC. In doing so, however, the CNSC has neglected a body of research that provides contemporary insight into whether radionuclides should be designated as CMC.

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[35] CNSC Assessment, p 22.
[36] Joshi, S.R. 1991. Radioactivity in the Great Lakes. The Science of the Total Environment Vol. 100, 61-104.
[37] CNSC Assessment, p 25.
[38] *Ibid*, p 26.
[39] Baweja, A.S., S.R. Joshi, and A. Demayo. 1987. Radionuclide content of some Canadian surface waters: A report on the national radionuclides monitoring program, 1981-1984. Environment Canada, Inland Waters/Lands Directorate Water Quality Branch, Scientific Series No. 156. 00; IJC (International Joint Commission). 1983. 1983 Report on Great Lakes water quality -- appendix on radioactivity. Great Lakes Water Quality Board, International Joint Commission, Windsor; Joshi, S.R. 1991. Radioactivity in the Great Lakes. The Science of the Total Environment Vol. 100, 61-104; Ontario Hydro. 1987. Annual summary and assessment of environmental radiological data for 1986. Safety Services Department, Rep. SSD-AR-86-1, Toronto. In, Joshi, S.R. 1991. Radioactivity in the Great Lakes. The Science of the Total Environment Vol. 100, 61-104.OPG (Ontario Power Generation). 2007. Refurbishment and Continued Operation of Pickering B Nuclear Generating Station Environmental Assessment.

For example, a study by Kramer & Evans (2012) showed that even though a Madawaska uranium mine had been inactive since 1982, there was unequivocal evidence U levels were still significantly elevated in Bow Lake biota, and in some cases U accumulation was 1–2 orders of magnitude higher in Bow Lake biota when compared to reference lake biota.[40] T. I. Evseeva et al. (2010) showed that chronic exposure of Scots pine trees to radionuclides, with the total absorbed dose being accounted for by both external and internal irradiation, results in the increased level of cytogenetic disturbances and reduced reproductive capacity, which are maintained in populations for a long time. These effects can take place at dose rates (determined by different methods) that are much lower than those regarded as safe for the biota according to the existing standards (IAEA, 1992; Bird et al., 2003; Real et al., 2004).[41] Burnett-Seidel, C. & Liber, K. (2012) found a high number of exceedances of the lowest effect levels ("LEL") at reference and no-effect sites (false-positives). This calls into question the appropriateness of the CNSC-derived sediment quality guidelines ("SQG"). The authors recommended that the CNSC should explore alternatives to the screening-level concentration ("SLC").[42]

Finally, the Pembina Institute published a fact sheet in 2007, Uranium Mining: Nuclear Power's Dirty Secret,[43] detailing the adverse effects of uranium mining and tailings management facilities and noted impacts include contamination of ground and surface waters. The Pembina Institute cites a study by P.A. Thomas and T.E. Gates (1999), which reached the following troubling conclusion in relation to Wollaston Lake-area caribou in northeastern Saskatchewan:[44]

> an adult eating 100g/day of caribou meat would receive annual effective radiation doses of 0.85 mSv/year. Additional eating of one liver and ten kidneys per year would double this dose to 1.7 mSv/year. A one-year-old child who consumed only 10 percent of the adult caribou intake would receive more than half the adult dose of radiation.

While these publications are by no means an exhaustive representation of the studies undertaken to measure the impact of uranium mining on the environment and human health, they do serve to establish a basis of scientific evidence that is at odds with the CNSC Assessment's stated lack of evidence of harm from radionuclides from anthropogenic sources.

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[40] Kraemer, Lisa D., and Douglas Evans. "Uranium Bioaccumulation in a Freshwater Ecosystem: Impact of Feeding Ecology." Aquatic Toxicology 124-125.Complete (2012): 163-70. Web. 23 Apr. 2018

[41] Evseeva, T.I., Geras'kin, S.A., Belykh, E.S. et al. Russ J Ecol (2011) Assessment of the reproductive capacity of Pinus sylvestris trees growing under conditions of chronic exposure to radionuclides of uranium and thorium series 42: 382. https://doi-org.ezproxy.lib.ryerson.ca/10.1134/S1067413611050055

[42] Burnett-Seidel, C. & Liber, K. Environ Monit Assess (2012) Evaluation of sediment quality guidelines derived using the screening-level concentration approach for application at uranium operations in Saskatchewan, Canada 184: 1593. https://doi-org.ezproxy.lib.ryerson.ca/10.1007/s10661-011-2063-1.

[43] Pembina Institute, Pembina Institute's Life Cycle Study of Nuclear Power, Fact Sheet No. 2 May 2007- Uranium Mining: Nuclear Power's Dirty Secret. https://www.pembina.org/reports/ClearingAir_UraniumMining.pdf.

[44] Thomas, P. A., & Gates, T. E. (1999). Radionuclides in the lichen-caribou-human food chain near uranium mining operations in northern Saskatchewan, Canada. *Environmental Health Perspectives*, *107*(7), 527–537.

4. Opportunities for Transparent and Meaningful Public Participation are Lacking

4.1 Public Participation in the Hearing Process

The CNSC's Assessment states that it "has no promotional role for the industry," and it provides "transparency of …regulatory process and opportunities for public participation."[45] Despite these pronouncements, the CNSC has been widely criticized for its lack of institutional independence from the community it regulates.[46] It has been over twenty years since Canada's *Nuclear Safety and Control Act* was passed by Parliament to replace the previous *Atomic Energy Control Act.* A number of stakeholders maintain that further modernization is necessary to remedy the CNSC's predecessor, the Atomic Energy Control Board (AECB), legislated mandate to 'promote' nuclear power. Despite this mission statement no longer appearing in the CNSC's mandate, there remains the public perception that the CNSC promotes the industry it regulates.[47] As recent findings from a federal expert panel tasked with updating Canada's laws relating to environmental assessment concluded, "the apprehension of bias or conflict of interest, whether real or not, was the single most often cited concern by participants with regard to the … CNSC. The apprehension of bias …eroded confidence in the assessment process."[48]

A public body that lacks the requisite public trust should not be tasked with fulfilling the commitments that would otherwise be realized through Annex 3 of the GLWQA. While the CNSC Assessment states it provides "opportunities for public participation in the regulatory process," the CNSC lacks the rules of procedure necessary for hearing participants to fairly and effectively test the factual, technical and scientific evidence often presented at licensing hearings. For instance, there are no requirements for duly qualifying experts who wish to present opinion evidence, and no provisions that enable participants to cross-examine experts or other witnesses under oath. As a result, CNSC Commissioners appear to presuppose the validity of the evidence provided primarily by the licence applicant, and internally evaluated by their own technical and professional staff.

Decisions by the CNSC also afford greater considerations of fairness to the licensee than the public. For instance, in a recent decision by the Commission, the CNSC rejected an adjournment

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[45] CNSC Assessment, p 1

[46] Letter by the Canadian Environmental Law Association et al to the Right Honourable Justin Trudeau (Office of the Prime Minister), 8 March 2016, http://www.cela.ca/sites/cela.ca/files/Trudeau-NuclearReview.pdf

[47] Letter by Michael Binder (President of the CNSC) to the Honourable David Heurtel (Minister of Sustainable Development, Environment and the Fight Against Climate Change), 27 July 2015, http://www.nuclearsafety.gc.ca/eng/pdfs/letters/BAPE-letter-eng.pdf; Minister of Environment and Climate Change, Building Common Ground: A New Vision for Impact Assessment in Canada (2017), https://www.canada.ca/content/dam/themes/environment/conservation/environmental-reviews/building-common-ground/building-common-ground.pdf, p 50 - 51

[48] Minister of Environment and Climate Change, Building Common Ground: A New Vision for Impact Assessment in Canada (2017), https://www.canada.ca/content/dam/themes/environment/conservation/environmental-reviews/building-common-ground/building-common-ground.pdf, p 48.

request by the Saugeen Ojibway Nation with regard to the upcoming hearing of Bruce Power's relicensing on the basis that "Bruce Power, as the only party to this hearing, is owed a timely hearing of its application" (emphasis added).[49] There is a strong history of public intervenors before the CNSC during relicensing hearings; to truly engage with the public requires that procedural fairness be imparted equally on all individuals before the Commission.

4.2 Canada's Commitment to Open and Public Data

One of the stated purposes of the GLWQA's Annex 3 is that "knowledge and information concerning the use, creation and release of chemical of mutual concern, and combinations therefore, are fundamental to the sound management of chemicals in the Great Lakes Basin Ecosystem." While the CNSC's states in its Assessment that it "ensures reporting transparency"[50] and contends there is "a very good dataset and knowledge of radionuclide concentrations" within the Great Lakes basin, it does not comment on the public availability of this data and the ease with which it can be accessed.

The lack of comprehensive, publicly-available data was briefly discussed at a recent CNSC meeting in December 2017. In response to a recommendation from a public intervenor that the CNSC report nuclear substance release information to the National Pollutant Release Inventory. In response to CNSC staff response that the data is available on the CNSC website, the CNSC Commissioners responded that while the reportable data may be collected, it is "very hard to interpret" and "we need to make it more accessible."[51] As the CNSC's Assessment demonstrates, environmental data is disseminated in a range of documents spanning for instance, the annual reports submitted by the licensee to the CNSC, annual regulatory oversight reports, and reports resulting from audits and compliance inspections.[52] Unfortunately, many of these documents are available by request only (with some licensees being more or less willing to publicly disclose the raw data), and are not housed in an online data repository. Due to these barriers, the onus remains on members of the public to diligently maintain an understanding of the CNSC's processes and guidelines regarding public disclosure.

Lastly, the CNSC's approach to public participation is incongruous with a key pillar of Canada's open government plan and its commitment to increase the openness of federal science activities and increase the public availability of data.[53] While the CNSC Assessment points to sector-specific annual regulatory oversight reports as providing an additional comment opportunity for

[49] CNSC, Record of Decision in the Matter of Bruce Power, "Request from the Saugeen Ojibway Nation for Adjournment" (21 December 2017), p 5
[50] CNSC Assessment, p 46
[51] CNSC, Transcript of Meeting December 13, 2017, p 119
[52] CNSC Assessment, p 26 and 46
[53] Government of Canada, "Third Biennial Plan to the Open Government Partnership – Commitment 14," online: https://open.canada.ca/en/content/third-biennial-plan-open-government-partnership#toc5-3-2

the public, these annual updates only provide high-level summaries of licensee activity. The information disclosure requirements and practices are inferior and scoped more narrowly to the information permitted for review in licence renewable hearings, and the meetings do not routinely allow the public to make oral presentations. Therefore, these meetings – which are held outside of the host communities – do not provide an opportunity to ask questions of staff or licensees.

Conclusion

Having critically reviewed the conclusions reached by the CNSC in its Assessment, we affirm our recommendation that radionuclides be designated as chemicals of mutual concern under Annex 3 of the Great Lakes Water Quality Agreement.

First, while the CNSC has sought to advance the comprehensive nature of its current regulatory framework and national monitoring programs, an independent review of its programming reveals systemic deficiencies in its regulatory oversight of the nuclear industry. This is reiterated by the most recent audit conducted by the Commissioner of the Environment and Sustainable Development and also CNSC's licensing track record, where it continues to grant licences despite licensee performance graded at "below expectations."

Secondly, the CNSC's enabling legislation, the *Nuclear Safety and Control Act*, is a regulatory statute and not environmental legislation. The Act does not require the consideration of cumulative effects, nor measures which would mitigate significant adverse environmental effects. As a consequence, the CNSC's monitoring programs, assessments, and environmental planning considerations are inadequate to address whether or not anthropocentric sources of radionuclides pose an unreasonable risk to human health and the environment.

Thirdly, the CNSC's review of scientific literature is neither comprehensive in scope nor up to date. The disproportionate weight the CNSC gives to anachronistic research leaves its conclusions on the harm from radionuclides from anthropogenic sources dangerously outdated. Lastly, the CNSC has not demonstrated a willingness to facilitate open and public data, despite repeated requests from intervenors which participate in its hearing processes. The lack of comprehensive, accessible publicly-available data minimizes the ability of independent scientific experts to provide valuable insight on relevant considerations to support the decision-making process. This is especially relevant considering the shortcomings in the CNSC's regulatory oversight and environmental monitoring programs.

Upon this basis, we respectfully reiterate our recommendation that radionuclides, as a chemical originating from anthropogenic sources and posing a potential threat to human health and the environment become a designated CMC under the GLWQA.