Renomination of Radionuclides as Chemicals of Mutual Concern Under the Great Lakes Water Quality Agreement

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Five years ago, in March 2016, 110 groups submitted an application under the Great Lakes Water Quality Agreement (GLWQA) to designate radionuclides as Chemicals of Mutual Concern (CMCs) under Annex 3 of that Agreement. We submitted our nomination in reply to Environment and Climate Change Canada's (ECCC) and the U.S. Environmental Protection Agency's (EPA) call for nominations from the public.

In December 2017, the Great Lakes Executive Committee (GLEC), which oversees activities under the GLWQA, decided that they needed to develop binational screening criteria before deciding on the nominated CMCs. In March 2021, GLEC released its binational screening criteria. The ECCC and EPA co-leads of Annex 3 promised that those who had already nominated CMCs would have the opportunity to revise their nominations to reflect the new screening criteria. This is our updated nomination of radionuclides as CMCs.

After going through the new screening criteria, we come to the same conclusion as we did in March 2016:

> Given that radionuclides are persistent toxic substances, given a situation where there is a substantial number of facilities that are sources of radionuclides to the Lakes, and given the relatively closed characteristics of the Great Lakes system, which means that radionuclides build up in the system, it is essential to designate radionuclides as a Chemical of Mutual Concern so that the data and science needed will be generated and so that preventive actions can be taken to protect the Lakes from threats from radionuclides.

Part 1: Government Screening Criteria

SCREENING CRITERION 1: TOXIC: Is the chemical substance toxic, persistent, and/or bioaccumulative?

- **a. Has the chemical substance been found to be toxic?**
- **b. Is the chemical substance persistent and/or bioaccumulative?**

Are Radionuclides Toxic?

Numerous studies show toxic effects from exposure to radionuclides. These include childhood leukemia,[1] estrogen pathway disruption,[2] birth defects and abnormal pregnancy development,[3] gonadal cancer,[4] kidney damage, impaired neural development and lower IQ,[5] respiratory issues,[6] heart disease and strokes,[7] chronic fatigue immune dysfunction syndromes,[8] and thyroid cancer[9].

Recent extensive studies on nuclear workers through the International Nuclear Workers' Study (INWORKS) have shown impacts of low-dose exposures for workers are much higher than previously realized.[10] Being as these findings are based on low-dose exposures, the findings are also relevant to non-worker populations of people and wildlife.[11]

Are Radionuclides Persistent?

The International Joint Commission's (IJC) Nuclear Task Force declared in their December 1997[*] report that the radionuclides of most concern for the Great Lakes are tritium, carbon-14, iodine-129, isotopes of plutonium, and radium-226 because they present long-term toxicological and ecological problems.[12] We will look at these in discussing persistence. The IJC Task Force also listed eight other radionuclides, but here we will only use the examples of the ones they considered most serious.

Canadian regulations say that a substance is declared persistent if it has a half-life of 2 days in air, 182 days in water, 365 days in sediments, or 182 days in soil.[13] The U.S. EPA declares them persistent if they have a half-life of 2 or 5 days in air, 1 month in water, 6 months in sediments, or 2 months in soil.[14] Radionuclides have a very wide range of half-lives. Many of them are stated in years – not days. For example, tritium has a half-life of 12 years; carbon-14 a half-life of 5,730 years; iodine-129 a half-life of 1.7×10^7 years; Isotopes of plutonium (plutonium-239 half-life of 24,100 years; plutonium-241 half-life of 14.4 years); radium-226 half-life of 1,600 years. This shows that some of the radionuclides far exceed the half-lives in Canadian and U.S. regulations that would put them into the persistent category.

Are Radionculides Bioaccumulative?

Both Canada and the U.S. say that a substance is bioaccumulative when it has a bioaccumulation factor equal to or greater than 5,000.[15]

The IJC's Task Force was unable to find data on bioaccumulation for a lot of the radionuclides. For those where they found scientific studies, the bioaccumulation rates in aquatic biota (plants and invertebrates) often exceeded the factor of 5,000. They ranged from 1,000 to 300,000, with nine out of the thirteen being well over 5,000.[16]

Conclusion: Some of the radionuclides far exceed the screening criteria for being toxic, persistent and/or bioaccumulative.

SCREENING CRITERION 2: RELEASE: To what extent is the chemical substance released in the Great Lakes Basin?

a. **Are there releases of the chemical substance to water or air?**
b. **Are releases likely to increase in the future due to increasing manufacture, import, or use in Canada or the U.S.**

[*] This 1997 IJC report is referred to frequently in this submission. It is now 25 years later but, unfortunately, the report is not out of date. For evidence of it not being out of date, see: John Jackson, Radionuclides as a Chemical of Mutual Concern in the Great Lakes Basin, 2016, Part 3, pp. 13 – 15.

Are there Releases?

As a result of human activities, there are releases of radionuclides to the water, air, sediments, and land of the Great Lakes. These include on-going releases from now-closed uranium mines near Elliot Lake and the remaining tailings, and processing facility at Blind River (both near the north end of Lake Huron), fuel fabrication in places like Port Hope, on the shore of Lake Ontario (a place which has been designated as a Great Lakes Area of Concern because of contamination from radionuclides) and the West Valley Demonstration Project in New York state, medical facilities, research labs, test nuclear reactors, and from military facilities.

In addition to this are the regular releases from the 38 nuclear power reactors at 15 sites within the Great Lakes basin near the shores of all the Great Lakes except Lake Superior.[17] [See Appendix 1 for a map showing the facilities related to nuclear power generation.] Also, high-level radioactive wastes from used nuclear fuel are stored on each of these sites, creating sources for additional on-going releases.[18]

Eight of these nuclear power reactors are now permanently shut down and seven more are scheduled to be decommissioned by 2025.[19] Even when decommissioned, each of these sites will still have highly radioactive nuclear fuel in storage on-site near the shores of the Great Lakes for decades, if not centuries to come, until they are potentially moved to centralized long-term storage or disposal sites. In addition, even long after decommissioning, there will be residual radioactive materials in the soils, sediments, etc. at each site. As a result, these nuclear power plant sites may continue to be a threat to the Great Lakes ecosystem far into the future.

The Nuclear Waste Management Organization (NWMO) estimates that as of 2021, almost 60,000 tonnes of spent nuclear fuel was in storage in Canada. Ninety percent of that was at six nuclear generation stations in Ontario near the shores of the Great Lakes. By the end of the lives of the existing nuclear power plants, the NWMO estimates that the amount of nuclear fuel waste in storage near the shores of the Great Lakes will be around 106,000 tonnes.[20] On the U.S side of the Great Lakes, as of 2017, nearly 10,000 tonnes of spent nuclear fuel was stored on the sites of the nuclear power plants[21].

Given the extreme persistence of some of these radionuclides and the nature of the Great Lakes system where the waters and the pollutants have a long hydraulic residence time in the basin, it is essential to not just look at annual releases but to also take into account the cumulative releases over the years, i.e., to take into account both past, current and projected releases to the basin. For example, Lake Superior has a hydraulic residence time of 182 years; Lake Michigan 106 years; Lake Huron 21.1 years; and Lakes Erie and Ontario of just over two years.[22]

Will Releases Increase?

The IJC's Nuclear Task Force "concluded that monitoring of radionuclides in the Great Lakes primarily meets the need for compliance by users of radioactive materials with the conditions of the licenses for discharge"[23] but does not provide a useful way for understanding the amounts of releases to the Great Lakes system. A major part of this problem is that all facilities are not required to report on the same radionuclides.

Since it is currently impossible to state the extent of the releases of radionuclides into the Great Lakes basin, our answer to whether releases will increase is based on the likelihood of the sources of releases being maintained or increased.

Some more reactors around the Great Lakes may close soon, but radioactive wastes are likely to continue to be stored at each of these sites, whether they are closed or not, for decades or hundreds of years or even longer. This situation is an on-going threat to the lakes. Some nuclear power reactors within the basin have received operating licenses for another fifty years. And new reactors may be built.

Currently there is a relentless push by industry and the two federal governments to build "small nuclear reactors" (SMRs). The governments are making financial contributions to the industry to help them in developing their SMR technologies. For example, recently the US federal government contracted for $38 million to three companies to develop a SMR reactor.[24] In December 2020, the Canadian federal government released its Small Modular Reactor Action Plan to get onto "the next wave of nuclear innovation."[25]

The nuclear regulatory agencies have been preparing guidance specific to SMRs for proponents of such facilities to simplify and speed up the approval's process. For example, the CNSC has put together "Regdoc 1-1-5: Supplemental Information for Small Nuclear Reactors."[26] In August 2018, CNSC and NRC signed "a memorandum of cooperation aimed at enhancing technical reviews of advanced reactor and SMR technologies."[27]

The use of SMRs would likely result in nuclear reactors being built in parts of the basin where they are not now, including near Lake Superior. This would increase the potential for new sources of releases of radionuclides to the Great Lakes.

In addition, there are the on-going uses of research reactors at universities and the increasing use of isotopes in nuclear medicine procedures.

There is also the question of whether new long-term storage or disposal facilities will be built for low, medium, and high-level radioactive wastes in the Great Lakes basin. For example, the NWMO has narrowed down its search for one disposal site for all of Canada's high-level nuclear fuel waste to two possible locations. One of these sites is in Ontario 30 miles from Lake Huron. If chosen, this site would receive all the nuclear fuel waste now in Ontario, as well as having waste brought to it from nuclear power plants in New Brunswick and Quebec.

Also, it is important to recognize that, with so many major sources of radionuclides around the Great Lakes, the potential increases for an accident with serious releases that could have a devastating effect throughout the Great Lakes basin and beyond.[28] Cindy Folkers summarized for us the health impacts that have been found on studies in areas where catastrophes have occurred.[29]

Health Canada's Radiation Protection Bureau concluded: "As a result of the large inventories of radioactive material at these facilities [nuclear fuel cycle facilities], there is a potential for a significant accidental release of radionuclides into the environment. Although the probability of such an occurrence is extremely small, the health, social, and economic consequences could be significant."[30] Theresa McClenaghan points out the regulatory failure to plan for significant accidents in Canada:

"Regulatory capture in the nuclear industry frequently reflects a hubris that is shared among experts in both the regulated industry and the regulatory bodies, seen, for example, in the belief that "worst case scenarios" are extremely improbable and therefore need not be planned for."[31]

Conclusion: This criterion is met because there are releases to the Great Lakes from a substantial number of sources and these sources are likely to continue and may even increase.

SCREENING CRITERION 3: LEVELS: Are levels of the chemical substance harmful, or likely to become harmful, in the Great Lakes environment?

a. **Are measured concentrations of the chemical substance in the Great Lakes environment (air, water, sediment, and/or biota) nearing, meeting or exceeding benchmarks or guidelines for protection of wildlife and humans, including fish consumption advisory levels, water quality standards, etc.?**
b. **Are concentrations of the chemical substance in the Great Lakes environment (air, water, sediment, and/or biota) increasing, suggesting early action is warranted?**

Levels Meeting or Exceeding Benchmarks or Guidelines?

Because of serious data limitations, we do not have adequate knowledge of the levels of radionuclides in the Great Lakes environment. Also, there are serious limitations in the bases for the benchmarks and guidelines that exist for radionuclides. These two issues are related because data called for is usually based on needs to assess whether benchmarks or guidelines are being met.

Data available on radionuclide releases to the Great Lakes are for the most part for the purpose of determining whether a particular source, a nuclear power plant, for example, is complying with its permit.[32] Cindy Folkers points out that "NRC bases protection standards on engineering principles primarily, not public health."[33] The situation is similar in Canada. As a result, the standards are inadequate to protect the environment.

Benchmarks or guidelines for levels to protect life are limited. Most determination of safety is on the basis of maximum allowable exposure, i.e., what dose is it safe to come into contact with? This is based on only a limited understanding of cycling of radionuclides. The U.S. EPA sets as a goal for the "acceptable" level of additional cancers from a lifetime of exposure to a chemical as one in one million, with the goal of using the lower bound of 1 in 10,000 only in rare instances. By contrast, the NRC regulates for radionuclides to a level of 1 in 143 additional cancers.[34] This is a level that would not be accepted for other chemicals of concern.

The benchmarks just referred to are based on the assumption that there is an acceptable level of exposure. The U.S. National Academy of Sciences report known as BEIR (Biological Effects of Ionizing Radiation) VII Panel rejected having a threshold for acceptable radiation risk concluding that "there is no compelling evidence to indicate a dose threshold below which the risk of tumor induction is zero."[35] For genetic impacts, this report also recognized that "… there is a vast amount of evidence for radiation-induced mutations in diverse biological systems."[36] In addition, it is important to note that biota also come into contact with radiation from natural sources. Therefore, it is even more important to avoid coming into contact with additional radionuclides as a result of human activity.

In addition, there is very little monitoring for the presence of radionuclides in biota, etc. In 2016, the International Union of Radioecology concluded that radiation effects on non-human biota and the environment is still an underdeveloped field, observing that "radiation protection institutions are only starting to engage the range of expertise that can conceptualize and conduct the relevant research.[37] This reinforces the findings of the IJC Nuclear Task Force, which called for a "revised monitoring and analytical protocol with emphasis on biouptake characteristics, physiological roles and impacts."[38]

Another problem with current benchmarks and guidelines for acceptable radionuclide releases is that they are heavily based on the work of the International Commission on Radiological Protection (ICRP). These usually rely on data in marine (ocean) and river sites. The IJC Task Force stated that it was "concerned that the factors derived from riverine and oceanic systems are inappropriate for use in the Great Lakes"[39] because of the nature of the Great Lakes system, especially their relatively long hydraulic residence times. Also in an earlier report, the IJC Task Force had pointed out that it can be misleading to use "data from marine species to make judgements about freshwater species."[40]

These are only a few examples of the limitations in current data collection and in benchmarks and guidelines that make it impossible to answer CMC screening Criterion 3 for radionuclides.

Is Early Action Needed?:

As just shown, the present standards, monitoring and understanding are too poor to definitively answer this question.

Conclusion: We do not have enough benchmarks and guidelines for radionuclides in biota to have a good understanding of the risk. In addition, there are serious flaws in the benchmarks that we do have, for example, acceptable risk of additional cancers. In addition, we do not have enough monitoring and have challenges with monitoring and testing to be able to tell if the benchmarks we do have are being met.

Given that many radionuclides meet the criterion for toxicity, persistence and bioaccumulation and the criterion for releases to the basin, it is essential to use the precautionary approach in the GLWQA and designate radionuclides as CMCs with one of the goals of that designation being to address the severe limitations in the benchmarks, in biomonitoring, and in understanding of cycling of radionuclides through the ecosystem.

SCREENING CRITERION 4: ROUTE OF EXPOSURE: Are the Great Lakes a significant route of exposure to humans or wildlife for this chemical substance? Are the impacts, or likely impacts, caused by routes of exposure via:

a. **Great Lakes water?**
b. **Great Lakes sediments?**
c. **Great Lakes food web?**

The IJC's Nuclear Task Force report included an assessment of the literature and of available data to describe the quantities and composition of reported releases of radionuclides to air and water, and the distribution of these nuclides in atmospheric, aquatic and biotic compartments of the ecosystems of the

Great Lakes. They found water, sediments, air and the food web to be routes of exposure for radionuclides in the Great Lakes basin. They concluded that "the primary anthropogenic source of radionuclides is the discharge from nuclear fuel cycle facilities in the Great Lakes region."[41] They also concluded that the multiplicity of small quantities of radionuclides released from commercial, industrial, medical and research institutions "make, in the aggregate, a significant contribution to the burden of radioactive materials in the environment."[42] They pointed out that the data they were able to gather were limited because "very little of the monitoring activities are designed to address or are capable of considering the movement and cycling of radionuclides through environmental compartments and ecosystems."[43]

Conclusion: The indications are that radionuclides meet this criterion, but more research and monitoring is necessary to more completely understand the exposure routes.

SCREENING CRITERION 5: SCALE: Does the geographic scale of the levels of the chemical substance in the Great Lakes have binational significance?

a. **Is the contamination currently, or likely to become, lakewide or multi-lake in scale as opposed to localized?**
b. **Does the contamination have the potential to cause binational transboundary impacts?**

Is Contamination Only Localized?

Under the releases criterion, we identified the numerous types of sources where radionuclides are released to the Great Lakes. The map that we prepared (Appendix 1) shows the location for each of the facilities related to the generation of nuclear power. Most of them are on or very near the shores of each of the Great Lakes in both Canada and the United States, except for Lake Superior. With the exception of lakes Erie and Huron, these facilities are on both the Canadian and U.S. sides of each lake. Sources of contamination may well become even more widely spread around all of the Great Lakes if current plans by the nuclear power industry to build small nuclear reactors (SMRs) come to fruition.

Also non-nuclear power-related sources of radionuclides are scattered throughout the lakes.

Is there Potential for Transboundary Impacts?

Given the persistence of many radionuclides and given how widely spread sources for releases of radionuclides are as a result of human activities around the Great Lakes, it is inevitable that there is and will continue to be transboundary impacts.

Conclusion: This criterion is met.

SCREENING CRITERION 6: MANAGEMENT: To what extent are the releases of the chemical substance controlled/managed?

a. **Are programs and management actions for the chemical substance currently in place at the local, state/provincial, tribal, Indigenous, federal or international level?**
b. **Are current actions adequate, and/or do gaps exist?**

Do Management Programs Exist?:

Yes. The main regulatory agencies are the CNSC in Canada and the NRC in the U.S. The environmental and health agencies in both countries take a back seat to the CNSC and the NRC.

Are Current Actions Adequate?:

Here are a few examples of the major inadequacies in the ways that both the CNSC and NRC operate that have negative impacts on the Great Lakes:

1) Failure to use the guiding principles of the GLWQA to decide their decisions: The ones most important here for persistent toxic substances, which includes many radionuclides, are zero discharge, virtual elimination, the precautionary approach, and prevention. In 1994, in its Seventh Biennial Report, the IJC Commissioners called on the Federal governments to "incorporate those radionuclides which meet the definition of persistent toxic substances in their strategy for virtual elimination."[44] Both federal governments rejected this recommendation. In its response, the Canadian government said that "application of a virtual elimination strategy to radionuclides would have serious impacts on major segments of the nuclear fuel cycle within and outside the basin, including power reactors used to produce electricity and research reactors that are used in the production of medical isotopes."[45] The U.S. response included the statement: "The U.S. cannot fully support this recommendation. The majority of the long-lived radionuclides detected in the Great Lakes Basin occur naturally."[46] In its Eighth Biennial Report in 1996, the IJC Commissioners repeated their recommendation, stating "We continue to believe, however, that the consideration of radionuclides under the Agreement is important and cannot be ignored, particularly with new proposals to reprocess radioactive material in the Great Lakes Basin.[47]
2) Use of As Low As Reasonably Achievable (ALARA) standard: This means that the determination of acceptability is based on what is possible through engineering instead of what is needed to protect the environment and health. The standards are engineer-based – not health-based.[48]
3) The lack of substantial involvement of the respective country's environmental and health agencies in the decision-making by the CNSC and NRC.
4) Use of inappropriate risk factors: The acceptable yearly dose for exposure of the public to radiation is 100 millirems in Canada and in the U.S. as allowed by the NRC. Both the Canadian and U.S. dose factors work out to an "acceptable" risk for additional cancers in a lifetime of 1 in 143. This is a very weak standard in comparison with US EPA's use of 1 in 10,000 to 1 in 1 million for toxic chemicals, with the goal being 1 in 1 million. [See commentary under Criterion 3.]
5) Inadequate monitoring and reporting: Monitoring is facility and license specific and does not take into account cumulative impacts among all the sources of releases to the Great Lakes

and also does not take into account cumulative impacts over time. As was described under the route of exposure criterion above, the IJC found that the monitoring carried out was far from adequate to assess impacts on the Great Lakes system.

6) Failure to be strict with those it is regulating: After an analysis of the granting of licenses, etc., Blaise and Khan concluded: "The CNSC, by its own admission, would hold nuclear operating licence applicants to a lower standard than the Ontario Ministry of Environment and Climate Change does ECA [Environmental Compliance Approval] applicants."[49] Cindy Folkers pointed out that in the U.S. the NRC's "regulatory framework is unreliable because it depends substantially on truthfulness of licensee reporting."[50]

   Theresa McClenaghan, who has extensive experience in nuclear licensing matters, describes the problem of "regulatory capture:" "Until the long-standing problem of blurred roles and improperly conflated responsibilities for safety regulation versus nuclear technology promotion are solved, it is inevitable that regulatory capture of the CNSC by the Canadian nuclear industry will continue."[51] She describes a similar problem in research on nuclear matters: "Without independent technical research capacity, the regulator is beholden to industry and their contractors for its state of knowledge and for the projects that are authorized for funding, contrary to the goal of research independence that had been held by the AECB in its earlier days.[52]

Conclusion: The activities of the nuclear regulatory agencies in both countries have major inadequacies and gaps.

Part 2: Response from CNSC & NRC

ECCC and EPA sent our application for designation of radionuclides to the nuclear regulatory agency in each country for review. In January 2017 the U.S. Nuclear Regulatory Commission (NRC) made a nine-page comment on the application.[53] In September 2017, the Canadian Nuclear Safety Commission (CNSC) made a seventy-four-page response.[54] They both recommended that the governments not designate radionuclides as CMCs.

We commissioned three studies to review CNSC's and NRCs responses to our nomination of radionuclides.[55]

The NRC determined that "With the comprehensive regulatory framework that effectively limits radionuclide discharges already in place, designating radionuclides as chemicals of mutual concern is unnecessary, would be unduly burdensome, and would not provide a safety or an environmental protection benefit."[56]

The CNSC concluded that "radionuclides are among the most heavily regulated substances both internationally and nationally. Canada has an independent national nuclear regulatory body (i.e., the CNSC), the mandate of which is to protect the environment, and the health and safety of persons. The CNSC has no promotional role for the industry."[57] By contrast, in 2016, the Canadian Environmental Commissioner of the Environment and Sustainable Development criticized the CNSC's program for failing to "systematically" audit nuclear facilities.[58]

Under Criterion 6 above on management, we gave some of the problems with CNSC and NRC's activities, which contradict their self-assessment in their submissions opposing designation of radionuclides as CMCs.

After reviewing CNSC's and NRC's critiques of our nomination, both of our reviewers concluded that there is a conflict of interest in having the regulatory agency determine whether they are doing a good enough job. Blaise and Khan described it this way: "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."[59] The NRC itself showed this conflict by stating in its response to our nomination that "the change in designation may unnecessarily increase public concerns by implying that current regulations are not protecting public health, safety and the environment."[60] This is a political reason for denying nomination – not a scientific one.

Part 3: Conclusion

Our assessment shows that radionuclides meet all of the criteria that GLEC has chosen to determine CMCs. Also our review of the critiques by CNSC and NRC of our original application shows that their interventions in no way weaken our application.

In a few of the CMC criteria, we have pointed out serious problems with the data available, with inadequate monitoring, and with inadequate science to understand the cycling of radionuclides through the Great Lakes ecosystem, especially in a system that has so many sources of radionuclides as a result of human activities, and is more closed in nature than the places where much of the science has been carried out, i.e., in the oceans. This lack of science and ecosystem monitoring is **not** a legitimate reason to deny a nomination for a chemical of mutual concern, especially with substances like many radionuclides that have extremely long persistence and have high bioaccumulation factors.

The GLWQA tells us that we should take a preventive and precautionary approach – especially with persistent bioaccumulative toxic substances. That is why Annex 3 of the Agreement describes the actions that should be taken **once a substance has been designated** as a Chemical of Mutual Concern:

> preparing binational strategies for chemicals of mutual concern, which may include research, monitoring, surveillance and pollution prevention and control provisions. [GLWQA, Annex 3, B. 2nd 1].

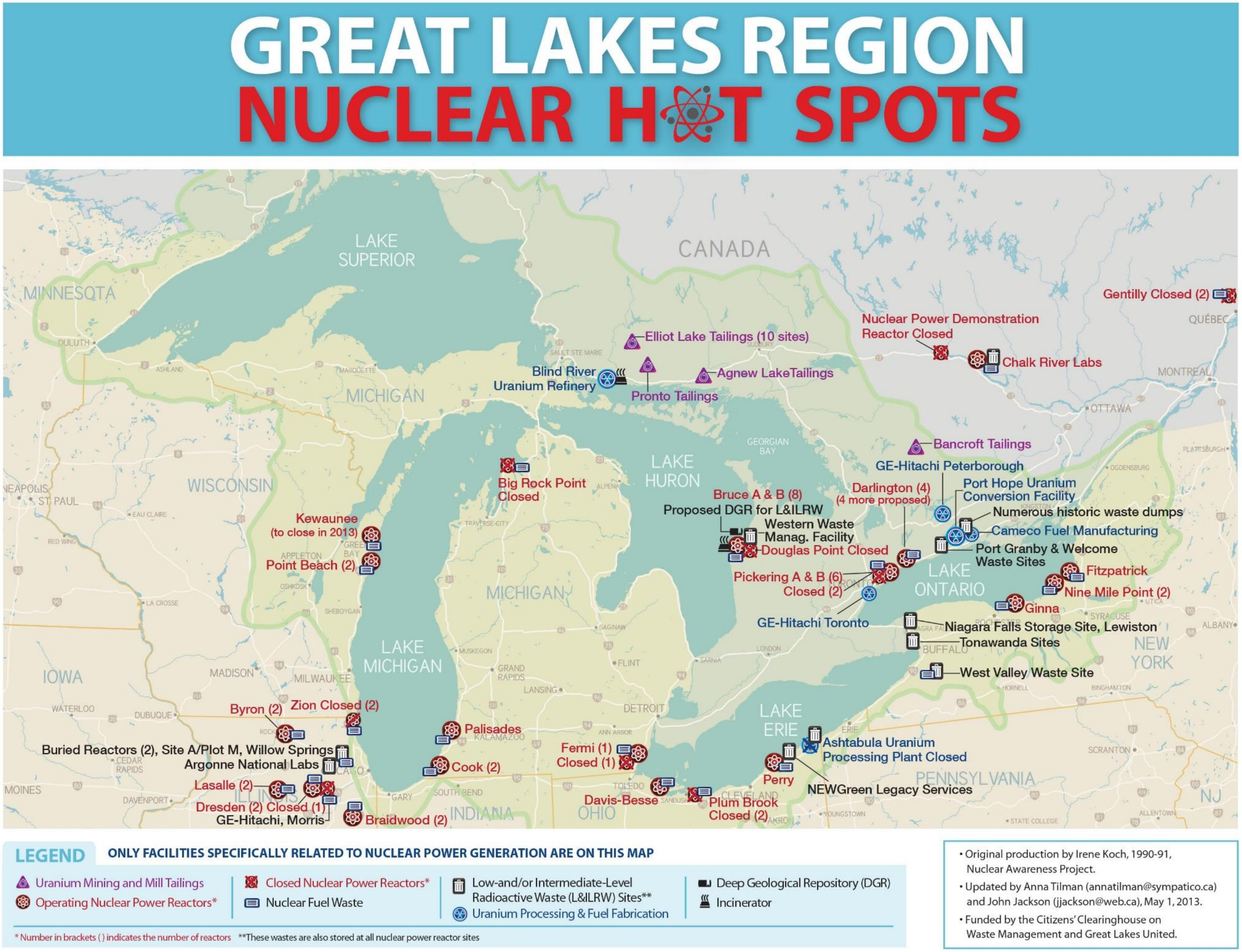
Delaying designation until more data, monitoring, and science are available is highly unlikely to generate the necessary monitoring and science to help us understand ecosystem impacts of radionuclides in the Great Lakes. In 1987, the IJC's Nuclear Task Force said: "a revised monitoring and analytical protocol with emphasis on biouptake characteristics, physiological roles and impacts would greatly help in meeting the goals of the Great Lakes Water Quality Agreement of 1978, as amended by the Protocol of 1987"[61] In the twenty-five years since that call from the IJC Task Force, there has been little improvement in the status of relevant science and monitoring on radionuclides in the Great Lakes.[62] Designation of radionuclides as CMCs should result in a plan and implementation of such a plan for making these improvements.

In addition, the very toxic, persistent and bioaccumulative characteristics of some radionuclides is enough to give us the basis under the precautionary approach in the GLWQA to take immediate action on "pollution prevention and control provisions" as called for in Annex 3 while the science is being carried out.

Therefore, we repeat our nomination of March 2, 2016 for radionuclides to be designated as CMCs under the GLWQA. As we said then:

> Given that radionuclides are persistent toxic substances, given a situation where there is a substantial number of facilities that are sources of radionuclides to the Lakes, and given the relatively closed characteristics of the Great Lakes system, which means that radionuclides build up in the system, it is essential to designate radionuclides as a Chemical of Mutual Concern so that the data and science needed will be generated and so that preventive actions can be taken to protect the Lakes from threats from radionuclides.

APPENDIX 1: Map of Facilities related to Nuclear Power Generation



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