Unexpected and Catastrophic Events

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September 2, 2025

The governments' report[2] is inconsistent with the Great Lakes Water Quality Agreement

Article 2 of the Great Lakes Water Quality Agreement (GWQA)stipulates that in pursuit of the Agreement's purpose to "maintain the chemical, physical and biological integrity of the Waters of the Great Lakes," the parties commit to "eliminate or reduce, to the maximum extent practicable, *environmental threats* to the Waters of the Great Lakes" (emphasis added). The use of the word "threats," in plain language, clearly encompasses things that are not currently happening, but rather might take place in the future. This approach is emphasized in subsection 3, which explicitly states that the parties undertake not only to resolve existing problems, but also "to anticipate and prevent environmental problems"—an approach sometimes referred to as the Precautionary Principle. Annex 3 carries this approach farther with specific reference to management of Chemicals of Mutual Concern (CMCs), seeking to achieve zero discharge and virtual elimination of these substances. "[A]chieve zero discharge" is clearly a forward-looking mandate, requiring responsible agencies and the involved public to find ways of eliminating future releases of listed chemicals.

At no place does the GLWQA say that these protective mandates are directed only at the impacts of current or routine releases of the substances in question. Instead, the Agreement requires "a life-cycle management approach" for CMCs, focusing on what may happen as the materials are created, shipped, used, released, and disposed of (Annex 3 A. 3.).

Radionuclides present special risks of releases that can be considered catastrophic and, as developed below, are possible. The fact that these risks are not current or imminent is no reason or excuse for ignoring them. There are methods and approaches for considering such risks in a public and accountable way. The Report fails to do that.

These comments will first address the reasons why it is shortsighted and self-defeating to focus only on current routine releases of radionuclides while ignoring the risks of plausible but low

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[2] Summary of Binational Screening Criteria for Nominated Chemicals of Mutual Concern Under Annex 3 of the Great Lakes Water Quality Agreement: Radionuclides (Updated Draft May 21, 2025) [hereafter cited as "Report"]

probability catastrophic releases. The Report's approach does not comport with best practices for risk assessment of such threats, and it essentially misleads the public about these risks. This is an unsustainable and indefensible approach.

Public trust in experts and governments is low, and declining. In a wide variety of settings, not only in the US and Canada but in other countries as well, trust in the competence and good faith of governments in general and expert agencies in particular has reached one of the lowest levels in living memory. This growing distrust has not yet focused specifically on nuclear power, but the example of what has happened with vaccines, especially in the United States, is a warning. Despite the fact that the US developed anti-covid vaccines at a record pace, the combination of government agencies' failures in risk communication[3] and the general public's suspicion of official pronouncements has led to a situation where responsible government agencies have been de-funded, widely reviled, and headed by people who are opposed to vaccines. Recently one of these leaders announced that development of promising mRNA vaccines might be halted because the general public had doubts about the technology.

If a similar loss of faith were to happen in the Great Lakes region, and the agencies responsible for regulating the use of nuclear materials lost credibility and capacity, we would all be losers. Some people are generally opposed to commercial use of nuclear materials in particular contexts, but regardless of one's attitude toward the underlying technology, there is one important common ground: Radionuclides are dangerous, often long-lived materials, and we need not only effective governmental management of these substances through their hazardous lives, but also public perception that the responsible agencies are honest and competent. The only way to achieve that public perception and support is by openness and full transparency. We would like to believe that we are in the safest possible position with regard to radionuclides in the Great Lakes Basin, especially with respect to catastrophic releases; but the governments initial report in response to the application to have radionuclides designated as Chemicals of Mutual Concern does not give that confidence. Instead, by its silence regarding potential catastrophic releases, it just says: "trust us." That doesn't work.

We are going through a period of physical and social instability. While it is perhaps redundant to call attention to the obvious, it merits emphasis that we as nations and societies cannot any longer plan on the basis of an assumption that things will continue to be much like they have been in the past. Climate change will affect lakes' levels and flows, and the behavior of rivers. Scenarios range from much lower lake levels to more water inputs into the lakes, raising levels. The shift among different risks may be dramatic, if the climate regime involves enhanced cycles

[3] According to some analysts, CDC and other agencies overstated the scientific support for some actions they were promoting, such as mask wearing, maintaining three-meter distances among people in crowded environments, and school closures. When experience showed that these measures were not uniformly necessary, people lost faith and turned against the agencies that had called for them.

of “drought and deluge” within the region. How will various plausible climate scenarios affect the operation of cooling systems and spent fuel pools at nuclear nuclear power facilities around the edges of the Great Lakes?

At the same time, and perhaps partly as a consequence of climatic instability, social institutions that have long seemed solid and unchanging become less dependable. Patterns and institutions of communication are rapidly evolving in new directions, and the rise of Artificial Intelligence threatens further disruption of the delivery and content of public information. Political parties are reinventing themselves in a populist direction, both reflecting and enhancing increasing polarization of the electorate. National administrations’ energy policies have oscillated between enthusiastic support and indifference or hostility toward alternatives to fossil fuels. Regulatory agencies such as USEPA have shifted between stringent regulation and laissez-faire policies. The nonprofit sector, trying to accommodate to these changes, has lost effectiveness. It is possible that relevant institutions can rebound from these conditions and resume their historical condition of reliability, but it is not a sure thing. With many vectors of change and instability in play, our nations’ ability to control radionuclides for generations to come needs to be analyzed rather than assumed.

Under any circumstances, and especially in the case of radionuclides, “complete safety” is likely an illusion. For fifty years, it has been a core maxim of risk assessment that “*a thing is safe if its risks are judged to be acceptable*. … Nothing can be absolutely free of risk.”[4] This simple truth leads to several guiding principles.

First, the work of risk assessment essentially consists of two separate activities, risk measurement and risk management. The first part, measuring risk, is properly regarded as a largely technical and therefore expert operation (though as in any technical decision with significant public consequences, transparency to assure peer and public accountability is important). Risk management, however—the task of deciding whether the measured risks are acceptable—is more a social and political determination than a scientific inquiry and thus should not be dominated by experts. The governments’ initial report merges those two separate inquiries into a single judgment that we are “safe”, which serves to exclude the public from effective participation in the aspect of risk assessment—the risk acceptability judgments—that they are most qualified to make.

Second, the concept of “risk” itself implies a forward-looking assessment of the probability or possibility of future harm. A risk assessment that looks only at current conditions is not a proper risk assessment. Past or current performance is not a guarantee of future safety. The

[4] William W. Lowrance, Of Acceptable Risk: Science and the Determination of Safety p.8 (William Kaufman, Inc. 1976).

Report falls short in this regard, because it poses the question it purports to answer only in terms of current and historical events:

> "2.0 RELEASE: To what extent *is the chemical substance released* in the Great Lakes Basin?
>
> 2.1 *Are there releases* to water or air of the chemical substance?"

It is not wrong to ask those questions about current routine releases but, as developed below, it is wrong to ask *only* those questions.

Third, a key stage in the process of risk assessment is determining what risks are worth assessing. By focusing only on current releases, the Report ignores what, to most people, is the most significant risk of radionuclides in the Great Lakes Basin: an accidental catastrophic release of radionuclides into the environment. As Cass Sunstein, the head of the White House Office overseeing risk assessment in the Obama Administration, has put it: "specialists in risk perception have long emphasized the fact that under some circumstances, people are especially averse to risks that are irreversible, potentially catastrophic, or both."[5] He notes that a common response to this type of risk is to adopt some variant of the Precautionary Principle—a principle which, as noted above, is incorporated into the Great Lakes Water Quality Agreement. Sunstein cites several examples of domestic and international regulations and agreements that include a directive to analyze low-probability risks of catastrophic events, including the 1972 Rio Declaration, the United Nations Framework Convention on Climate Change, and the Final Declaration of the First European Seas at Risk Convention. Perhaps most relevant for present purposes, Sunstein notes that the US Council on Environmental Quality directed agencies conducting environmental impact reviews to assess "impacts which have catastrophic consequences, even if their probability of occurrence is low."[6]

In short, what we are advocating is not something new or radical; rather, it is just a "best practice" established by governmental risk assessors. Commentators vary regarding the extent to which risk assessments of low-probability catastrophic events can or should be quantified, and we would certainly be willing to engage in such a discussion in this context;[7] but whether quantitative or qualitative, it seems clear that such an assessment should be done, and should be done publicly.

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[5] Cass R. Sunstein, *Irreversible and Catastrophic*, 91 Cornell L. Rev. 841, 843 (2006). The office Sunstein headed in the Obama Administration was the Office of Information and Regulatory Affairs (OIRA).

[6] *Id.* at 845.

[7] See, e.g., Lisa Heinzerling, *Book Review: The Accidental Environmentalist: Judge Posner on Catastrophic Thinking,* 94 Geo. L.J. 833 (2006).

Even the best expert judgments cannot eliminate the risk of catastrophic releases. Many nuclear facilities, such as reactors, are extremely complex entities involving many components and institutions (manufacturers, equipment suppliers, architect-engineers, operators, regulators) interacting in many different ways.[8] In this type of setting, it is difficult to foresee all significant risks and to engineer protections against them. For example, the problem of foreseeing and designing for extreme natural events is illustrated by the partial meltdowns at the Fukushima Daiichi nuclear power station in 2011. Earthquakes were a known hazard at the site, and the units comprising this facility were designed to withstand peak ground acceleration of .18 to .46g. Actual ground acceleration during the earthquake event was estimated to be as high as 2.7 to 2.9. Similarly, the design basis for withstanding an earthquake-caused tsunami was 5.7 meters, while the actual tsunami was about 14 meters. Damage from these design shortcomings was magnified by an additional poor decision: locating the generators and batteries for backup systems in the basement of the facilities, where they were vulnerable to flooding. The resulting loss of power contributed to core meltdowns in several units.

It is worth noting that the principal institutions involved in Fukushima Daiichi were not neophytes freshly encountering nuclear risks. The facility was operated by a utility, Tepco, that was long experienced in managing nuclear power plants, using a reactor designed by a company, Westinghouse, that had decades of experience in the industry, operating within a country, Japan, which had had first-hand experience of the potential harm caused by radionuclides. Yet they got it wrong, and the resulting catastrophe may take decades and some $200 billion to clean up.

Management of nuclear facilities less complex than power reactors has also shown vulnerability to accidents. Geologic storage of nuclear waste is a seemingly straightforward technology, but even in this field the 2014 fire and resulting release of radionuclides at the US Waste Isolation Pilot Plant[9] is a warning that many things can go wrong.

We are not suggesting that nuclear facilities in the Great Lakes Basin are likely to experience similar accidents (though we note that there have been some near misses in this region, ranging from the partial core meltdown at the Fermi plant outside Detroit, to the boric acid leak eroding the cladding on the reactor vessel at Davis-Besse near Toledo). The point is that there are real (if indeterminate) risks of catastrophic releases,

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[8] E.g., Charles Perrow, Normal Accidents 4-5, 15-31 (Basic Books, Inc. 1984)
[9] EPA Response to 2014 Radioactive Release at the Waste Isolation Pilot Plant (WIPP), https://www.epa.gov/radiation/2014-radiological-event-wipp

and that there should be maximum public participation and public accountability in working to understand and minimize those risks.[10]

[10] Researchers have found that near misses are important warning signs of potential catastrophe, but they are often misinterpreted. Catherine H. Tinsley, Robin L. Dillon and Peter M. Madsen, *How To Avoid Catastrophe,* Harvard Business Review, April 2011:

> Our research reveals a pattern: Multiple near misses preceded (and foreshadowed) every disaster and business crisis we studied, and most of the misses were ignored or misread. Our work also shows that cognitive biases conspire to blind managers to the near misses. Two in particular cloud our judgment. The first is "normalization of deviance," the tendency over time to accept anomalies—particularly risky ones—as normal. . . . The second cognitive error is the so-called outcome bias. When people observe successful outcomes, they tend to focus on the results more than on the (often unseen) complex processes that led to them.