State of Radionuclides in the Great Lakes

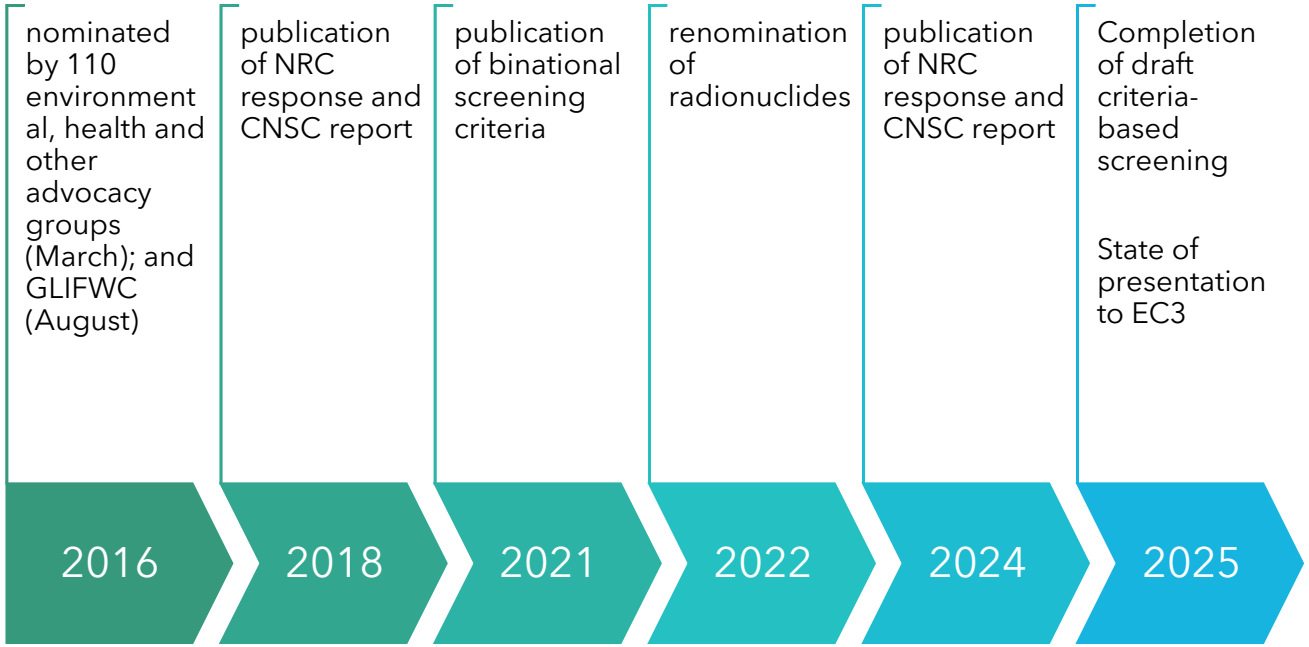
A review of the findings of the criteria-based screening for radionuclides

Overview

Photo credit: the Detroit News

1. Review of nomination
2. State of radionuclides in the Great Lakes Basin (GLB)
3. Questions

Nomination timeline



Key Concerns from nominators

Original NGO nomination

- Effects on health and wildlife
- Number of nuclear facilities near the shores of the GLs
- Continuous discharges and high probability of accidents during transportation
- GLs are particularly susceptible to PBT substances
- Scientific, medical and public concerns about threats posed by radionuclides – no safe level of exposure

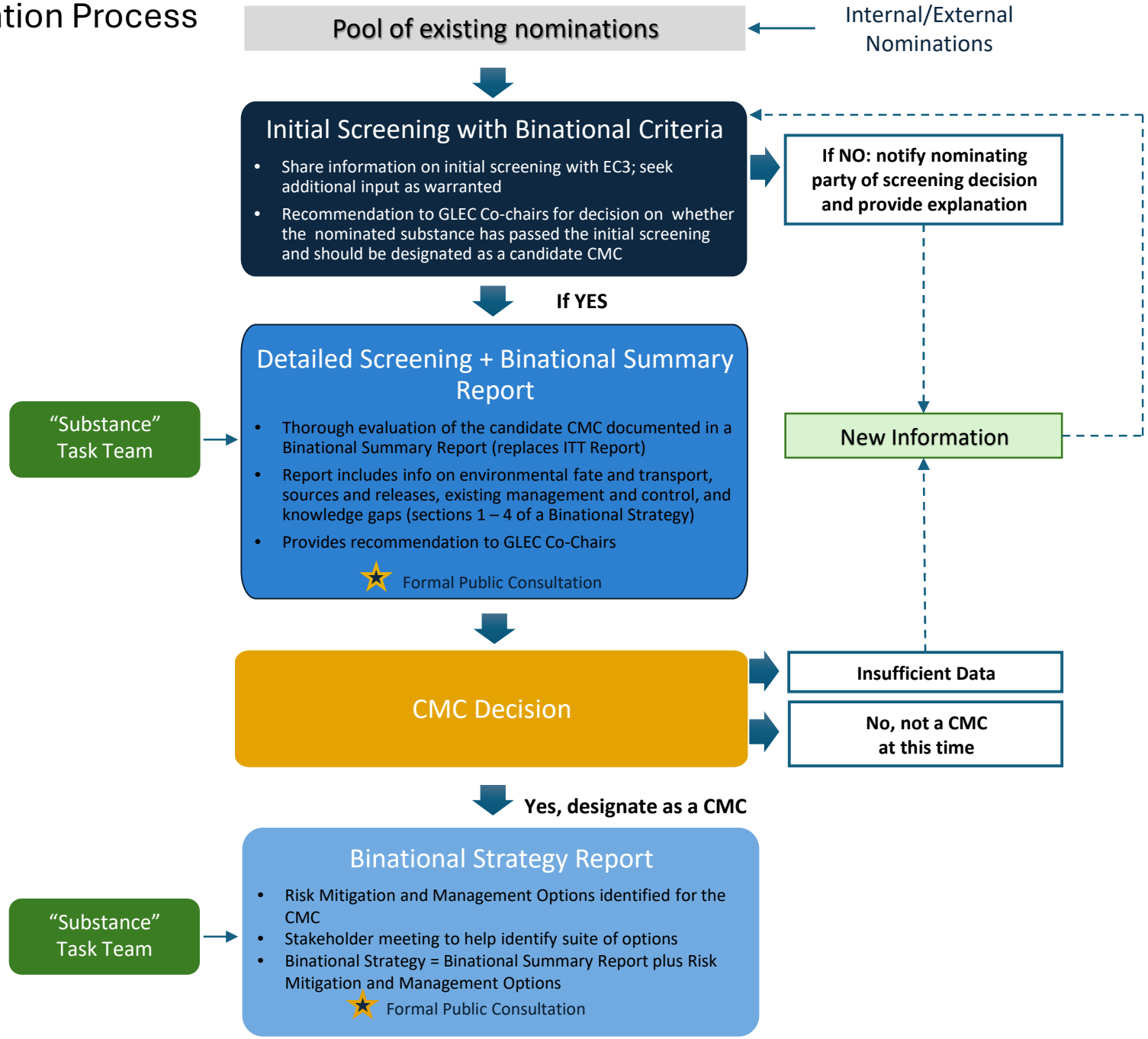
GLIFWC nomination

- Drinking water exceedances of radon and uranium on some reserves (due to geology of the area) and this water supply eventually enters WWTPs and ultimately the GLs
- There is no safe level of exposure

Renomination

- Some radionuclides exceed screening criteria for being PBT
- Ongoing releases from a number of sources, likely to continue and increase
- Present standards and monitoring are insufficient to determine impacts to the GLs environment
- GLs are a likely route of exposure, more research/monitoring need to understand routes of exposure
- There are and will continue to be transboundary impacts
- Major inadequacies in nuclear regulatory agency management activities

CMC Designation Process



Criteria	Initial Screening Results
Toxic?	✓ evidence of toxicity
Persistent Bioaccumulative?	✓ Some radionuclides ✓ Some radionuclides
Extent of Release?	✓ to air and water **X** Releases likely to increase, but continue to be small and well below limits
Levels?	**X** No significant evidence of exceedances of guidelines/reference levels **X** despite increased nuclear activity, radionuclide exposure has decreased
Route of Exposure?	**X** data does not suggest water is a significant route of exposure ✓* Port Hope AOC, sediment remediation to be completed in 2026 **X**- data does not suggest food web is a significant route of exposure
Scale?	**X** Contamination is not lakewide or multi-lake **X** No potential to cause binational transboundary impacts
Management Actions?	✓ Programs and management actions in place ✓Management actions considered adequate ✓ Some Gaps in management and data exist

Photo credit: Great Lakes Now

Summary of the results of the criteria-based screening

TOXIC: is the chemical substance toxic, persistent or bioaccumulative?

- **Some radionuclides are toxic.**
- **Some radionuclides are persistent.**
- **Some radionuclides are bioaccumulative.**

RELEASE: to what extent is the chemical substance released in the GLB?

- Canadian side of GLB has a total of 20 nuclear reactors at 3 sites (14 in operation)
- No active uranium mines or milling in Ontario; 11 decommissioned sites
- 2 refining and conversion facilities: Blind River Refinery (BRR) & Port Hope Conversion Facility (PHCF)
- 3 fuel fabrication facilities: Cameco fuel manufacturing*, BWXT Toronto & Peterborough
- 3 interim storage waste-management facilities: Western Waste Management, Pickering and Darlington waste management facilities
- 2 long-term waste management facilities: Port Hope Long-Term Waste Management Facility (LTWMF) and Port Granby LTWMF

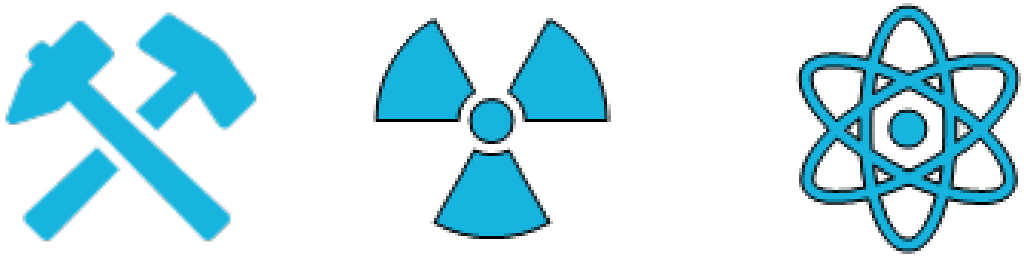
Release: to what extent in the Great Lakes Basin on the U.S. side?

- 12 operating nuclear facilities
  - 8 on shores of Lake Michigan, Lake Erie, or Lake Ontario
  - 4 within 75 miles of Lake Michigan
- 5 closed

RELEASE: to what extent is the chemical substance released in the GLB?

Source:

Main Potential Sources Identified:



Are there releases to water or air?

YES; however releases are small and well below regulatory limits. Adequate measures have been made through existing regulatory measures for the protection of US and Canada from exposure to radionuclide releases, including tritium.

Are releases likely to increase in the future?

Releases are expected to remain small, even with a potential increase in number of active sources. Adequate measures are in place to manage releases.

LEVELS: are levels of the chemical substance harmful, or likely to become harmful, in the Great Lakes environment?

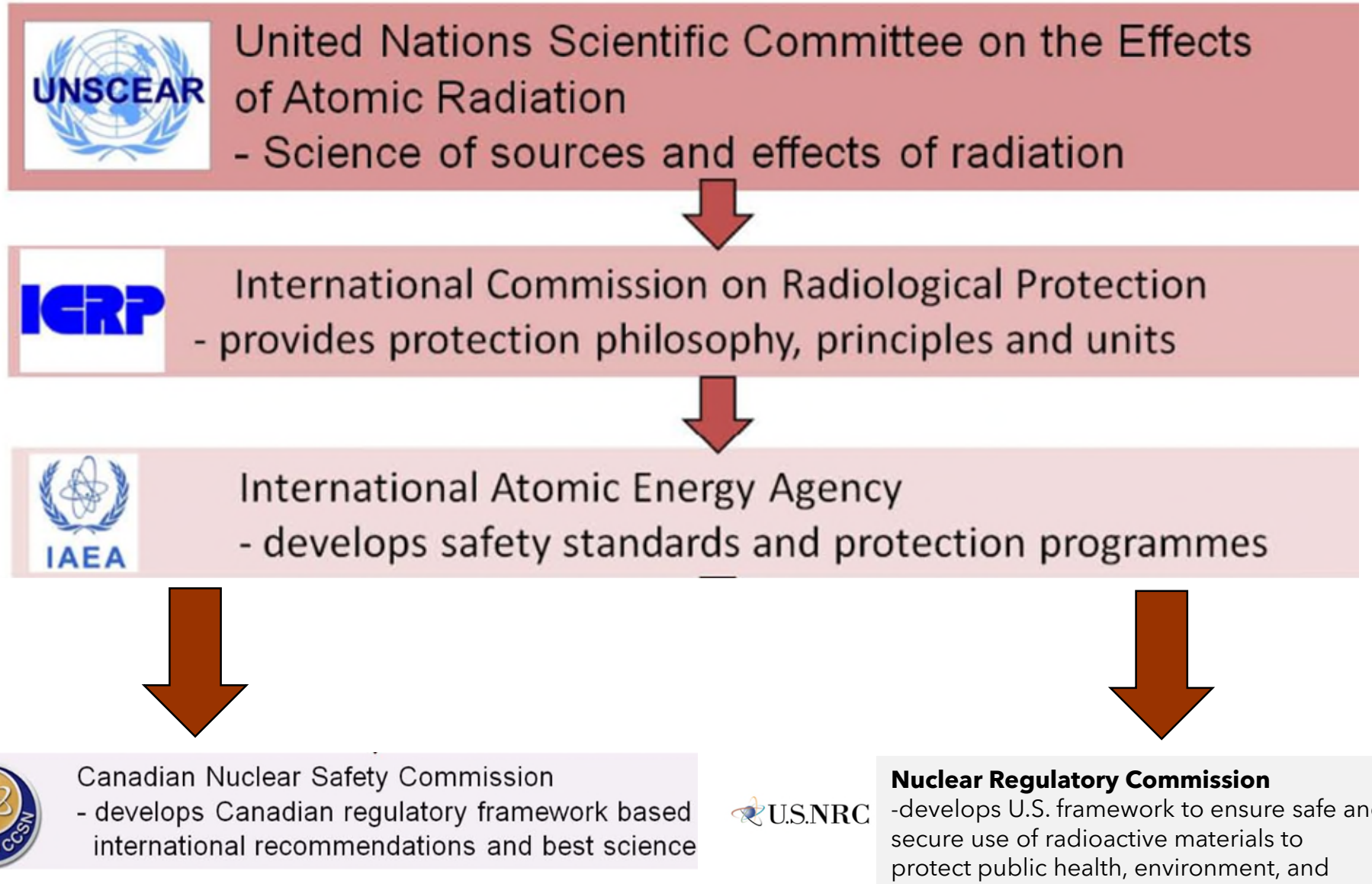
Are measured concentrations of the chemical substance in the GLs environment (air, water, sediment, and/or biota) meeting or exceeding guidelines for the protection of wildlife and humans.

No. There is no significant evidence of exceedances of guidelines/reference levels for measured parameters

Are concentrations of the chemical substance increasing, suggesting early action is warranted?

Despite increase in nuclear power generation since the 1970s, radionuclide exposure as a whole has decreased.

The core radiation science and safety organizations and their roles with respect to protecting the public and the environment from ionizing radiation



ROUTE OF EXPOSURE: are the GLs a significant route of exposure to humans or wildlife?

Are the impacts, or likely impacts, caused by routes of exposure via Great Lakes water, sediment* or food web?

No. Evidence shows that radionuclides associated with nuclear power plant operations in the Great Lakes contribute a negligible radiation dose to humans and to non-human biota and do not pose a risk to the aquatic environment.

SCALE: does the geographic scale of the levels of the substance in the GLs have binational significance?

Is the contamination currently, or likely to become, lakewide or multi-lake in scale as opposed to localized?

No. While there is evidence of tritium signatures associated with liquid effluent releases from CANDU (CANada Deuterium Uranium) reactors, there is no evidence of levels that are a concern from a lakewide or multi-lake perspective

No, NRC report show no evidence of levels that are a concern.

Does the contamination have the potential to cause binational transboundary impacts?

No. While there is evidence of tritium signatures associated with liquid effluent releases from CANDU reactors, there is no evidence of levels that these levels have the potential to cause transboundary impacts

No, NRC reports show no evidence of levels that are of concern.

MANAGEMENT: to what extent are the releases of the chemical substance controlled/managed?

Federal – Canada

Acts: *Nuclear Safety and Control Act, Nuclear Terrorism Act, Impact Assessment Act, Canadian Environmental Protection Act, Transportation of Dangerous Goods Act, Nuclear Waste Fuel Act, Nuclear Liability and Compensation Act, Radiation Emitting Devices Act.*

Regulations: *General Nuclear Safety and Control Regulations, Radiation Protection Regulations, Class I Nuclear Facilities Regulations, Class II Nuclear Facilities and Prescribed Equipment Regulations, Uranium Mines and Mills Regulations, Nuclear Substances and Radiation Devices Regulations, Packaging and Transport of Nuclear Substances Regulations, Nuclear Security Regulations, Nuclear Non-Proliferation Import and Export Control Regulations.*

Policy: *Radioactive Waste Policy Framework*

Federal Arrangements: the CNSC has a memorandum of understanding (MOU) with the following agencies: Transport Canada, Health Canada, the National Energy Board, Fisheries and Oceans Canada, Environment and Climate Change Canada, the Minister of the Environment; *Federal Provincial Territorial Radiation Protection Committee, the Port Hope Area Initiative*

MANAGEMENT: to what extent are the releases of the chemical substance controlled/managed?

Federal – Canada

Environmental Monitoring: NSCA licensee Effluent Monitoring and Environmental Monitoring Programs, CNSC's Independent Environmental Monitoring Program, Canadian Radiological Monitoring Network, Fixed Point Surveillance Network, Health Canada's Total Diet Study, National Pollutant Release Inventory

Provincial – Ontario

Ontario Energy Board Act, the Electricity Act, the Environmental Protection Act, the Ontario Water Resources Act, the Environmental Assessment Act

MOU between CNSC and Office of the Fire Marshall and Emergency Management

Ontario Drinking Water Surveillance Program, Ontario Reactor Surveillance Program

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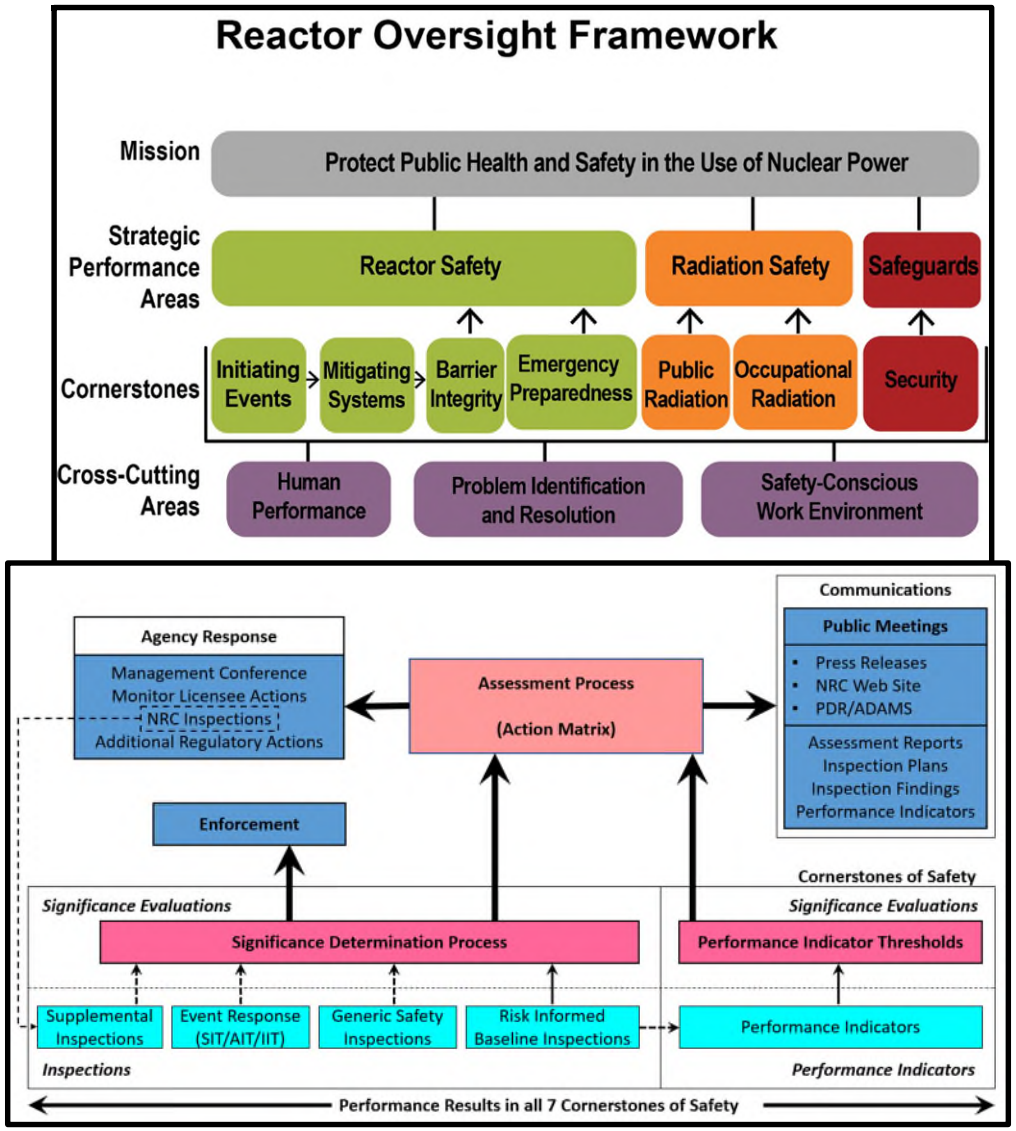

- NRC oversight and existing regulatory framework ensures that radionuclide release levels will remain at levels that are within regulatory limits and criteria, ensuring adequate protection of the public and the environment
- Licensees are required to maintain equipment and processes to ensure releases result in doses that are within limits
- NRC oversight includes inspection by resident and regional-based subject matter expert inspectors
- US EPA and states have established MCLs for community water systems
- U.S Department of Energy is responsible for medical waste and legacy waste

MANAGEMENT: to what extent are the releases of the chemical substance controlled/managed?

Are programs and management actions for the chemical substance currently in place?

Yes, there is significant oversight and regulation by numerous committees and government agencies.

Are current actions adequate, and/or do gaps exist?

Yes, current actions are adequate

Gaps: guidelines are not available for all radionuclide/matrix combinations; there is a growing desire to incorporate attributes of ecosystem science into radiological risk assessment; opportunity to improve consistency in data

Data Gaps

Known data gaps	The availability of guidelines for all relevant radionuclide/matrix combinations was a limitation noted during a recent Canadian radionuclide status review
	The need for further integrating ecosystem science and ecological receptors in assessment of radionuclide contamination is being recognized at the international level and is an emerging areas of research
	There is an opportunity to improve consistency and cross-talk between radionuclide data from federal programs, and potentially beyond, such that their analytical compatibility is improved

Summary

Photo credit: the Independent

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Questions?

Background

Sources for Canadian Monitoring Data on Radionuclides

Government of Canada – Radionuclide Release Datasets Radionuclide Release Datasets - Open Government Portal

Canadian Radiological Monitoring Network Open Government Portal

Fixed Point Surveillance Network 2024 Dose Data from the Fixed Point Surveillance Network - Canada.ca

Health Canada's Total Diet Study Concentration of Contaminants and Other Chemicals in Food Composites - Canada.ca

CNSC Independent Environmental Monitoring Program Independent Environmental Monitoring Program (IEMP)

Ontario Drinking Water Surveillance Program Drinking Water Surveillance Program - Dataset - Ontario Data Catalogue

Bruce Power Environmental Protection Reports Publications - Bruce Power

Ontario Power Generation Regulatory Reporting Reporting | Regulatory reporting – OPG