

Principles of Radioactive Waste Management

Nuclear Waste Watch Preparatory Workshop for NRCan
Radioactive Waste Policy Review

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This presentation compares the radioactive waste management principles developed by the International Atomic Energy Agency – the IAEA - to Canada’s current radioactive waste policy, and to a set of principles developed by Canada’s nuclear regulator – the Canadian Nuclear Safety Commission, or CNSC.

I will also briefly discuss the radioactive waste principles in a 2017 joint declaration issued by the Anishinabek Nation and the Iroquois Caucus.

Introduction: 1994 IAEA Principles of Radioactive Waste Management

Radioactive waste occurs in a variety of forms with very different physical and chemical characteristics, such as the concentrations and half-lives of the radionuclides:

- gaseous form, such as ventilation exhausts from facilities handling radioactive materials;
- liquid form, ranging from scintillation liquids from research facilities to high level liquid waste from the reprocessing of spent fuel;
- solid form, ranging from contaminated trash and glassware from hospitals, medical research facilities and radiopharmaceutical laboratories to vitrified reprocessing waste or spent fuel from nuclear power plants

In 1994, the IAEA introduced its set of radioactive waste management principles by describing these three types of waste.

IAEA Principles of Radioactive Waste Management (1994)

“The objective of radioactive waste management is to deal with radioactive waste in a manner that protects human health and the environment now and in the future without imposing undue burdens on future generations.”

The IAEA’s overall objective for managing radioactive waste was to deal with it in a manner that protects human health and the environment with imposing burdens on future generations.

The IAEA provided nine principles to achieve that objective. These principles were later superseded by a 2006 publication, but they provide a useful starting point for comparison with Canada’s existing waste policy.

Principle 1: Protection of human health Radioactive waste shall be managed in such a way as to secure an acceptable level of protection for human health.

Principle 2: Protection of the environment Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment.

Principle 3: Protection beyond national borders Radioactive waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will be taken into account.

Principle 4: Protection of future generations Radioactive waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.

Principle 5: Burdens on future generations Radioactive waste shall be managed in such a way that will not impose undue burdens on future generations.

Principle 6: National legal framework Radioactive waste shall be managed within an appropriate national legal framework including clear allocation of responsibilities and provision for independent regulatory functions.

Principle 7: Control of radioactive waste generation Generation of radioactive waste shall be kept to the minimum practicable.

Principle 8: Radioactive waste generation and management interdependencies Interdependencies among all steps in radioactive waste generation and management shall be appropriately taken into account.

Principle 9: Safety of facilities The safety of facilities for radioactive waste management shall be appropriately assured during their lifetime.

The IAEA's nine principles included protecting human health, protecting the environment, avoiding burdens on future generations, minimizing waste, and providing independent regulatory functions.

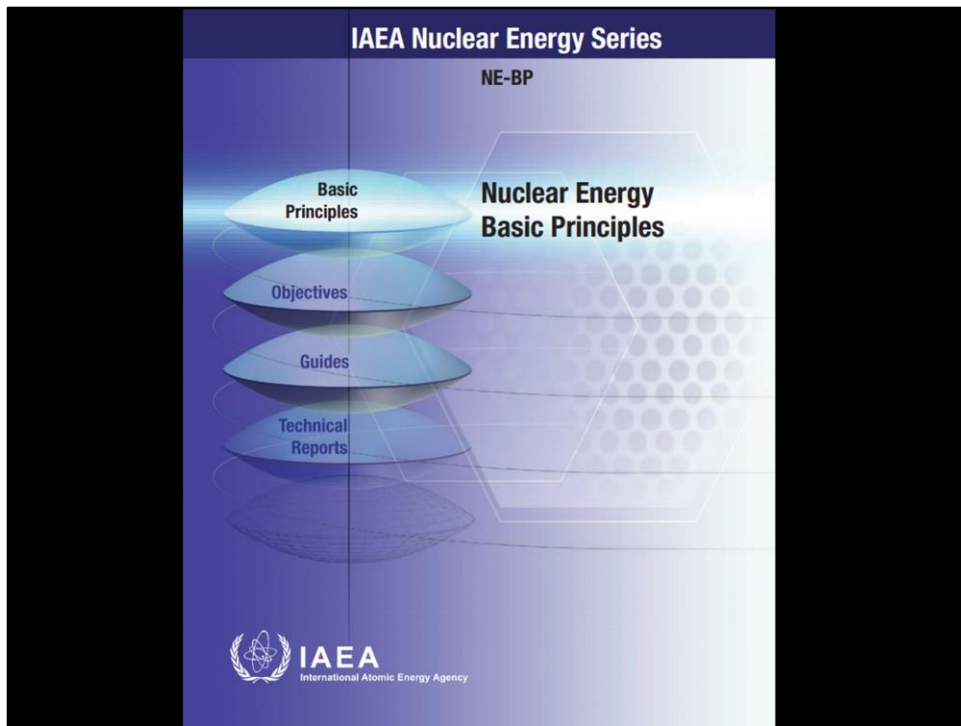
Key questions: What is an "acceptable" level of protection of human health or the environment? Who decides?

Aarhus Convention

- the right to receive environmental information held by public authorities: **access to environmental information**
- the right to participate in environmental decision-making: **public participation in environmental decision-making**
- the right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general: **access to justice**

With regard to “Who decides?”, the United Nations Economic Commission for Europe (UNECE) [Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters](#) , which was adopted in 1998 in Aarhus, Denmark, establishes a number of rights of the public, including individuals and their associations, with regard to the environment.

Although Canada is not a Party to this convention, these three rights could be considered as basic principles worth including in radioactive waste management policy.

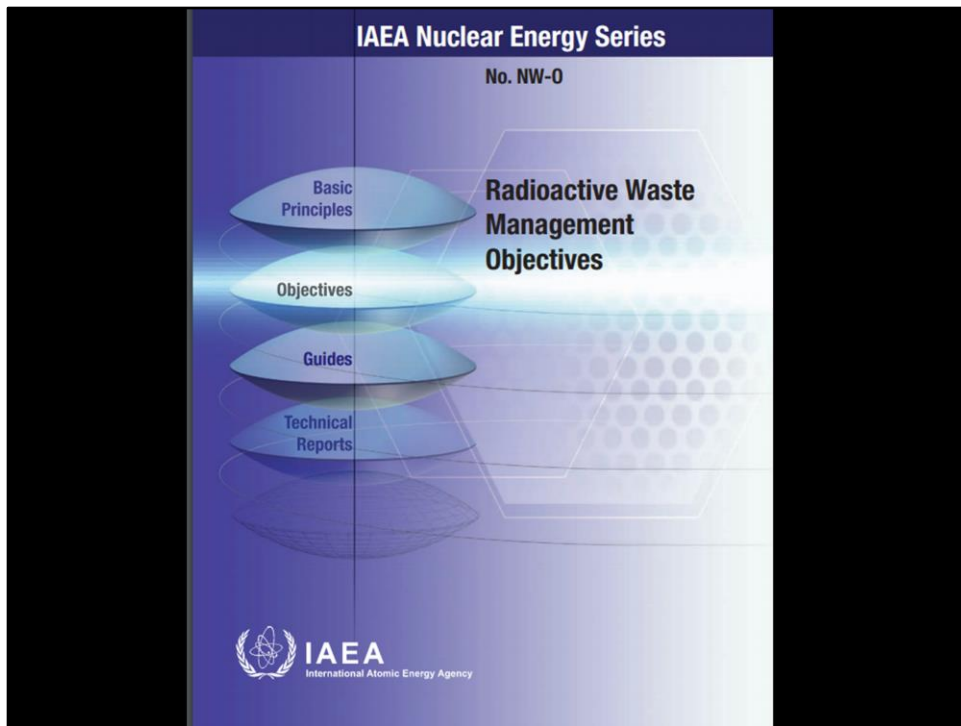


The 2008 *Nuclear Energy Basic Principles* are at the top tier of the hierarchy of the IAEA's Nuclear Energy Series.

IAEA Nuclear Energy Principles

- **Benefits**
- **Transparency**
- **Protection of people and the environment**
- **Security**
- **Non-proliferation**
- **Long term commitment**
- **Resource efficiency**
- **Continual improvement**

These are the IAEA's eight nuclear energy basic principles.



In this second-tier document, [*Radioactive Waste Management Objectives*](#), the IAEA tries to explain how its eight basic principles relate to radioactive waste.

IAEA Radioactive Waste Objectives

Benefits *Minimization of generation and optimization of the management of radioactive waste.*

Transparency *Establishment of methods and approaches for building trust among persons involved and affected by the management of radioactive waste.*

Protection of people and the environment *Implementation of radioactive waste management methods that ensure the protection of people and the environment.*

Security *Implementation of physical protection systems relevant to radioactive waste.*

Non-proliferation *Incorporation of nuclear safeguards requirements in the design and operation of radioactive waste management facilities.*

Long term commitment *Development of solutions that provide for the long term management of radioactive waste.*

Resource efficiency *Promotion of radioactive waste management methods and schemes that save resources and utilize them efficiently.*

Continual improvement *Steady improvement of methods and technologies in radioactive waste management.*

Under “Benefits”, the IAEA calls for waste minimization. “Transparency” is a very important principle. The IAEA says that siting of radioactive waste repositories raises particular public concerns, and that progress can be made only if “concerned members of the public believe and respect the persons and organizations responsible for implementing the waste management procedures.”

Under “Security” IAEA cites two types of radioactive waste that pose particular security threats -- disused high activity radioactive sources and spent nuclear fuel. Canada has large amounts of both. Under “Non-proliferation” the IAEA points out that spent nuclear fuel could be processed and the recovered nuclear material used in the production of nuclear weapons.

Long-Term Commitment

“The legacy from the early nuclear era and early nuclear weapons production and testing has left many areas of the world affected by radioactive contamination due to poorly managed uranium mining operations, accidents at production facilities, and from weapon testing... these areas should be remediated with priority given to the areas with people living in the vicinity.”

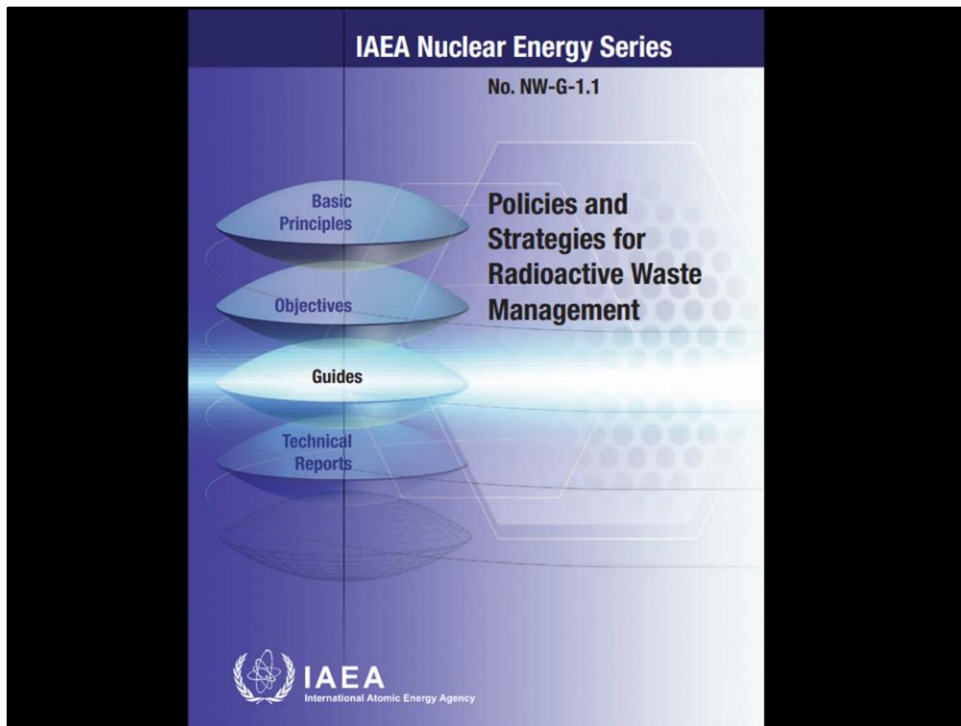
The principle of “Long-Term Commitment” is particularly important given Canada’s involvement in the early nuclear era, which included production of uranium and plutonium for nuclear weapons. Contaminated areas in Canada dating back to that era include uranium mines, the Port Hope area, and the Chalk River Laboratories.

Resource Efficiency - A Problematic Principle

- The IAEA says “essential principles of waste minimization should be followed... i.e. to reduce, reuse and recycle.” It adds, “Many components used throughout the nuclear energy chain can be reused and recycled, ranging from site locations and plant equipment to fuel (uranium, thorium and plutonium) and construction materials.”
- However, “recycling” of metals from reactors can cause radioactive contamination of metal scrap.
- “Recycling” of fuel to extract plutonium creates problematic high-level reprocessing wastes and creates risks of nuclear weapons proliferation.

All the elements of the IAEA’s eight principles should not be accepted uncritically. Some may lead to conflicts. For example, under “Resource Efficiency”, the IAEA appears to endorse fuel reprocessing as a way of minimizing waste. This practice, not currently done in Canada, creates problematic high-level wastes and increases risks of nuclear weapons proliferation .

Recycling of radioactive metals from reactor components can contaminate scrap metal supplies. Reuse of site locations could be interpreted as allowing reactors to be converted into permanent waste disposal facilities, as in the proposals for so-called in-situ decommissioning of shut-down federal reactors in Manitoba and Ontario.



The third tier in the IAEA's Nuclear Energy Series also has ideas worthy of consideration and debate.

Containment and Isolation, or Release to the Environment?

- The generally preferred approach for the management of radioactive waste is to concentrate the waste and to contain the radionuclides in it by means of a waste matrix and waste container followed by disposal in an appropriate disposal facility designed to provide isolation from the biosphere.
- For radioactive waste in liquid and gaseous forms, however, it may be appropriate to release them into the environment provided that their concentrations are sufficiently low to satisfy the requirements set by the national regulatory body.

These two bullet points from the IAEA *Policies and Strategies* document raise a number of questions.

The IAEA refers to containment and isolation of radioactive waste from the biosphere as a “generally preferred approach.” But should containment and isolation from the biosphere be a fundamental principle of Canadian radioactive waste management policy?

What is an “appropriate” disposal facility? Who decides?

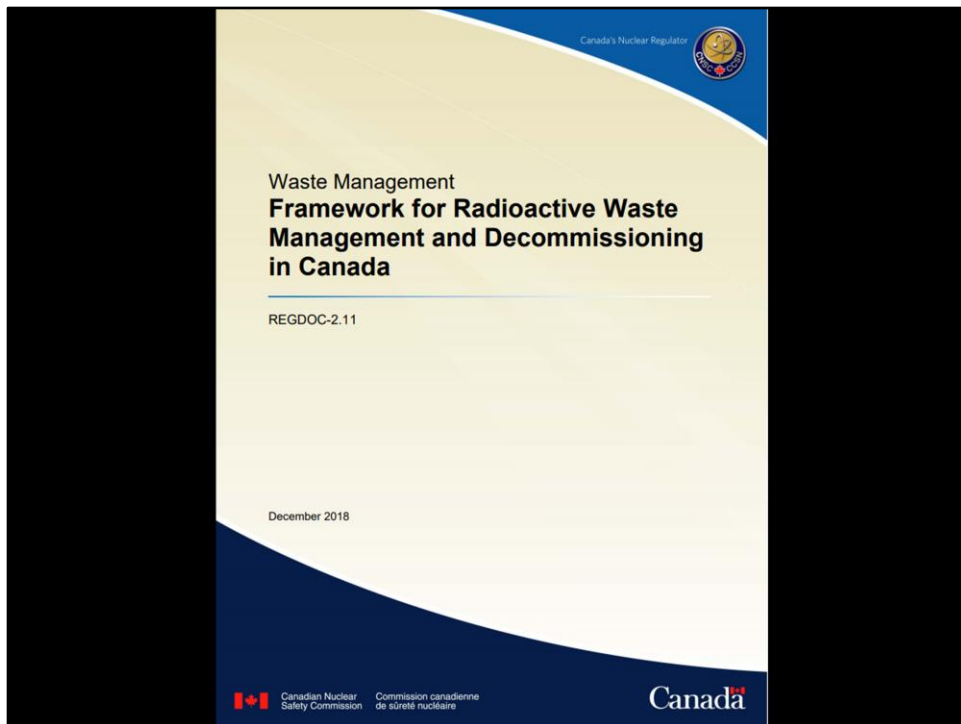
What concentrations of waste are “sufficiently low” to release to the environment? Should the public trust the national regulatory body to make the right decisions?

Canada's Radioactive Waste Policy Framework

- The federal government will ensure that radioactive waste disposal is carried out in a safe, environmentally sound, comprehensive, cost-effective and integrated manner.
- **The federal government has the responsibility to develop policy, to regulate, and to oversee producers and owners** to ensure that they comply with legal requirements and meet their funding and operational responsibilities **in accordance with approved waste disposal plans.**
- **The waste producers and owners are responsible, in accordance with the principle of "polluter pays", for the funding, organization, management and operation of disposal and other facilities required for their wastes.** This recognizes that arrangements may be different for nuclear fuel waste, low-level radioactive waste and uranium mine and mill tailings.

This is Canada's 1996 *Radioactive Waste Policy Framework*. It sets no overall objective for managing radioactive waste. It has only one principle – “polluter pays”. It makes no mention of protecting human health. But this is the extent of Canada's current radioactive waste policy.

It says the federal government is responsible for policy, regulation and oversight; but in practice, the federal government has delegated its policy, regulation and oversight responsibilities to the CNSC. It refers to “approved waste disposal plans”, but provides no basis for their approval. It says waste owners must fund and operate waste facilities but provides no guidance on what types of facilities might be acceptable.



In 2018, CNSC staff published a document with six principles they use in “making regulatory decisions about the management of radioactive waste.” They released this document without consultation or public notice. It was never approved by the CNSC’s so-called “Independent Commission,” an administrative tribunal set up at arm's length from government.

The CNSC’s six principles do not address the IAEA’s *Basic Nuclear Energy Principles* issued in 2008. They appear to be a watered-down version of the IAEA’s nine principles issued in 1994. The next few slides compare the 2018 CNSC principles and the 1994 IAEA principles.

| IAEA | CNSC |
|---|--|
| <p>1. <i>Protection of human health</i> Radioactive waste shall be managed in such a way as to secure an acceptable level of protection for human health.</p> <p>2. <i>Protection of the environment</i> Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment.</p> | <p>The management of radioactive waste is commensurate with the waste's radiological, chemical and biological hazard to the health and safety of persons, to the environment and to national security.</p> |

In the 1994 principles, the IAEA used the verb “shall”, which is the strongest language in legal terms. The IAEA says that waste shall be managed to protect human health and the environment; the CNSC refers to waste management that is “commensurate with the hazard”.

| IAEA | CNSC |
|--|--|
| <p data-bbox="292 285 615 363"><i>3. Protection beyond national borders</i></p> <p data-bbox="292 382 722 691">Radioactive waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will be taken into account.</p> | <p data-bbox="765 285 1182 730">The trans-border effects on the health and safety of persons and the environment that could result from the management of radioactive waste in Canada are not greater than the effects experienced in Canada</p> |

Canada's long border with the U.S. includes the Great Lakes. Canada must acknowledge its responsibility for protection beyond national borders.

| IAEA | CNSC |
|--|---|
| <p data-bbox="279 282 608 349">4. <i>Protection of future generations</i></p> <p data-bbox="279 359 686 591">Radioactive waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.</p> | <p data-bbox="722 282 1179 552">The predicted impacts on the health and safety of persons and the environment from the management of radioactive waste are no greater than the impacts that are permissible in Canada at the time of the regulatory decision.</p> <p data-bbox="722 600 1172 832">The assessment of future impacts of radioactive waste on the health and safety of persons and the environment encompasses the period of time during which the maximum impact is predicted to occur.</p> |

With regard to protection of future generations, the IAEA used the phrase “levels of impact that are acceptable today.” This would appear to allow new knowledge of radiation hazards to be incorporated into radioactive waste management practices.

The CNSC uses “impacts that are permissible at the time of the regulatory decision.”

IAEA

CNSC

5. *Burdens on future generations*

Radioactive waste shall be managed in such a way that will not impose undue burdens on future generations.

The IAEA's 1994 *Principles of Radioactive Waste Management* were superseded by a 2006 document with more general "*Fundamental Safety Principles*." The newer IAEA document retains the following language: "Radioactive waste must be managed in such a way as to avoid imposing an undue burden on future generations."

The 2006 document also says "All practical efforts must be made to prevent and mitigate nuclear or radiation accidents," and that "Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents." Not burdening future generations, preventing accidents, and preparing for emergencies – these fundamental principles should be included in Canadian radioactive waste management policy.

IAEA

CNSC

6. *National legal framework*

Radioactive waste shall be managed within an appropriate national legal framework including clear allocation of responsibilities and provision for independent regulatory functions.

The CNSC was created when the *Nuclear Safety and Control Act* came into force on May 31, 2000. The *Act* has no mention of waste, leaving Canada without an appropriate national legal framework. While the *Act* does not address waste management it has language allowing the CNSC to license the abandonment of a nuclear substance or facility.

Unlike other IAEA member states, Canada has no provision for independent regulatory functions, such as an independent body to deal with radioactive waste. The CNSC issues licenses that incorporate waste management standards developed jointly with the nuclear industry. The Nuclear Waste Management Organization, or NWMO, is an industry body that deals only with spent fuel rods.

IAEA

7. Control of radioactive waste generation

Generation of radioactive waste shall be kept to the minimum practicable.

CNSC

The generation of radioactive waste is minimized to the extent practicable by the implementation of design measures, operating procedures and decommissioning practices

We will discuss waste minimization later in this webinar.

| IAEA | CNSC |
|--|------|
| <p data-bbox="294 289 735 415">8. <i>Radioactive waste generation and management interdependencies</i> Interdependencies among all steps in radioactive waste generation and management shall be appropriately taken into account.</p> | |

Canadian policy should recognize interdependencies among different steps in waste generation.

Reactor refurbishment and reactor decommissioning generate large quantities of long-lived radioactive waste.

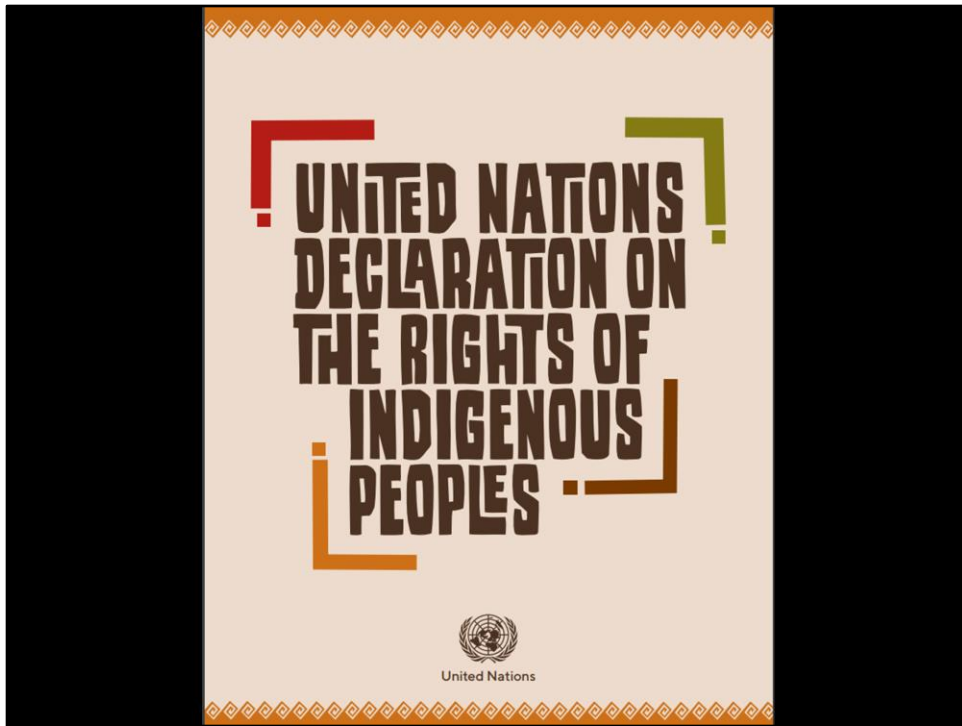
All six federal nuclear reactors – Douglas Point, Rolphton, Whiteshell, Gentilly-1, and Chalk River - are shut down. Ontario Power Generation’s Pickering reactors are currently scheduled to be shut down at the end of 2024.

Lack of consideration of interdependencies may explain why CNSC approves refurbishment and decommissioning plans that make no provision for long-term management of refurbishment and decommissioning wastes.

| IAEA | CNSC |
|--|---|
| <p data-bbox="294 285 605 324">9. <i>Safety of facilities</i></p> <p data-bbox="294 343 728 556">The safety of facilities for radioactive waste management shall be appropriately assured during their lifetime.</p> | <p data-bbox="768 285 1162 683">The measures needed to prevent unreasonable risk to present and future generations from the hazards of radioactive waste are developed, funded and implemented as soon as reasonably practicable.</p> |

The IAEA requires that safety of facilities for waste management be “assured during their lifetime.”

The CNSC uses “as soon as reasonably practicable.”



The U.N. Declaration on the Rights of Indigenous Peoples speaks to management of hazardous wastes in Indigenous territories.

Article 29

2. States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent.

This U.N. declaration, which Canada has agreed to uphold, requires states to ensure that no hazardous waste storage or disposal take place without the free, prior and informed consent of Indigenous peoples.



ANISHINABEK NATION

Joint Declaration between the Anishinabek Nation and the Iroquois Caucus on the transport and abandonment of radioactive waste

No Abandonment: Radioactive waste materials... must be kept out of the food we eat, the water we drink, the air we breathe, and the land we live on for many generations to come.

Monitored and Retrievable Storage: Continuous guardianship of nuclear waste material is needed. This means long-term monitoring and retrievable storage.

Better Containment, More Packaging: The right kinds of packaging should be designed to make it easier to monitor, retrieve, and repackage insecure portions of the waste inventory as needed, for centuries to come.

Away from Major Water Bodies: Rivers and lakes are the blood and the lungs of Mother Earth. When we contaminate our waterways, we are poisoning life itself.

No Imports or Exports: The import and export of nuclear wastes over public roads and bridges should be forbidden except in truly exceptional cases after full consultation with all whose lands and waters are being put at risk.

In May 2017, The Anishinabek Nation and the Iroquois Caucus issued a joint declaration on the transport and abandonment of radioactive waste. The declaration opposes nuclear waste abandonment. It calls instead for continuous guardianship, with monitored and retrievable storage of wastes. It calls for with better containment and more packaging. It says waste facilities should be sited away from major water bodies. It allows waste transport only in exceptional cases after full consultation.

These important principles – no abandonment, monitored and retrievable storage, containment and isolation of radioactive waste away from the biosphere and major water bodies, and strict limits on transport, should be included in Canadian radioactive waste policy.