

Transport of radioactive waste

Submitted to the NRCan Radioactive Waste
Policy Review by



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Introduction

- There are NO regulations or policies specifically covering transport of radioactive wastes, as opposed to radioactive commodities (i.e. yellowcake, uranium hexafluoride, medical isotopes, industrial sources. . .).
- Transport of radioactive waste should not take place without strong justification, full transparency, and public input.

Transport of radioactive waste entails different risks from transport of radioactive commodities that are uniform in composition and are well characterized. Radioactive waste generally contains a complex mixture of radioisotopes. Its components are difficult to characterize and pose a range of significant hazards in the event of accidental release. The lack of regulations and standards specific to transport of radioactive waste creates unacceptable risks to conveyers, first responders, and the general public. Transport of radioactive waste should not take place without strong justification, full transparency, and public input.



Some will remember the January 2000 MOX fuel incident. Jean Chretien had agreed to see if waste plutonium from dismantled U.S. and Russian nuclear weapons could be used as mixed oxide fuel in CANDU reactors.

U.S. regulations prohibit air shipment of plutonium. The U.S. trucked the plutonium from New Mexico to Sault Ste. Marie.

Transport Canada had agreed not to ship the plutonium by air. But the CNSC's predecessor quietly sent a letter saying the fuel packaging could withstand most accident conditions in air transport. Transport Canada backed down. The plutonium was put in a helicopter and flown to Chalk River.

Loss of capacity at Transport Canada

- Transport Canada formerly took responsibility for public consultation and licensing of hazardous radioactive materials shipping
- A highly controversial instance was the MOX shipments from Russia and the US twenty years ago – after consulting the transportation routes and promising no flights, the MOX from the US was flown in through Sault Ste. Marie
- A judicial review was commenced because of this inconsistency with public expectations and resolved when Transport Canada committed to reconsult
- However ever since they have deferred to CNSC on these approvals through an MOU

Ever since the MOX incident Transport Canada has deferred to CNSC on matters related to shipments of radioactive materials.

Memorandum of Understanding between the CNSC and Transport Canada, 2018

[http://www.nuclearsafety.gc.ca/eng/pdfs/MoU-Agreements/2018-Memorandum-of-Understanding\(MOU\)-Between-Transport-Canada-and-the-CNSC-eng.pdf?ver=2](http://www.nuclearsafety.gc.ca/eng/pdfs/MoU-Agreements/2018-Memorandum-of-Understanding(MOU)-Between-Transport-Canada-and-the-CNSC-eng.pdf?ver=2)

Policies needed specific to transport of radioactive waste

- Waste transport only in exceptional cases
 - destination should be a long-term management facility
 - avoid double-handling or “consolidated interim storage”
 - ensure that records are transferred and retained
- Requirements for shippers prior to waste transport
 - proper characterization, packaging and labelling (wastes often contain a mix of difficult-to-measure substances)
 - waste packages that provide adequate shielding/containment
 - transport plans that anticipate and minimize risks to transporters, public, emergency responders
- Authorize multiple public agencies to enhance safety
 - Transport Canada, Environment and Climate Change Canada, Health Canada have relevant specialist knowledge

Canada needs policies specific to transport of radioactive waste. Wastes should not be transported unless they have been fully characterized, emergency response plans are in place in case of an accident, and the recipient has approved measures for long-term management and record-keeping.

Population exposure (P) during radioactive waste transport by road

P-same – exposures to people travelling in the same direction as the waste

- A car might follow a waste shipment a long way before passing or turning off.
- In a traffic jam, one could be stuck in front, beside or behind a shipment.

P-opp – exposures to people travelling in the opposite direction.

- Briefer exposures to a larger number of people.
- Adverse health effects (cancers, genetic damage) proportional to TOTAL population dose (average dose x number of people).

P-mov - exposures to stationary people along the route

- Individual doses are brief but repeated for years.
- Radiation exposures are cumulative (causing “delayed effects”).

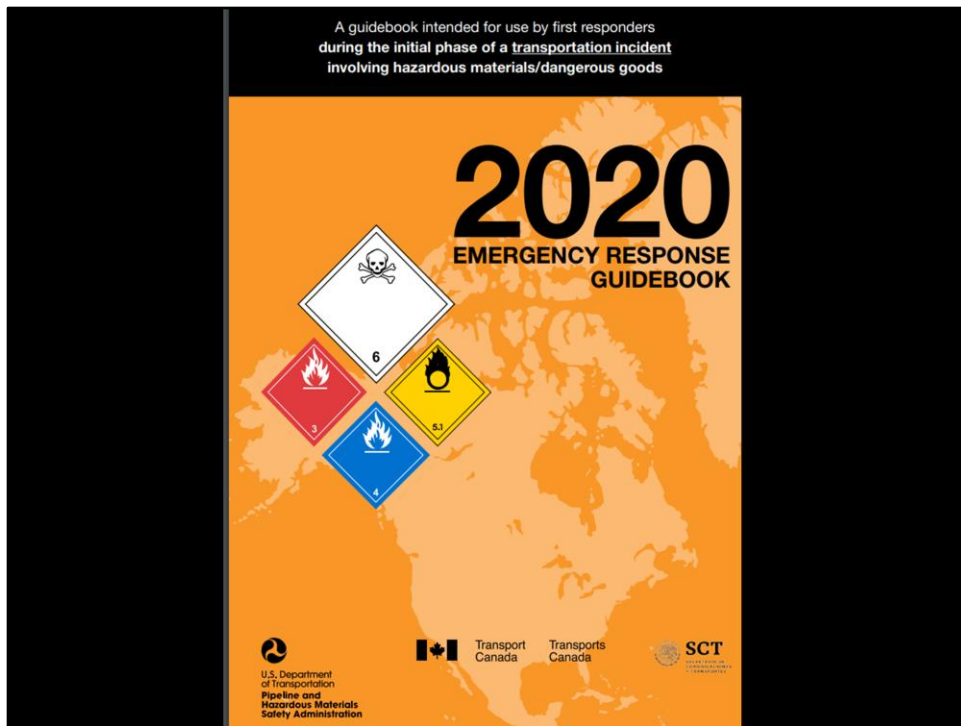
P-stop - exposures to people from stopping the truck carrying the waste

- Those in the vicinity get an unusually prolonged exposure.
- NWMO documents say each transport truck will have a bed on board so a second driver can take over without stopping for more than a minute.
- In case of accident, this dose can be much higher – with or without leaks.

People in vehicles adjacent to a truck carrying radioactive waste are exposed to gamma radiation that penetrates the walls of the waste containers.

Individual exposure is related to direction of travel and duration of exposure. Total radiation exposure, or population dose, is related to the average individual exposure times the number of people exposed.

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As noted earlier, CNSC now controls nearly all matters related to radioactive material transport. Transport Canada is only involved in emergency response.

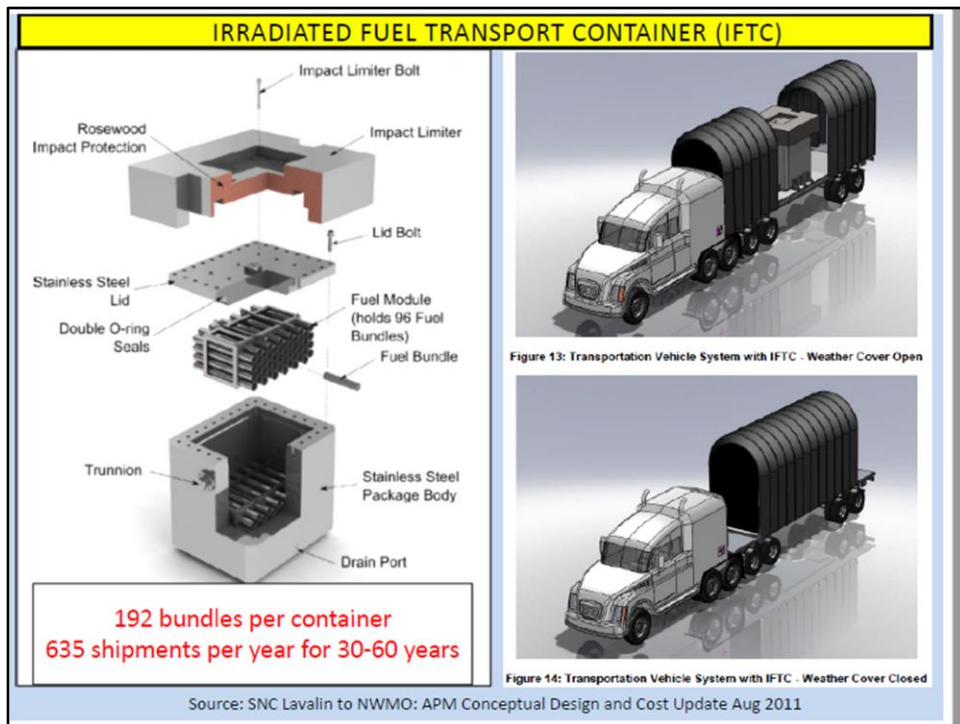
Excerpts from Emergency Response Guidebook Guide 163 – Low to High Level Radiation

- Damaged packages may cause higher external radiation exposure, or both external and internal exposure if contents are released.
- Type A packages (cartons, boxes, drums, articles, etc.) contain non-life-endangering amounts. Partial releases might be expected if packages are damaged in moderately severe accidents.
- Type B and Type C packages (large and small, usually metal), contain the most hazardous amounts. Life-threatening conditions may exist if contents are released or package shielding fails.
- Radioactive Yellow-II and Yellow-III labelled packages have higher radiation levels. The label identifies the maximum radiation one meter from a single undamaged package.
- Some radioactive materials cannot be detected by commonly available instruments.
- Water from cargo fire control may cause pollution.

Guides 161 to 166 in Transport Canada's *Emergency Response Guidebook* deal with radioactive materials. Guide 163 warns that life-threatening conditions may result from release of package contents, that not all radioactive materials are easily detected, and that water from fire control may cause pollution.



CNL's Integrated Waste Strategy, which has not been consulted on or approved by the federal government, calls for shipping federal radioactive waste to Chalk River, including high-level fuel waste for consolidated interim storage.



This is a proposed transport container for high level fuel waste.

Case study: Waste transport to Chalk River

CNL's Whiteshell Labs Closure Project (2020-2029) includes

- Low-Level Waste (LLW) - 1500 shipments
- Intermediate-Level Waste (ILW) - 500 shipments
- **High-Level Waste (HLW) reactor fuel - 46 shipments**

As of July 2019, 3,557 m3 of Whiteshell LLW and 18 m3 of ILW had been transported to Chalk River in 175 shipments.

- evidence lacking of proper characterization, labelling, packaging
- Over 1800 planned shipments remained as of July 2019; most high-risk ILW and HLW shipments yet to be done

Chalk River receiving additional waste shipments

- CNL "Integrated Waste Strategy" calls for consolidating all other federal radioactive wastes at Chalk River
- commercial waste shipments (e.g., imports of "disused" Cs-137 and Co-60 gamma irradiators, and expired tritium exit signs)
- federal government assumes ownership of commercial wastes

CNL is already shipping Whiteshell low- and intermediate-level waste 1900 kilometers along the Trans-Canada Highway to Chalk River. CNL receives additional shipments of commercial waste for storage at Chalk River. These wastes, some imported from around the world, become the property of the federal government.

When it was noted at a 2019 CNSC hearing that the 46 planned shipments of high-level waste to Chalk River were never approved by the government and there had been no consultation about them, AECL responded that they accepted them. CNL said it decides whether to notify the public on a case-by-case basis. CNL added that it is working with NWMO to facilitate transport of high-level waste. CNSC said that the waste packages assure safety. CNSC cited an incident when a truck carrying a high-risk source caught fire and melted but the package and source were unaffected.



Canadians were horrified and first responders were shocked by a November 2017 fiery crash involving tanker trucks and several cars on a highway north of Toronto. Would radioactive waste containers remain intact in such a scenario?

CRL Waste Management Area H

- WMA H Expansion will support $\sim 72,000 \text{ m}^3$ ($\sim 4,000$ sea cans) of LLW
- Expandable to provide an additional $50,000 \text{ m}^3$ by stacking containers five high if required



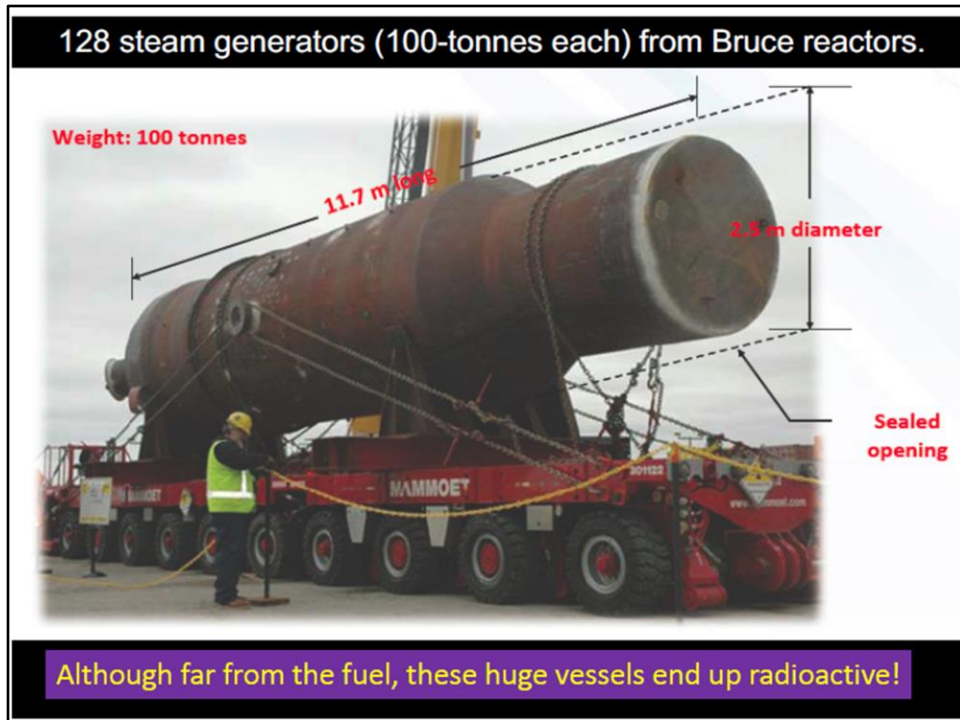
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UNRESTRICTED / ILLIMITÉ

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CNL is piling up trailer loads of radioactive building demolition wastes from Whiteshell and Chalk River. It plans to drive them directly into a giant mound, mix them with other radioactive waste, and abandon the trailers and their contents.



In a rare victory for public safety, First Nations and environmental groups blocked Ontario Power Generation plans to ship radioactive steam generators through the Great Lakes, St. Lawrence, and across the Atlantic Ocean to Sweden for metal recycling.

Policy Recommendations

A new set of regulations shall be formulated in conjunction with Transport Canada and first responders governing transport of radioactive waste, including requirements for

1. detailed justification of the need for transport,
2. documentation suitable for first responders, and
3. a thorough consideration of alternatives to transport.

Transport of radioactive waste shall only be allowed if the proponent can demonstrate an improvement in security and environmental protection as a result.

Any shipper of radioactive waste shall be required to provide a thorough manifest of radionuclides to accompany each shipment – with half-lives, activity levels (in becquerels and becquerels per kilogram or per litre), type of radioactive emission, radioactive progeny and target organs – in language meaningful to first responders.

Information about the radioactive inventory shall be communicated to Indigenous peoples and the public in plain language stripped of scientific jargon or abbreviations.

Transport of irradiated fuel from other CNL sites to the Chalk River site, or to any other site that is not chosen as the site for a final HLW repository, shall not be permitted.

An extensive consultation process shall be initiated – with input from all appropriate ministries, from Indigenous peoples, and from the public – to develop a new classification scheme for radioactive waste materials based on health and environmental considerations rather than ease of handling.

The federal government and Transport Canada should re-engage in the regulation of radioactive waste transport. Wastes should not be transported unless this will result in demonstrable improvements in security and environmental protection. Contents of waste shipments should be fully disclosed so that health risks can be assessed and first responders can respond appropriately to emergencies. A new radioactive waste classification scheme should be developed that addresses health and environmental considerations.