



# ASSEMBLY OF FIRST NATIONS

Nuclear Waste Technical Backgrounder Series

Part Three: *Transportation*



Canada currently has over 2 million used fuel bundles in temporary storage at reactor sites in New Brunswick, Quebec, and Ontario. All those bundles will need to be shipped from their current locations to the deep geological repository (DGR) by road, rail, or water, depending on the location of the facility. It is estimated that by the time the DGR is complete, there will be over 3.5 million used fuel bundles to be transported. This will be an enormous undertaking spanning several decades, and will require adherence to strict safety guidelines to prevent or mitigate accidents and their potentially disastrous consequences. The regulation of dangerous goods (which include radioactive materials) transported in Canada is shared between Transport Canada and the Canadian Nuclear Safety Commission (CNSC).

Based on estimates by the NWMO, if all the waste were transported by road, this would require over 50 trips per month over a span of 30 years. This totals about 19,000 shipments. Fewer trips would be required for rail and water modes of transport, however road transportation would still be required for portions of the trip. With such extensive transportation requirements, the used nuclear fuel will most likely be transported through First Nation territories or treaty lands. This could potentially adversely affect First Nations Treaty and Aboriginal rights, which requires that the Crown consult with First Nations peoples and governments to minimize the negative impacts and ensure that their concerns and recommendations are taken into account.

During the NWMO's public dialogue sessions, concern was expressed regarding the risks associated with transportation of used nuclear fuel. This is understandable simply given the amount of transportation required and the fact that during transport, the used nuclear fuel is in the public domain.

### ***Transportation Packages***

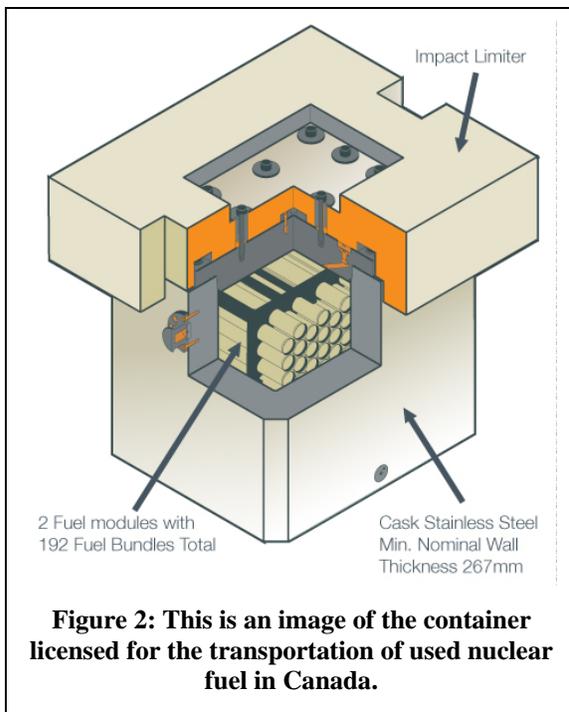
Transportation packages are specially designed to withstand severe accident conditions such as a train accident or truck rollover. The packages themselves are massive and provide physical protection and containment of the radioactive material as well as



shielding from radiation. A current package certified for the transport of used nuclear fuel in Canada is made of 30cm thick stainless steel and weighs approximately 35 tonnes.



**Figure 1:** These images illustrate the kind of tests done on used nuclear fuel shipping containers. The transport truck stops on the railroad tracks to simulate a stalling scenario, while a fast moving train slams into the flatbed directly. The shipping container is slightly damaged, but the contents remain contained.



**Figure 2:** This is an image of the container licensed for the transportation of used nuclear fuel in Canada.

Every package design must meet severe performance requirements outlined in regulations to demonstrate the ability to withstand impact, fire, and immersion in water. Some specific tests that packages must undergo are: a free drop of 9 meters onto a solid, unyielding surface; a 1 meter free drop onto a rigid vertical bar to test penetration resistance; exposure to an 800 degree Celsius fire for 30 minutes; and immersion in 15 meters of water for 8 hours.

Packages used for the transport of used nuclear fuel are designed to retain their integrity during the various conditions that may be encountered while they are being transported, ensuring that an accident will not have any major consequences. Packages of used nuclear fuel are checked prior to shipping and, when it is found to be necessary, cleaned to remove contamination.



When used nuclear fuel is transported, it is important to ensure that the radiation exposure of those involved in its transport as well as the general public along transport routes is limited. Packaging for used nuclear fuel transport casks includes shielding to prevent radiation exposures. Packages of used nuclear fuel are also labelled in accordance with the requirements of Canadian and international regulations. These labels indicate that the material is radioactive by including a radiation symbol. Personnel directly involved in the transport of radioactive materials are trained to take appropriate precautions and to respond in case of an emergency.



**Figure 3: This map shows the current storage sites of used nuclear fuel, which will have to be transported from these locations to the DGR site. Approximately 90% of Canada's used nuclear fuel is located in Ontario.**

Every year, about 1 million packages of nuclear materials (mostly for medical use) are successfully shipped in Canada. Here and around the world,

transportation safety regulations are similar and are based on the standards developed by the International Atomic Energy Agency (IAEA). The IAEA is an international organization created by the United Nations to promote the safe, secure, and peaceful use of nuclear technologies.

Since 1971, there have been over 7000 shipments worldwide of used nuclear fuel over many million kilometres with no property damage or personal injury, no breach of



containment, and low dose rate to the personnel involved. This includes about 300 sea voyages in specialized ships covering over 8 million kilometres. Used nuclear fuel will not be transported by air, however, because the shipping casks are not tested for airline accidents (i.e. high altitude drops) and the size and weight of the shipping containers make it impractical. Transportation options, therefore, are limited to road, rail, and water routes.

Before beginning the process of transporting the used nuclear fuel, the NWMO will iron out the specific provisions of the transportation program and will engage in dialogues with communities along the transportation routes to address their concerns in planning the program. Their strategy for developing a transportation plan includes: monitoring of international best practices, and ensuring up-to-date technology for transportation; adopting an integrated approach to siting the DGR that includes the implications of transportation; consulting interested and potentially affected communities and developing implementation plans collaboratively with them, including transportation modes, routes, and emergency response training and equipment.

### ***Transport Regulations***

The IAEA publishes advisory regulations for the safe transport of radioactive materials, including used nuclear fuel. These regulations are recognised throughout the world as the basis for both national and international transport safety requirements in this area.

Requirements based on the IAEA regulations have been adopted in about 60 countries, including Canada. The IAEA regularly updates its regulations to ensure they reflect the latest technologies and knowledge, and publishes these regulations in its *Regulations for the Safe Transport of Radioactive Material*.

With respect to the transport of used nuclear fuel in Canada, it is the CNSC's responsibility to:

- certify packages that transport nuclear substances
- register users of certified packaging



- conduct inspections of nuclear shipments for compliance with applicable regulations
- evaluate radiation protection programs for transport

CNSC issues licences and certificates for the packaging and transport of nuclear substances as specified in the *Packaging and Transport of Nuclear Substances Regulations*. Canada's *Nuclear Security Regulations* require that any application for a license to transport used nuclear fuel contain specific information such as:

- a threat assessment consisting of an evaluation of the nature, likelihood, and consequences of acts or events that may place the nuclear material at risk;
- a description of the method of transport;
- the proposed security measures;
- the communication arrangements made among the licensee, the operator of the land vehicle transporting the used nuclear fuel, the recipient of the material and any off-site response force along the route;
- the arrangements made between the licensee and any off-site response force along the route; and
- the alternate route to be used in case of emergency.

Each method of transport has its own challenges and risks. Canada's regulations have specific requirements for each mode of transport to respond to these associated risks. In addition, Emergency Response Assistance Plans (ERAPs) are required by the *Transportation of Dangerous Goods Regulations* for the transport of used nuclear fuel. The plans are intended to assist local emergency responders by providing them with technical experts and specialized equipment at an accident site.

The plan will explain how specialists and other personnel with knowledge, equipment and skills will be available at accident sites. These plans supplement those of the carrier and of the local and provincial authorities, and must be integrated with other organizations to help minimize the consequences of an accident.