

# Canada's Approach to the Transport of Radioactive Materials

Karen Owen-Whitred, Anna Lee

Canadian Nuclear Safety Commission, 280 Slater Street, Ottawa, Ontario, Canada K1P 5S9

## Abstract

The Canadian Nuclear Safety Commission (CNSC) is the federal regulator for nuclear energy and materials in Canada. The CNSC's mandate includes the regulation of all nuclear materials in Canada to protect health, safety security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective, scientific, technical and regulatory information to the public. The CNSC's regulatory framework is based on the *Nuclear Safety and Control Act* (NSCA), under which there exist a suite of 13 associated regulations. To navigate these regulations and provide further clarity of its expectations, the CNSC has created a set of regulatory documents (REGDOCs) which generally detail the CNSC's approach to regulating the nuclear industry.

With respect to transportation activities, the CNSC's regulatory framework begins with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR 2015), which apply to all persons transporting, or offering for transport, nuclear substances. The PTNSR 2015 introduces an ambulatory reference to the IAEA's *Regulations for the Safe Transport of Radioactive Material* (as amended from time to time), thereby ensuring that Canada's domestic regulations continue to remain aligned with international regulations for the packaging and transport of nuclear substances. In addition to the PTNSR 2015, transport activities must also comply with the *Transportation of Dangerous Goods Regulations*, which are implemented by Transport Canada and deal with the transport of all classes of dangerous goods. Although the CNSC is the sole federal regulator for the use of nuclear substances in Canada, the CNSC and Transport Canada work cooperatively to maintain regulatory oversight of the transport of radioactive material, while minimizing regulatory overlap. Finally, the CNSC's regulatory document framework includes a number of REGDOCs related to transport, in order to further explain to licensees and applicants in the transportation sector what they must achieve in order to meet the requirements set out in the NSCA and the PTNSR 2015.

This paper will provide an overview of the CNSC's regulatory approach to the transportation of radioactive materials in Canada, its partnership with Transport Canada, and the use of regulatory documents to disseminate regulatory information related to transportation.

## Introduction

The *Nuclear Safety and Control Act* (NSCA) came into effect in May 2000, replacing the *Atomic Energy Control Act*. The NSCA established the Canadian Nuclear Safety Commission (CNSC), which is Canada's sole federal regulator for nuclear materials and activities. Under the NSCA, the CNSC has the authority to regulate the use of nuclear energy and materials to protect health, safety, security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public. The CNSC has developed a regulatory framework consisting of laws passed by Parliament, regulations, licences and certificates, and regulatory documents that are used to regulate the nuclear industry. A suite of 13 regulations, ranging from radiation protection to transportation of radioactive materials, set the requirements and obligations the regulated community must meet.

Regulations specific to the transport of radioactive materials in Canada are currently encompassed in the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR 2015). These regulations were first introduced in May 2000. The 2015 update introduced a number of amendments including clarifying and updating issues involving radiation protection programs, dangerous occurrences, and unidentified loads of nuclear substances.

The PTNSR 2015 apply to all persons transporting or offering for transport nuclear substances within, and to and from Canada, which include licensees and carriers. The regulations provide the requirements for various activities such as record keeping for the transport of nuclear substances; the design and certification requirements of packages, special form radioactive material and other prescribed equipment; and obtaining a licence to transport when required. In addition to the PTNSR 2015, those transporting radioactive materials must also comply with the *Transportation of Dangerous Goods Regulations* (TDGR), which are implemented and overseen by Transport Canada, another federal department.

In an effort to help licensees and applicants better understand the expectations of the CNSC and to ensure clarity of the regulations, the CNSC develops regulatory documents (REGDOCS) to explain the requirements and provide guidance. REGDOCS are organized into three categories: the first covers regulated facilities and activities; the second covers each of the CNSC's 14 safety control areas (described further below); and the third touches on other

areas of regulatory interest. The organizational structure was designed to ensure documents pertaining to different topics could be easily found. REGDOCs are considered living documents and are regularly reviewed.

This paper will provide specific details on how the CNSC regulates the transportation of nuclear substances within, and to and from Canada. It will describe the PTNSR 2015, the partnership between the CNSC and Transport Canada, and the CNSC's regulatory framework.

### ***Packaging and Transport of Nuclear Substances Regulation, 2015***

The PTNSR 2015 were published in June 2015 and are based on the 2012 edition of the IAEA's SSR-6, *Regulation for the Safe Transport of Radioactive Material* (IAEA Regulations). Historically, Canada's regulations have been based on these international regulations and are followed to the extent practicable within the context of the Canadian nuclear industry and the CNSC's regulatory framework. The original PTNSR were based on the 1985 edition of the IAEA regulations, and were subsequently amended in 2003 to reference the implementation of the 1996 edition in 2001. This amendment focused on updating the explicitly referenced paragraphs and sections of the 1996 edition in the PTNSR. To reduce the frequency of future updates to the PTNSR when the IAEA Regulations are revised, the amendment of the PTNSR in 2015 incorporates the IAEA Regulations by ambulatory reference, i.e. without explicitly referencing sections and paragraphs, thus ensuring PTNSR 2015's consistent alignment with international regulations.

In order to provide certainty for those subject to the regulations, the PTNSR 2015 contain a built-in implementation period. The effective date for new editions is either two years after the day on which the amendment was initially published by the IAEA, or six months after the publication of the regulations in both English and French, the official languages of Canada, whichever is later. This ensures that licensees and carriers are provided enough time to alter their operations to comply with the new regulations if necessary. The 2018 edition of the IAEA Regulations, *SSR-6 (Rev. 1)* is expected to become effective in Canada in July 2020.

The PTNSR 2015 introduced a number of other changes to better harmonize the Canadian regulations with the requirements of the IAEA Regulations. As the CNSC primarily regulates through licensing and certification, new licences and certificates were created to reflect changes and new approvals in the IAEA Regulations. For example, the 2009 and 2012 editions of the IAEA Regulations included new provisions for situations such as transport by special-use vessels, shipments requiring multilateral approvals, and demonstration of subcriticality of fissile-excepted radioactive material, which were not included in the earlier versions of the PTNSR. These approvals were included in the PTNSR 2015 by incorporating them into the CNSC's licensing and certification processes. Shipment-specific transport licences were added for transport by special use vessels and shipments requiring multilateral approvals. A new type of certification was introduced for demonstrating that fissile-excepted radioactive material will remain subcritical.

While better alignment was achieved, certain differences between the IAEA Regulations and the PTNSR 2015 remain to account for the specificity of the Canadian nuclear industry. For example, to be classified as LSA-I material under Canadian regulations, ores cannot contain naturally occurring radionuclide concentrations that are greater than 3% by mass. The 2012 edition of the IAEA Regulations do not set a limit for ore concentration as ore concentration mined globally tends to be low. However, Canada has two of the highest grade ore deposits in the world, located at McArthur River and Cigar Lake, and so a specific limit was set on the concentration of ores.

The PTNSR 2015 also include provisions for the transport of unidentified nuclear substances. Over time, there has been increased usage of radiation portal monitors by businesses, such as scrapyards and waste management facilities, which has consequently increased the number of detections of nuclear substances in loads that were not initially classified as transporting nuclear substances. These receiving sites could refuse to accept these loads due to the detection of radioactivity. Without knowing the type and quantity of radioactivity present in the load, it was difficult to determine whether transporting the material back to its origin without further characterization would be considered a non-compliance under the Canadian transport regulations. To address this issue, the CNSC included the provision of a one-time exemption for the transport of unidentified loads. This exemption can be used if the following criteria are satisfied:

- the load was already in transport,

- the contents were not classified as radioactive material prior to transport,
- a radiation portal alarm is triggered and the maximum dose rate on the external surface of the transportation vehicle is less than or equal to 500 uSv/hr, and
- there is no dispersal or loss of material during transport.

The characterization and reporting requirements for unidentified loads are also dependent on the dose rate that is measured, and whether the nuclear substances are identified as medical isotopes. If dose rates are between 5 and 500 uSv/hr, the consignor, carrier and consignee must immediately make a preliminary report to the Commission indicating the alarm level, the details of transport, information regarding the location and circumstances of the incident, and any actions taken. For dose rates greater than 25 uSv/hr and less than or equal to 500 uSv/hr, it is also necessary to have an expert in radiation protection assess the situation. If characterization is conducted, the person or organization performing the characterization must keep a record of the detection and disposal of the nuclear substances, and also submit an annual report to the CNSC. Loads that are identified as short-lived medical isotopes may continue onward to their destination and no records need to be kept.

In addition, the term “special arrangement” was removed from the PTNSR 2015 as a circumstance under which a transport licence is required, and replaced with “when the transport cannot meet the requirements of these regulations”. In seeking this type of licence, the applicant must provide the CNSC with the reason why the consignment cannot meet the requirements of the regulations as well as information that demonstrates the overall level of safety is at least equivalent to that which would have been provided if all the applicable requirements of the regulations were met. The name “special arrangement” was removed as it is often interpreted by the public to mean that the shipment has a lesser degree of safety than that of other shipments of radioactive material, which is not the case.

Lastly, the PTNSR 2015 clarified issues regarding the transport of large objects, radiation protection programs and the reporting of dangerous occurrences. The transport of large objects was previously conducted under special arrangement. With a number of aging nuclear power plants in Canada, there was an expectation that there would be increased shipments of large objects or components (e.g. steam generators) due to refurbishment or decommissioning activities. The CNSC now classifies these shipments as ‘large objects’ and the requirements for transporting these are outlined in the PTNSR 2015. In regard to radiation protection programs, the PTNSR 2015 now consolidate all regulatory requirements related to these programs, whereas previously licensees and carriers would need to refer to the CNSC’s *Radiation Protection Regulations* for this information. Furthermore, the PTNSR 2015 provide an exemption for carriers, consignors, and consignees who only handle excepted packages from implementing radiation protection programs due to the low radiation dose levels associated with these packages. Finally, the last clarification broadens the reporting requirements for packages to include package defects where the integrity of the package is degraded, or where they do not fully comply with the regulations. For example, improperly closing a container when containment is still provided by another outer container is now considered a reportable event, as this could be symptomatic of a larger issue. In the original PTNSR, only dangerous occurrences, i.e. those events which could reasonably be expected to adversely affect the environment, health and safety of persons or national security, needed to be reported to the CNSC. The PTNSR 2015 include this broadening of the reporting requirements in order to maintain “defence in depth”.

### **CNSC and Transport Canada**

In addition to complying with the PTNSR 2015, those persons who transport, or offer to transport, nuclear substances are also required to comply with the *Transportation of Dangerous Goods Regulations* (TDGR). The TDGR are implemented and enforced by Transport Canada, which is the federal department responsible for developing transportation regulations, policies and programs within Canada. Transport Canada oversees the transport of all classes of dangerous goods in Canada (nine in total), whereas the CNSC provides oversight over the transport of Class 7 (Radioactive Materials) only. To avoid unnecessary redundancies for applicants, Transport Canada and the CNSC have a [Memorandum of Understanding](#) in place that outlines the responsibilities of each organization, as described below.

Under this partnership, the CNSC and Transport Canada are expected to carry out their respective mandates and support each other where appropriate. Both agencies make a reasonable effort to ensure their policies are complementary and provide each other with the opportunity to advise on regulatory amendments, policies and

program changes that may affect the other. To facilitate the partnership, each agency offers training to the other on their respective Acts and regulations, and share information where feasible to foster strong working relationships.

The CNSC and Transport Canada regulate different aspects of the transportation of radioactive materials. In accordance with its mandate and the NSCA, the CNSC regulates all aspects of transportation that relate to radiation protection of the public and the environment. These aspects include package design, transport licences, and handling of the material prior to, during and after delivery of the package as they relate to radiation protection. Transport Canada, in accordance with the *Transportation of Dangerous Goods Act*, regulates the handling, offering for transport, and transport of the package. While the CNSC and Transport Canada regulate transport from different angles, there is still the potential for regulatory overlap. To minimize regulatory burden that may arise, the memorandum notes that if an action must be taken on a consignor, consignee or carrier due to requirements or obligations enforced by a reference to the PTNSR 2015 in the TDGR, then that action will be taken by the CNSC. The opposite is also true, i.e. Transport Canada will take action if an enforceable requirement or obligation arises from a reference to the TDGR in the PTNSR 2015.

The memorandum also includes further details regarding which agency is responsible for various situations. For instance, the CNSC is responsible for issuing certificates for transport packages, licences to transport nuclear substances, and licences for the import and export of nuclear materials in accordance with the *Nuclear Non-Proliferation Import and Export Control Regulations*. In addition, the CNSC is also responsible for the physical security of nuclear substances during transport and is the lead investigator in the event that a dangerous occurrence involving Class 7 dangerous goods takes place. In contrast, Transport Canada is responsible for regulating the handling and transportation of dangerous goods, which includes loading and unloading the means of containment onto the transport, securing the means of containment, and transporting the shipment to its destination. Transport Canada is also responsible for reviewing and approving Emergency Response Assistance Plans (ERAPs) of those persons who offer for transport or import dangerous goods into Canada. Moreover, Transport Canada maintains the Canadian Transport Emergency Centre (CANUTEC), which is available 24-hours to provide advice regarding dangerous occurrences involving dangerous goods, including Class 7.

Despite differences in responsibilities, the CNSC and Transport Canada work together to ensure that transportation of radioactive materials in Canada is safe. For example, both agencies are responsible for ensuring that persons who transport radioactive materials are trained and hold a certificate under the *Transportation of Dangerous Goods Act*. Inspectors from both agencies may also perform joint compliance activities and designate qualified inspectors from the other organization as an inspector under their Act. Through joint cooperation, the CNSC and Transport Canada work towards overseeing the safe transport of radioactive materials in Canada while minimizing regulatory overlap.

## **Regulatory Framework**

The CNSC has the authority under the NSCA to develop regulations to meet its mandate. To assist stakeholders in understanding these regulations, the CNSC has developed regulatory documents – REGDOCs – that set out the expectations of the CNSC, and provide information on licensing or certification requirements or guidance.

Over the past few years the CNSC has been engaged in an effort to modernize its regulatory framework. Historically, regulatory documents were produced on a wide spectrum of subjects without any clear organizing structure. They were given unique identifiers composed of one or two letters indicating the nature of the document (e.g. “RD” for requirements document, “GD” for guidance document, “S” for standard, etc.), followed by a numeric code. These numbers were assigned based on the order of publication, which made it difficult to search for a given document and meant that there was no clear way to connect different documents covering similar subjects. In an effort to improve clarity in the regulatory framework, the CNSC has reorganized its regulatory documents – which are now all referred to as REGDOCs – into a structured Table of Contents (see Table 1).

<b>1.0</b> Series	<b>Regulated Facilities and Activities</b> 1.1 Reactor Facilities 1.2 Class IB Facilities 1.3 Uranium Mines and Mills 1.4 Class II Facilities 1.5 Certification of Prescribed Equipment 1.6 Nuclear Substances and Radiation Devices		2.7 Radiation Protection 2.8 Conventional Health and Safety 2.9 Environmental Protection 2.10 Emergency Management and Fire Protection 2.11 Waste Management 2.12 Security 2.13 Safeguards and Non-Proliferation 2.14 Packaging and Transport
<b>2.0</b> Series	<b>Safety and Control Areas</b> 2.1 Management System 2.2 Human Performance Management 2.3 Operating Performance 2.4 Safety Analysis 2.5 Physical Design 2.6 Fitness for Service	<b>3.0</b> Series	<b>Other Regulatory Areas</b> 3.1 Reporting Requirements 3.2 Public & Aboriginal Engagement 3.3 Financial Guarantees 3.4 Commission Proceedings 3.5 Information Dissemination 3.6 Glossary of CNSC Terminology

*Table 1. Regulatory Document Categories*

The first category, facilities and activities (1.0 Series), contains regulatory documents that provide guidance on licence applications or the requirements to conduct a licensed activity. The second category (2.0 Series) contains documents that pertain to the 14 Safety and Control Areas (SCAs), which are the technical topics the CNSC uses to assess, review and verify regulatory requirements and performance of regulated activities and facilities. The third category (3.0 Series) contains regulatory documents that cover other regulatory areas of interest including public and Indigenous engagement, CNSC processes and practices, and financial guarantees. As shown in Table 1, the numbering convention for the regulatory documents now links each document to its place within the overall structure.

The REGDOC-2.14 “chapter” addresses packaging and transport matters. The CNSC has developed three packaging and transport regulatory documents in response to stakeholders’ need for further information and regulatory clarity. The regulatory documents are:

- REGDOC-2.14.1, Volume I: *Information Incorporated by Reference in Canada’s Packaging and Transport of Nuclear Substances Regulations* (published)
- REGDOC-2.14.1, Volume II: *Radiation Protection Program Design for the Transport of Nuclear Substances* (published)
- RD-364, *Joint Canada-United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages* (this document was developed under the previous nomenclature regime and will be republished as REGDOC-2.14.1, Volume III in the future)

In 2016, the CNSC published the regulatory document *Information Incorporated by Reference in Canada’s Packaging and Transport of Nuclear Substances Regulations* after the amendment of the PTNSR and the introduction of the ambulatory reference to the IAEA regulations. As the Canadian regulations no longer explicitly identify or state the relevant sections or paragraphs of the IAEA regulations, the purpose of the document is to link sections of the PTNSR 2015 to relevant content in the IAEA Regulations. In addition, the document also identifies pertinent sections of the NSCA, other CNSC regulations, and other related information.

In 2018, the CNSC re-published *Radiation Protection Program Design for the Transport of Nuclear Substances* (previously known as GD-314 under the older nomenclature). The majority of consignors and consignees are licensed by the CNSC and are required to have radiation protection programs in place for the activities they carry out. Transport activities are generally exempted from CNSC licensing as long as they comply with regulatory requirements. While the majority of carriers are not licensed, they are still required to implement radiation protection programs under the requirements of the PTNSR 2015. The purpose of this regulatory document is to

provide guidance to those persons who are not licensed, but are regulated by the CNSC in implementing radiation protection programs for transport activities involving nuclear substances.

In 2009, the CNSC published *Joint Canada-United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages*. The document, developed in collaboration with the United States Department of Transportation (DOT) and Nuclear Regulatory Commission (NRC), provides direction on the standard format and content for applications for approval of packages used to transport Type B(U) and fissile materials. Published as RD-364 in Canada and NUREG-1886 in the US, it facilitates the Canada/United States validation of Competent Authority approvals and limits redundant technical reviews. The NRC is currently updating their regulations, and it is expected that the document will be revised once this update is complete.

To ensure regulatory documents remain relevant, the CNSC periodically reviews all published documents. Depending on the needs of stakeholders and changes in the nuclear industry, regulatory documents may be amended, reaffirmed or withdrawn where applicable. The CNSC's [Regulatory Framework Plan](#) outlines the regulations or regulatory documents that the CNSC plans to amend or develop in the future. The Plan sets out the CNSC's corporate priorities, but is also dependent on developments in the nuclear industry.

## **Conclusion**

In summary, the CNSC has a robust regulatory framework in place to regulate the transportation of radioactive materials to protect health, safety, security and the environment of Canadians and to ensure that Canada's international commitments on the peaceful use of nuclear energy are met. The PTNSR 2015, in conjunction with the IAEA Regulations, outlines all requirements those transporting, or offering to transport, radioactive materials must meet. With the incorporation by ambulatory reference of the IAEA Regulations, the PTNSR 2015 will remain consistent with international regulations even if they are amended in the future. In addition to the PTNSR 2015, consignors, consignees and carriers must also be in compliance with the TDGR, which are implemented by Transport Canada. While the CNSC and Transport Canada share regulatory oversight of Class 7, Radioactive Materials, the two organizations work cooperatively to reduce regulatory overlap. Through a modernized regulatory framework, the CNSC provides extensive regulatory guidance on the transportation of radioactive materials. The CNSC develops regulatory documents in consultation with licensees and stakeholders, and periodically reviews these documents to ensure they provide relevant information to those involved in the Canadian nuclear industry. Through these various approaches, the CNSC effectively regulates the transportation of nuclear substances within Canada, while adhering to international regulations and standards.