

**Paper No.**

**Publication of the Packaging and Transport of Nuclear Substances  
Regulations (2015)**

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**Abstract**

The Canadian Nuclear Safety Commission (CNSC) has published its *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR 2015)<sup>[1]</sup> to incorporate an ambulatory reference (as amended from time to time) to the IAEA's *Regulations for the Safe Transport of Radioactive Material* (IAEA Regulations)<sup>[2]</sup> (hereafter referred to as "IAEA Regulations"). The use of an ambulatory reference ensures Canada's continued alignment with the IAEA Regulations, without the need to amend the PTNSR 2015 as new editions of the IAEA Regulations are being published.

In addition, other changes were made to the PTNSR 2015 to address issues that had been identified since they were last revised in 2003. These include new regulatory provisions relating to the one-time transport of shipments containing unidentified radioactive material for proper characterization purposes; the introduction of specific criteria and approval for the transport of large objects; the removal of the reference to "special arrangement"; and clarifications of existing provisions such as the requirements related to radiation protection programs for carriers as well as the reporting of dangerous occurrences and other situations.

This paper explains the rationale behind these changes and outlines the regulatory approach taken in incorporating them into the PTNSR 2015.

**Introduction**

The Canadian Nuclear Safety Commission (CNSC) first published its *Packaging and Transport of Nuclear Substance Regulations* (PTNSR) in 2000, and amended them in 2003 to incorporate the 1996 Edition (Revised) of the *Regulations for the Safe Transport of Radioactive Material*<sup>[3]</sup>. Since 2000, the IAEA Regulations have been revised frequently (i.e. in 2003, 2005, 2009, and 2012).

In 2011, the CNSC hosted an IRSS follow-up mission and requested that the mission review the Canadian Packaging and Transport program for compliance with the IAEA Regulations. The IRSS follow-up mission recommended that the CNSC adopt the latest edition of the IAEA transport regulations and consider options in increasing the clarity and user-friendliness of its transport regulations.

A significant amount of work to update the PTNSR in order to adopt the 2009 edition of the IAEA Regulations had already been accomplished prior to the mission. Following the mission, the project was prioritized and aimed at adopting the 2012 edition since the new edition was near completion. In addition to the recommendations from the mission, several factors were considered as part of development of the revised regulations, such as:

- A proposal to replace the static reference to the IAEA Regulations with an ambulatory reference (or “as amended from time to time”), thereby allowing for the continued alignment of the PTNSR with the latest published edition of the IAEA Regulations.
- Specific transportation issues that had been identified since 2003, in particular the need to establish regulatory provisions to address the shipment of large objects, such as steam generators, and the need to clarify the regulatory requirements related to:
  - The shipments of unidentified nuclear substances discovered in non-radioactive shipments during transport;
  - The radiation protection programs applicable to carriers;
  - The reporting of dangerous occurrences.

In August 2012, stakeholders were consulted on the proposed changes (listed above) with the publication of a discussion paper <sup>[4]</sup> for a 60-day period. The major changes were related to the method of incorporation of the IAEA Regulations within the PTNSR, the removal of the term “special arrangement”, the development of specific regulatory requirements for the transport of large objects and the development of exemptions related to the discovery of radioactive material within load of scrap metal and waste that are occasionally triggering radiation portal monitors. The feedback received during the consultation period was used in the development of the draft regulations that were submitted for public comments in June 2014. The final regulations were published in June 2015, at which point they came into effect. In February 2016, the CNSC published a supporting guidance document to increase the clarity and user-friendliness of these regulations as recommended by the IRRS mission.

## **Changes introduced with the *Packaging and Transport of Nuclear Substances Regulations, 2015***

### **1. Alignment with the IAEA Regulations**

One of the goals of the PTNSR 2015 was to better align with the IAEA Regulations by minimizing deviations from the IAEA Regulations while ensuring that they would not conflict with other Canadian regulations and that Canadian-specific issues would remain respected. As a result, a number of new approvals, either in the form of a licence or a certificate, have been incorporated into the PTNSR 2015.

New approvals requiring the issuance of a licence to transport:

- Transport by special use vessels
- Transport of large objects
- Shipments requiring multilateral approval
- When transport cannot meet the requirements of the Regulations (note: to replace “special arrangement”)

New approvals requiring the issuance of a certificate:

- Approval of unlisted basic radionuclide values
- Approval of an alternative activity limit for an exempt consignment of instruments and articles
- Approval for certain fissile-excepted radioactive material

It is expected that these new approvals will rarely be used in Canada. There were either newly introduced in the 2012 Edition of the IAEA Regulations (such as the approval of an alternative activity limit for exempt consignments of instruments and articles and the approval for certain fissile-excepted radioactive material) or transport would have been conducted under special arrangement prior to the publication of the PTNSR 2015.

The deviations from the IAEA regulations that have been maintained include:

- A cut-off limit of 3 percent for the categorization of uranium ore as LSA-I material due to the grade of ore currently mined in Canada, which may exceed 30 percent. This was an existing deviation but the cut-off limit has been revised from 2 to 3 percent, based on the feedback received during the consultation period and supported by an analysis performed by the CNSC.
- A limit of 225 litres of water containing a maximum of concentration of tritium of 0.8 TBq/l for LSA-II material. This is to ensure that higher concentrations of tritium in the water would be transported in a more robust package, such as a Type B package.
- The requirement to transport LSA and SCO in type IP-3 packages, while allowing for:
  - LSA-I and SCO-I to be transported unpackaged, in accordance with paragraph 520 of the IAEA Regulations; or
  - Type IP-1 or Type IP-2 packages to be used, as long as the material is transported in a conveyance or freight container from one consignor only, not carrying passengers, and is loaded at the consignor’s location and unloaded at the consignee’s location.

## 2. Introduction of an ambulatory reference to the IAEA Regulations

Another goal of the *Packaging and Transport of Nuclear Substances Regulations, 2015* was to introduce the use of an ambulatory reference to the IAEA Regulations (i.e. as amended from time to time) as oppose to a static reference (i.e. a reference to specific paragraph numbers of a specific

edition of the IAEA Regulations). This was the first time that an ambulatory reference was proposed for CNSC regulations. In order to do so, a number of specific provisions were included in the PTNSR 2015:

- A definition for the term “IAEA Regulations”, defined as “the Regulations for the Safe Transport of Radioactive Material, published by the IAEA, as amended from time to time”;
- An implementation period, established as follows: “For the purposes of these Regulations, the incorporation by reference of any particular amendment of the IAEA Regulations is effective two years after the day on which the amendment is initially published by the IAEA or six months after the day on which the amendment is available in both of the official languages of Canada, whichever is later.”;
- A requirement for the CNSC to clearly indicate which edition of the IAEA Regulations is in force, established as follows: “The Commission must note the effective date of the incorporation by reference on its website.” This is done by having the following note on the [CNSC webpage](#) where the CNSC regulations are listed: “For the purpose of these regulations, the CNSC Packaging and Transport of Nuclear Substances Regulations, 2015 incorporate by reference the 2012 Edition of the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material.”

The two-year implementation period provides enough time to the Canadian regulated community to implement new editions of the IAEA Regulations. Furthermore, it is approximately harmonized with the implementation period at the international level, through revisions to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* <sup>[5]</sup> and the *International Maritime Dangerous Goods Code* <sup>[6]</sup>, which also need to adopt new editions of the IAEA Regulations.

In February 2016, the CNSC has also published a guidance document REGDOC-2.14.1: *Information Incorporated by Reference in Canada’s Packaging and Transport of Nuclear Substances Regulations, 2015* <sup>[7]</sup> to assist users of the regulations in providing a mapping for the provisions of the PTNSR 2015 that relate to specific paragraphs of the IAEA Regulations and other Canadian regulations. This guidance document will be updated every time a new edition of the IAEA Regulations is published. The challenge with the implementation of the ambulatory reference will be to carefully analyze all future changes to the IAEA regulations to ensure consistency with the PTNSR 2015 and other Canadian regulations.

### 3. Removal of the reference to “special arrangement”

In the past, the public had questioned the use of the term “special arrangement” when a company applied for this type of approval. There was a perception that such an arrangement would alleviate certain regulatory requirements and that the transport of nuclear substances would not necessarily be conducted in a safe manner. The PTNSR 2015 have therefore removed the reference to the term

“special arrangement” from its regulations while keeping the concept of special arrangements within the regulations by requiring transport licence for such shipments using the following wording: “a transport licence is required when the transport of the nuclear substance cannot meet the requirements of these Regulations”. The application must still demonstrate that the overall level of safety in transport will be at least equivalent to that which would be provided if all the applicable requirements of the Regulations were met, and must include the reasons why the consignment cannot meet the requirements as well as any special precautions that will be employed during transport to compensate for the inability to meet the requirements. This approach better conveys the concept of restricted usage and equivalent safety considerations, while still allowing for the transport when it would not be possible to do so in full compliance with all of the regulatory requirements.

#### 4. Regulatory requirements applicable to the transport of large objects

Building on the work undertaken to incorporate similar requirements into the IAEA Regulations, a new type of approval was created for the PTNSR 2015, in the form of a new transport licence for the transport of large objects. This was done in an effort to provide greater clarity for the content of such applications by specifying the tests and calculations required to demonstrate that the transport of these components can occur safely. The PTNSR 2015 have defined “large object” as “an object that has been decommissioned from a nuclear facility, that is internally contaminated with nuclear substances meeting the requirements applicable to an SCO-I or SCO-II as set out in the IAEA Regulations and that cannot be transported in a type of package described in these Regulations due to its dimensions” since it was not possible to incorporate the new SCO-III category developed for the next revision of the IAEA Regulations. Further information on this work is provided in another paper titled *Proposed Regulations to Ship Large Objects as Surface Contaminated Objects* also presented at this conference. In summary, an application for the transport of a large object is to include detailed information on the level of contamination (internal and external), external dose level and demonstrate compliance with drop test requirements. In addition, the application must include a transport plan detailing the compensatory measures to be implemented during transport, such as emergency response and administrative operational controls.

It is believed that these regulatory requirements, which are based on the international experience and the proposal that was developed for the next edition of the IAEA Regulations, will simplify the application process for future applicants for such transport licences and will allow for an effective and safe transport of large objects under adequate regulatory oversight.

#### 5. Shipments of unidentified nuclear substances that triggered a radiation monitor alarm while in transport

In Canada and in other many countries, radiation detection equipment, such as radiation portal monitors, have been installed at border crossing, metal recycling facilities, waste transfer stations,

landfill sites and other locations. These radiation portal monitors are used to scan all incoming shipments to detect radiation above background levels.

When an alarm is triggered, the load of material is often rejected at the border or by the receiving site and may need to be transported elsewhere to be properly characterized and handled. Since the nature and quantity of the radioactivity is not known at the time of detection, it is difficult to determine if the shipment needs to be subjected to the application of the PTNSR 2015 or not. Often times, it is necessary to transport the load to another location that is equipped with proper instrumentation and facilities, where a detailed analysis of the radiation can be performed.

From the information collected over the years regarding these events, it was found that the majority of the alarms were caused by medical isotopes or naturally occurring radioactive materials. Given the experience gained in dealing with radiation portal alarms across Canada, the PTNSR 2015 have included exemptions to allow for the movement of these shipments for characterization purposes. These are meant to provide relief from regulatory burden with the use of a graduated risk approach. These exemptions:

- are intended to only apply to loads of waste that were not classified as radioactive material at the start of the shipment and are already in transport;
- can only be used as long as there is no loss of dispersal of the material during the transport; and
- include notifications and reporting requirements, when applicable.

The first example includes the most common type of alarms: medical isotopes in municipal waste. Under the PTNSR 2015, a load of waste can be moved if it can be determined that the material triggering the alarm is one of the following short-lived medical isotopes: Chromium 51, Indium 111, Iodine 123, 124 or 131, Gallium 67, Technetium 99m, Thallium 201. In these cases, the load is allowed to be moved without notifying the CNSC and no reporting is necessary.

For all other cases, i.e. where the identified isotopes are not from the list of short-lived medical isotopes or when it is not possible to determine the isotope in question, the exemption provided in the PTNSR 2015 is based on the radiation level measured at the portal monitor, up to a maximum of 500  $\mu\text{Sv/h}$ . It is recognized that the external dose rates may not fully correlate to the radiological hazard of the unidentified material; nonetheless this limit somewhat controls the level of risk in the absence of any other readily available measure.

There are three different categories for these exemptions, based on the dose rate:

- If the maximum dose rate is 5  $\mu\text{Sv/h}$  or less, the movement of the load is allowed without prior notification to the CNSC.

- If the maximum dose rate is between 5  $\mu\text{Sv/h}$  and 25  $\mu\text{Sv/h}$ , then the load is allowed to be moved provided that the CNSC is notified of the detection.
- If the maximum dose rate is between 25  $\mu\text{Sv/h}$  and 500  $\mu\text{Sv/h}$ , then the CNSC must be notified immediately prior to any further movement of the load and an expert in radiation protection must assess the situation and report to the CNSC.

In all cases, there is a requirement to perform a characterization at the earliest possible time and to keep a record of the detection and of the disposal of the nuclear substance. Once the characterization is completed, an immediate notification to the CNSC is required for cases where results indicate that the source of radiation is of a licensable quantity (such as a sealed source or radiation device containing a sealed source). In addition, there is an obligation to file an annual summary report of the detections with the CNSC.

Record keeping and reporting of these events allow for the monitoring of the use of the exemptions, ensuring that the characterizations have been completed and that the nuclear substances have been safely disposed.

## 6. Radiation protection programs applicable to carriers

In Canada, like in many other countries, carriers of nuclear substances do not generally require a licence to transport but are subjected to regulatory requirements when transporting nuclear substances, which include the requirement for the implementation of a radiation protection program. The PTNSR 2015 introduced two changes in that respect.

With the introduction of the PTNSR in 2000, a requirement for all carriers to implement a radiation protection program was incorporated and provided obligations for those involved in the transport of nuclear substances. An exemption was provided in the first few years to provide enough time for companies involved in the transport of nuclear substances to implement this new requirement. The PTNSR 2015 built on the requirement already included in the previous PTNSR, while adding clarity on the expectations, by essentially repeating obligations that were already incorporated in the CNSC's *Radiation Protection Regulations*<sup>[8]</sup> (those found in the *Radiation Protection Regulations* are only applicable to licensees while the majority of the carriers are non-licensees). Therefore having the radiation protection program requirements in the PTNSR 2015 ensures that those who are transporting nuclear substances in Canada are aware of their obligations under the regulations and have clear requirements to meet. In addition, consistent with the IAEA Regulations, companies that are only involved in handling and carrying excepted packages are now exempted from the requirement to implement a radiation protection program under the PTNSR 2015. In all other cases, the PTNSR 2015 require transport companies involved in the transport of nuclear substances to implement and maintain a radiation protection program since there is a possibility that a transport worker may receive a radiation dose greater than 1 mSv/yr.

## 7. Reporting of dangerous occurrences

A primary element in the safe transport of radioactive material is proper packaging. Under the previous PTNSR, package defects and instances of non-compliance with the regulations were only reported to the CNSC if they were reasonably expected to lead to a situation that adversely affected the environment, the health and safety of persons or national security (i.e. a dangerous occurrence). Occurrences where a package was used improperly or did not meet performance expectations could have been symptomatic of larger problems associated with the manufacturing, maintenance, and use of packages but would not have been considered as reportable under the previous PTNSR. An example of this would be the failure to adequately close a container when containment is still provided by another outer container. As containment would still be provided, it could have been claimed that the situation was not a dangerous occurrence under the previous PTNSR. Nonetheless, there would have been a degradation of the “defence in depth” afforded by the package. As such, the list of events considered to be dangerous occurrences was broadened to include the following:

- Package defects where the integrity of the package is degraded in a manner that could impair its ability to comply with the Regulations, and
- Situations where a package does not comply with regulatory requirements (for example when radioactive material is contained in the wrong type of package, is transported without a proper licence, the radioactive material’s activity exceeds the limit for the type of package, etc.).

## **Conclusions**

The PTNSR 2015 were published to incorporate the 2012 Edition of the IAEA Regulations, as recommended by the 2011 IRRS Mission, while maintaining certain Canadian-specific deviations. The PTNSR 2015 incorporated the IAEA Regulations as amended from time to time; allowing the CNSC transport regulations to remain current with the latest published edition of the IAEA Regulations while providing for a transition period to allow time for users to transition to any future edition. The CNSC has also published a guidance document to provide users with a mapping of the provisions in the PTNSR 2015 to the specific paragraphs of the IAEA Regulations.

The PTNSR 2015 removed the use of the term “special arrangement”, incorporated new exemptions for non-radioactive loads of waste triggering a radiation portal monitor while in transport, as well as new provisions for the transport of large components based on existing IAEA Guidance and requirements drafted for future inclusion into the IAEA Regulations.

Modifications to the radiation protection program requirements were made to clarify requirements applicable to non-licensees with regards to radiation dose limits and reporting requirements. In addition, modifications to reporting requirements related to dangerous occurrences were made to include package defects and certain non-compliances associated with transport activities.



## References

- [1] Canadian Nuclear Safety Commission (CNSC), [\*Packaging and Transport of Nuclear Substances Regulations, 2015\*](#), SOR/2015-145, June 2016.
- [2] International Atomic Energy Agency (IAEA) Safety Standards Series, [\*Regulations for the Safe Transport of Radioactive Material, 2012 Edition\*](#), No. Specific Safety Requirements No. SSR-6, Vienna, Austria, October 2012.
- [3] International Atomic Energy Agency (IAEA) Safety Standards Series, [\*Regulations for the Safe Transport of Radioactive Material, 1996 Edition \(Revised\)\*](#), No. TS-R-1, Vienna, Austria, 2000.
- [4] Canadian nuclear Safety Commission (CNSC), [\*Proposal to Amend the Packaging and Transport of Nuclear Substances Regulations\*](#), Discussion Paper DIS-12-06, August 2012.
- [5] International Civil Aviation Organization, [\*Technical Instructions for the Safe Transport of Dangerous Goods by Air\*](#), Doc 9284, 2005-2006
- [6] International Maritime Organization, [\*International Maritime Dangerous Goods Code\*](#), 2014 Edition.
- [7] Canadian nuclear Safety Commission (CNSC), REGDOC-2.14.1: [\*Information Incorporated by Reference in Canada's Packaging and Transport of Nuclear Substances Regulations\*](#), February 2016.
- [8] Canadian Nuclear Safety Commission (CNSC), [\*Radiation Protection Regulations\*](#), SOR/2000-203, June 2015.