

IMPLEMENTATION OF THE RADIATION PROTECTION PROGRAM FOR CARRIERS IN CANADA

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ABSTRACT

The 1996 Edition of the IAEA Regulations (TS-R-1), stipulates that a radiation protection program shall be implemented for the transport of radioactive material and that the nature and extent of the measures to be employed in the program shall be related to the magnitude and likelihood of radiation exposure. Canada has adopted this new requirement when it revised its *Packaging and Transport of Nuclear Substances (PTNS) Regulations*, in June 2000. A four-year exemption period was given to carriers of radioactive material in order for the Canadian Nuclear Safety Commission (CNSC) to complete a research project on doses received by transport workers and to develop guidance material to help carriers in complying with this new regulatory requirement.

Difficulties were foreseen in the implementation of the radiation protection program as carriers would need to develop a specific program that would only apply to a small fraction of their operation.

In preparation for the implementation date, the CNSC had to establish a comprehensive list of carriers transporting radioactive material since no detailed listing existed and only a small number of carriers were previously identified as part of the research project.

In early 2004, several visits were made to carriers of radioactive material to introduce this new requirement and explain the expectations of the CNSC in this regard. On June 1st 2004, the exemption period ended and carriers were required to have a radiation protection program for the transport of radioactive material.

Communication with carriers was established to obtain a copy of their radiation protection program. Visits have been conducted at some locations to verify that the program has been implemented and is being followed.

The current database includes 71 carriers that have submitted copies of their radiation protection program for evaluation. This number is still growing as new carriers are being identified and requested to submit a copy of their radiation protection program to the CNSC.

The main challenge is to maintain current information in the database since the transport industry is continually changing. From the experience gained since 2004, the CNSC is currently looking at new ways of gathering information on carriers transporting radioactive material in order to maintain current information in the database.

The CNSC expects that by adopting a more effective method for collecting the information on carriers, the effort required to maintain current information will be reduced. In addition, the development of a CNSC systematic inspection program for carriers will ensure that adequate resources devoted to compliance with the requirement to maintain a radiation protection program will be sufficient and commensurate with the level of risk of exposures of the transport workers.

INTRODUCTION

The 1996 Edition of the IAEA Regulations (TS-R-1), stipulates that a radiation protection program shall be implemented for the transport of radioactive material and that the nature and extent of the measures to be employed in the program shall be related to the magnitude and likelihood of radiation exposure. Canada adopted this new requirement when it revised its *Packaging and Transport of Nuclear Substances (PTNS) Regulations*, in June 2000. Although this new requirement applies to consignors, carriers and consignees, the impact was mainly on carriers since most of them are not required to have a license from the Canadian Nuclear Safety Commission (CNSC). However, consignors and consignees that are licensed by the CNSC were already required to have a radiation protection program under the *Radiation Protection Regulations*.

For carriers of radioactive material, the PTNS Regulations impose two important requirements on them. Specifically, they require the carriers to implement and maintain work procedures, and require them to implement and maintain a radiation protection program based on the risk of radiation exposure to their workers. A four-year exemption period was given to carriers in order for the CNSC to complete a research project on doses received by transport workers and develop guidance material to help carriers in complying with this new regulatory requirement.

A multi-phase research project was conducted to determine the doses received by transport workers involved in the carriage of radioactive material in Canada. The results of this research project were presented at PATRAM 2001¹ and at an IAEA Conference in July 2003². Canada is a major supplier of radioisotopes for medical use and the results showed that the transport of these medical isotopes was giving rise to the highest doses to workers. A correlation between the Transport Index (TI) and the dose received by a transport worker was developed for medical isotopes. The correlation showed that the transport of 300 TI in a year would likely give rise to a dose of 1 mSv. This correlation is similar to the one found in similar studies³.

CLASSIFICATION OF CARRIERS BASED ON THE RISK OF EXPOSURE

The CNSC established a risk-informed classification for carriers based on the potential radiation exposure of transport workers using an approach similar to the risk-informed approach used for the classification of CNSC licensees. The classification is as follow:

Low risk:	Workers receiving less than 1 mSv/y
Medium risk:	Workers receiving between 1 and 5 mSv/y
High risk:	Workers receiving more than 5 mSv/y.

The CNSC selected the value of 5 mSv/y instead of the 6 mSv/y specified in the IAEA Regulations in order to be consistent with the other CNSC Regulations and practices.

The risk ranking determines the level of complexity required for the radiation protection program from minimal requirements for the low risk category to a detailed program for the high risk category as recommended in TS-R-1.

In order to facilitate the transition to the new requirement, the CNSC produced a guidance document entitled: *Implementation of Radiation Protection Programs by Consignors, Carriers and Consignees of Radioactive Material*, based on an IAEA document⁴, to assist carriers in establishing their radiation protection program to reflect the risk category outline above. The guide was published in draft form in March 2004 for trial use and comments. Comments have been received by various users and the revised version is expected to be published by the end of 2007.

DEVELOPING THE INITIAL LIST OF CARRIERS

In Canada, the transport of dangerous goods is regulated by Transport Canada under the *Transport of Dangerous Goods (TDG) Regulations* and the transport of radioactive material is further regulated by the Canadian Nuclear Safety Commission under the *Packaging and Transport of Nuclear Substances (PTNS) Regulations*. Carriers do not have to register with any Canadian authorities in order to transport radioactive material. However, carriers are generally cognizant of the requirements of transport under the *TDG* regulations but are not necessarily familiar with the requirements of the *PTNS* Regulations from the CNSC. The *PTNS* Regulations and CNSC expectations have to be explained and guidance needs to be provided to facilitate compliance with CNSC regulatory requirements.

A quick look at the transport industry in Canada reveals that thousands of companies identify themselves as carriers, ranging from a one-person operation to large companies operating across the country. From our experience, it is believed that there are approximately 300 carriers that transport radioactive material in Canada.

In general, the volume of radioactive material transported only accounts for a small fraction of the total volume of goods transported by a carrier. They usually perform a cost benefit analysis to determine if it is worth continuing / starting to transport radioactive material considering the level of effort required to comply with the requirements of the regulations.

In 2004, the CNSC conducted site visits with carriers that were known to transport radioactive material in preparation for the coming into effect of the new requirement. These visits were made to promote the development of radiation protection programs and to assist the carrier in determining their risk category based on information available on site.

These visits were important as carriers also provided feedback on the new requirement as well as comments on the newly developed guide and its usefulness. In addition, these visits

provided an opportunity to discuss the new requirement with major carriers, in order to avoid a large disruption in transport with the coming into force of the requirement.

During these visits, some carriers raised concerns about the requirement and indicated they would have to reconsider their operation and see if they would keep transporting radioactive material. Once the program was explained and the expectations clarified, most of the carriers indicated that they would maintain their operation and would comply with the new requirement.

In order to identify carriers that are transporting radioactive material, Canadian licensees were contacted by letter in 2004 and requested to provide information on the transport companies they were using for transporting their radioactive material.

From the responses, a new database was developed in order to store information on carriers as the CNSC central licensing database only contains information on CNSC licensees. Approximately 200 carriers were identified as transporting radioactive material. Information about each company was entered in the database and a letter indicating that they have been identified as carriers transporting radioactive material was sent, requesting them to submit a copy of their radiation protection program.

An assessment of the information received from the carriers was performed and each carrier was assigned a risk category based on the level of exposure of the workers as determined by the company.

VALIDATION OF THE INFORMATION RECEIVED

From the fall of 2005 to early 2006 further site visits were organized for the carriers listed in the high and medium risk category. The visits were conducted at various locations for carriers who had submitted their radiation protection program to verify that these were adequate and effectively implemented. In most cases, the risk category identified for the company was confirmed during the site visit.

The visits were also useful for the companies who benefited from observations made by CNSC staff on site which resulted in the implementation of small changes in their operation in order to lower the doses received by the workers and contributed to increasing their radiation protection knowledge.

MAINTENANCE OF THE DATABASE

Relative success in introducing the new requirement to the transport industry by using several avenues to promote the implementation of the program such as articles in Canadian publications destined to the transport industry (Transport Canada Newsletters) and presentation to Canadian associations has been achieved. However, it has proven to be difficult to obtain accurate information on the carriers.

In June 2006, follow up with carriers that did not respond to the original letter was initiated and these companies were sent a second letter. An assessment of the information received from these companies was performed and each was assigned a risk category based on the level of exposure of the workers as determined by the company.

In April 2007, the CNSC decided to send a letter to all carriers listed in the database to update the information since the original request to licensees was made over three years ago. It has also been found that the data was outdated as many carriers indicated they were no longer transporting radioactive material and wished to be removed from the CNSC list.

Although most of the major carriers transporting radioactive material have been easily identified and provided the necessary information, the challenge resides in identifying other carriers that do transport radioactive material but have not been reached yet. Some of them are small companies that may transport radioactive material on an infrequent basis while others are under contract with licensees or are subsidiaries to other carriers or are hired for short periods of time.

From the carriers contacted in April 2007, 65 did not respond to the letter. Each of the non-responding companies was called and questioned as to whether or not they still transported radioactive material. Many of the carriers indicated that they were no longer transporting radioactive material as their contract was not renewed or the driver who was carrying the material no longer works for them, etc. Others indicated they would comply with the new requirement but needed more guidance regarding the information required. Although they were given a copy of the CNSC regulatory document, many were still not clear as to what needed to be submitted.

To assist them, the CNSC developed a form which is now included as an appendix to the revised CNSC guidance document. The new form has been developed to allow carriers to easily determine their risk category as well as identifying the minimum information needed for each element of the radiation protection program.

INSPECTIONS

The CNSC is in the process of establishing a more systematic inspection program to verify compliance of the carriers with the PTNS Regulations and in particular the requirements for written work procedures and the implementation of radiation protection programs. The inspection program will rely on the information contained in the carriers' database and will take into account various parameters such as the risk category (exposure risk) associated with the carrier, the radioactive material transported, the frequency of shipments and the number of incidents reported by the carrier. These parameters will be used to determine the locations and the frequency of inspections that will need to be performed by the CNSC. The inspection results will also be used to verify:

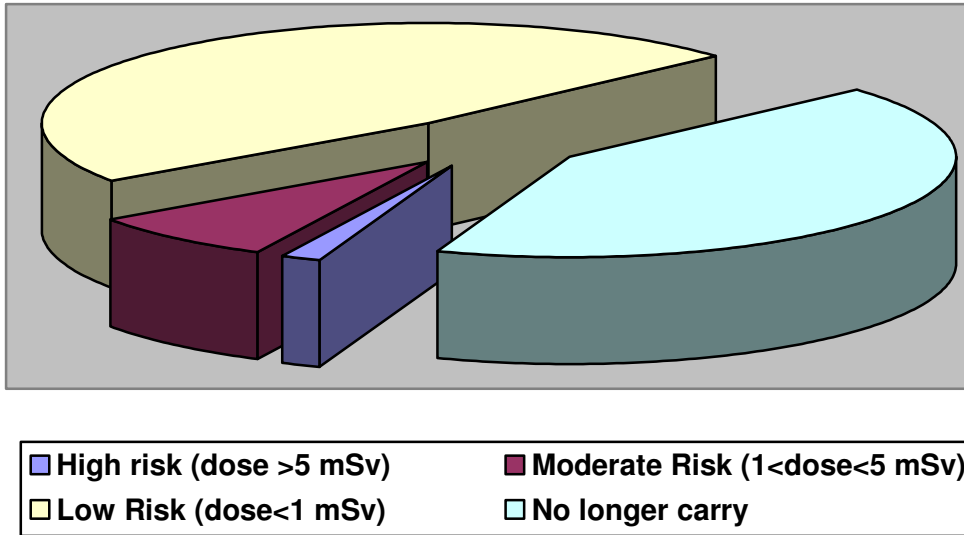
- ✓ The accuracy of the level of risk identified in the radiation protection program,
- ✓ The proper implementation of the carrier's radiation protection program, and
- ✓ The knowledge of the workers about the company's radiation protection program.

CURRENT STATUS

As of May 2007, 123 carriers are listed in the CNSC database as transporting radioactive material and 71 of them have submitted a radiation protection program; others have indicated that they no longer transport radioactive material. Of those that submitted their radiation protection program, 2 are identified as high risk, 10 are identified as medium risk and 59 are identified as low risk. The distribution by risk category is presented in Figure 1. The radiation

protection program for each carrier has been reviewed by the CNSC and some have been requested to make changes in order to meet the CNSC requirements.

Figure 1 Distribution based on Risk Category



Although the CNSC has been successful in promoting the implementation of radiation protection programs for carriers; the difficulty has been to obtain accurate information about the carriers. The main reason relates to the fact that the transport industry changes rapidly and that the CNSC does not currently have an easy way of gathering up-to-date information about carriers that transport radioactive material.

WAY FORWARD

The method used to gather the original information to populate the CNSC database involved significant effort. It is believed that this exercise needs to be repeated on a regular basis in order to maintain accurate information. Considering the effort required, the cost associated with this option and the fact that it would need to be repeated on a regular basis, other options are being looked at in order to optimize the effort required against the cost involved.

One of the options consists of requesting each licensee to provide detailed information regarding the carriers they use for transporting their radioactive material through their annual reporting to the CNSC. This would provide the necessary information on carriers that transport radioactive material. Each of the carriers not listed in the CNSC database will then be contacted and requested to submit their radiation protection program for evaluation. New information would be coming on a regular basis as the date of annual reporting varies for each licensee.

Better communication between the carriers and the CNSC will be established by contacting the newly identified carriers directly to discuss the regulatory requirements with respect to the radiation protection program.

However, this option will require significant computer programming effort from the CNSC since reporting forms were created electronically for several categories of licensees. In addition, the central licensing database used to store this information only contains information about CNSC licensees; it does not currently include information on carriers. New forms would need to be created to include information on carriers which would then need to be included in the central licensing database. In addition, the central database will need to be modified to store information on carriers collected from the electronic forms.

CONCLUSIONS

The CNSC is confident that the requirement for carriers to implement a radiation protection program has been generally well accepted. The main challenge is to establish a simplified method of obtaining up to date information on carriers that transport radioactive material as these carriers do not require registration with any Canadian authorities prior to transporting radioactive material and do not require the issuance of a license by the CNSC.

A simplified method is still under evaluation by the CNSC. Approximately 12 to 15 months would be required to finalize the revision of the electronic forms and the modification of the central licensing database to include the information on carriers once it is accepted.

The CNSC expects that by adopting a more effective method for collecting carrier information, the work required to maintain the quality of the information will be reduced. The information collected in the database will be used to develop the systematic inspection program for carriers and to schedule the inspections of the various carriers. This inspection program will ensure that adequate resources are devoted to compliance with the requirement to maintain a radiation protection program that will be sufficient and commensurate with the level of risk of exposures to the transport workers.

For the systematic inspection program, it is expected that the development of the various parameters used to determine the inspection frequency and location to be inspected will be completed by the end March 2008.

REFERENCES

¹ Proceedings of the International Symposium on Packaging and Transportation of Radioactive Materials, PATRAM 2001; **R-9, Study on Doses of Ionizing Radiation Received by Transport Workers in Canada**, Sylvain Faille, Canadian Nuclear Safety Commission, Canada

² International Conference on the Safety of Transport of Radioactive Material 7-11 July 2003, Vienna, Austria; **Dose of Ionizing Radiation Received by Transport Workers - A study conducted in Canada in 2002**, S. Faille, (IAEA-CN-101/19)

³ Proceedings of the International Symposium on Packaging and Transportation of Radioactive Materials, PATRAM 1992; **Implementation of ALARA for Transport**, Wilson C, et al (1992)

⁴ Safety Standards Series No. TS-G-1.3, IAEA Safety Guide; **Radiation Protection Programmes for the Transport of Radioactive Material**,