

The IAEA Regulations for the Safe Transport of Radioactive Material Today and the Future

Authors:

Betty Bonnardel-Azzarelli

Jan van Aarle

Specialist Advisor

Head Services Nuclear Fuel

WNTI

Axpo Power AG

Abstract

The IAEA Transport Regulations originated in 1961 and have developed over the past 50 years. Several editions have been issued but the format of the regulations did remain essentially the same.

Whereas experienced stakeholders in the RAM transport industry have come to terms with the current style of SSR-6 and can operate within it, many, especially those new to the industry, may find that both SSR-6 and its guidance documents, are fragmented, not user-friendly and they may have difficulty in applying them to the transport of specific materials, including some nuclear fuel cycle materials.

The paper reviews the current documents covering the radioactive transport regulations, highlights a number of shortcomings and puts forward suggestions for discussion which could lead to a simpler and more and user-friendly set of documents which would also facilitate compliance.

Introduction

The transport of radioactive materials has been carried out safely for over five decades. Last year, this outstanding achievement has been recognised by the International Atomic Energy Agency (IAEA) General Conference as stated in its 9th Resolution:

Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety [1], which contained the following “[...] historically, the safety record of civilian transport, including maritime transport, of radioactive materials has been excellent, [...]”

and stressing the importance of international cooperation to enhance the safety and security of international transport”.

Safety remains one of the main concern for the industry and this outstanding record cannot be taken for granted. The packaging and transport industry have gathered over the years a wealth of experience in the safe transport of radioactive materials. Sharing this with the bodies developing and approving the regulations is an important responsibility of the industry to ensure that radioactive materials will continue to be transported and packaged safely, efficiently and reliably.

The World Nuclear Transport Institute (WNTI) with some 50 industry members is accepted as the expert voice of the radioactive materials transport industry worldwide for developing common views and positions. A survey was recently carried out by the WNTI to gather views from industry members and international experts on the IAEA *Regulations for the Safe Transport of Radioactive Materials* (SSR-6) [2] and issues related to their implementation. Questions were asked concerning the structure and usability of the SSR-6, its benefits and shortcomings; how to change the IAEA Transport Regulations in order to make it more user-friendly; what are the current views on the harmonisation with the United Nations Model Regulations: *Recommendations on the Transport of Dangerous Goods*, [3] also called the “UN Orange Book” (UNOB), published by the Economic and Social Council (ECOSOC) Committee of Experts on the Transport of Dangerous Goods (TDG).

The objective of this paper is to review the current transport regulations in the light of this survey and to put forward suggestions for discussion which could lead to a simpler and more user friendly set of documents which would also facilitate compliance.

1. Current Transport Regulations

The *Regulations for the Safe Transport of Radioactive Materials*, now known as SSR-6, were first published in 1961, as Safety Series No. 6. These IAEA standards have been the subject of many reviews and have been revised nine times since the first edition (in 1964, 1967, 1973, 1985, 1996, 2003, 2005, 2009 and 2012), including a changing of identifier from SS-6 to ST-1, TS-R-1 and SSR-6. Following these regulations, radioactive materials are packaged and transported according to requirements graded according to their radioactive, physical, and chemical properties.

The current structure of the chapters in SSR-6 helps in guiding specialists to the specific areas on which they need to focus, including the design, fabrication and use of packages and their transport. A large variety of experts have to rely on the Transport Regulations, for instance for structural analysis, thermal analysis, nuclear criticality, shielding, containment evaluation, quality assurance, transport operations and operations management. It is therefore important that these different experts can readily find the information relevant to their needs.

Over the years, a lot of efforts have been made to ensure more stability in the Regulations, and the emphasis has been to make changes only if there would be a beneficial impact on safety. This stability allows the countries applying the regulations, and those required to comply with the regulations, to have a stable platform from which to work. The industry has welcomed this approach. For instance, it has been the case for several review cycles and also

in the latest review cycle, which started in January and concluded in May this year, the issues submission forms [4] included a section where the suggested changes had to be justified, stating the expected safety benefit and also the implementation cost.

An IAEA effort to establish and document the Technical Basis for the IAEA Transport Regulations, SSR-6, was initiated at a Technical Meeting in October 2010, with a follow-up Technical Meeting in 2011, and at a Consultant Meeting in March 2012 [9]. Experts, including WNTI representatives, compiled and evaluated information sources, searching for documents from the late 1950's and later, and developed a useful database of information. Organised in clearly identified chapters, this document represents the "memory" of the requirements and traces the rationale behind them. It clarifies existing requirements and also justifies the removal of previous requirements and the rejection of proposals for change. The documented justifications for removal and rejection are valuable in reducing repetition of the same requests and introducing rejected provisions while demonstrating the safety culture at the time. This document is equally important for Competent Authorities and the industry, as it underlines the spirit of the requirements and helps in clarifying their interpretation. This document will support the Regulations and will facilitate implementation. Its publication will be welcome. The document will also have to be maintained and updated regularly and more specifically during a review cycle, where new proposals are presented and justified.

On the format of the Regulations, the WNTI survey showed that views are more divided on the 'user-friendliness' of the Regulations. A few past studies and white papers have been drafted on what could be a universal user-friendly set of radioactive materials transport Regulations. The two main categories of Transport Regulation users are the transporters and the package designers. For those who have gathered a wealth of experience with the regulations, it would be difficult to consider a complete overhaul: they have proven workable, and changes of significance are seen as a potential disturbance of the current system. Some experts can remember full paragraphs by heart and can point to a specific requirement. It is therefore mostly new comers and smaller users of the Regulations who would benefit from a more user-friendly look. This would however mean a complete rewriting. Suggestions range from scrapping the document altogether, focusing on the Orange Book only or reshaping the SSR-6 according to the format of the Orange Book, or the modal Regulations or a combination thereof. There is little consensus at this time on how the format could be improved significantly. A new generation of transporters may one day come up with a solution but there is ample evidence that there is room for worthwhile improvement in the meantime.

It is important for the views of the various stakeholders on how these regulations are perceived, implemented, and used, to be fed back to the regulators. Last April, the IAEA organised a Technical Meeting to Produce Consolidated Drafts of the IAEA's New Transport Safety Standards Taking into Account the Results of the 2011 International Conference on the Safe and Secure Transport of Radioactive Material. This meeting included three WNTI participants. The final report for the meeting contains recommendations [5]. Some of these recommendations apply to the way the requirements are drafted and the meeting found it would be beneficial if the following points were considered:

- Clear definitions, no requirements in the definitions;
- Consistent use of definition;
- One requirement per one paragraph;
- Standards for legislation: use of shall, should, must, might;

- Use of “and” and “or”;
- Not doubling of negative words;
- Short, precise and concise sentences;
- Clear punctuation;
- More visuals, e.g. flow diagrams, tables;
- Avoid cross references, if possible.

On the practical side, the results of the WNTI survey on SSR-6 also suggested the use of electronic editing tools such as “hyperlinks” in the Regulations to allow easier navigation in the document, as it is quite common for paragraphs to cross-reference each other.

2. SSR-6 within the IAEA safety series

The SSR-6 is not a standalone document. It is supported by a series of guidance documents, of which two are of particular interest to this discussion: the *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material*, TS-G-1.1 [6] and the *Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition)*, Draft Safety Guide, DS461, IAEA, TS-G-1.6 [7].

The TS-G-1.1 provides guidance on the interpretation of the Regulations. However, it also contains explanatory material. When this document became under review this spring, the WNTI industry members submitted a proposal to move the explanatory material from TS-G-1.1 to the Technical Basis document mentioned above. This would allow TS-G-1.1 to be reduced leaving only advisory text in the document.

As a matter of fact, the IAEA Technical Meeting to Produce Consolidated Drafts of the IAEA’s New Transport Safety Standards Taking into Account the Results of the 2011 International Conference on the Safe and Secure Transport of Radioactive Material noted that *“[t]here is a lot of text in the Advisory Material (currently still TS-G-1.1 from 2008) that is valuable for various purposes but not to the daily needs of transport staff. The Technical Basis effort allows movement of some of the text and references to such a document. This concern is one of the major reasons for the Technical Basis effort.”* The Technical Meeting Working Group 1 then recommended to *“simplify the actual guidance (as opposed to explanatory and historical information) to transport staff in the Advisory Material. Preserve other information in a separate document such as a Technical Basis document”*.

TS-G-1.6 (schedules) is a document which presents the paragraphs from IAEA Transport Regulations relevant to each of 25 UN numbers. The document cannot be seen as a redrafting of the Regulations, as the full text is still needed to comply with the requirements. However, it can present a very useful entry point in the Regulatory text, useful for training purpose, as a reference, and for an overview. Working Group 3 of the IAEA Technical Meeting to Produce Consolidated Drafts of the IAEA’s New Transport Safety Standards Taking into Account the Results of the 2011 International Conference on the Safe and Secure Transport of Radioactive Material, *“recommend[ed] using the Schedules as a basis to improve Class 7 requirements in the table of Chapter 3.2 in UNOB and the modal agreements/regulations. [Working Group 3] has an opinion that Schedules are very useful for regulators, shippers and for training purposes for beginners... Moreover the Working Group 3 recommend[ed] inserting the flow diagram of TS-G-1.6 into SSR-6, Section 4 (Classification) and also into*

UN Orange Book, Chapter 2.7.” It can be noted that the proposals mentioned above are well in line with the conclusions of this Technical Meeting.

The IAEA Transport Safety Unit also started to develop an electronic version of the schedules, and this encouraging work should be pursued. Use of electronic means allow an easier access to the information, and therefore would be helpful.

The Technical Guide, Package Design Safety Reports for the Transport of Radioactive Material (PDSR), was developed in 2012 by Competent Authorities and their support organisations, of Belgium, France, Germany, Spain, the United States, as well as the World Nuclear Transport Institute and AREVA, as industry representatives on the basis of the 2009 Transport Regulations. This document was issued with the intent of providing standard roadmap guidance to licensees and Competent Authorities in the preparation and review of Safety Reports, to ensure they demonstrate that the packagings meet the package design requirements in compliance with the applicable dangerous goods regulations. This PDSR guidance document is providing clarity and ease of usefulness of the Transport Regulations with the specific aim to guide the package design applicant in using the SSR-6.

3. Harmonisation with UN Orange Book and modal Regulations

In addition to being part of the IAEA safety series, the IAEA Transport Regulations are also meant to be developed in harmonisation with the UN Orange Book (UNOB) and the modal Regulations, namely the International Maritime Organization (IMO) International Maritime Dangerous Goods (IMDG) Code, the International Civil Aviation Organization (ICAO) Technical Instructions, the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) and the Regulations concerning the International Carriage of Dangerous Goods by Rail (RID).

Over the years, a lot of effort has been made to get the IAEA Transport Regulations and the Model/modal Regulations harmonised. However, if there are general requirements in the UNOB that apply to Class 7, but are not yet incorporated into the SSR-6, then these requirements should be carried back to the IAEA Transport Safety Standards Committee (TRANSSC) and should be addressed by TRANSSC specifically and so that TRANSSC makes appropriate recommendations back to the UN Committee of Experts drafting the UNOB.

Another example of the need to consider harmonisation between the SSR-6 and the UNOB is given in the report of the IAEA Technical Meeting to Produce Consolidated Drafts of the IAEA’s New Transport Safety Standards Taking into Account the Results of the 2011 International Conference on the Safe and Secure Transport of Radioactive Material:

- Difference of requirements for UN Packing groups and IAEA types of packages (e.g. Industrial Packages);
- Certification requirements for non-approved package designs;
- Primary and subsidiary risk (technical basis for criteria);
- Limited quantity, Excepted quantity vs. Excepted package;
- Transport of samples (UNOB 2.0.4);

- Salvage packaging (UNOB 4.1.1.18, 6.1.5.1.11);
- Expand emergency provisions with general mode-independent requirements (304, 305 and 554 (c) of SSR-6);
- Assessment of special provisions of UNOB, applicable for radioactive material;
- Segregation requirements and guidance for persons (public and workers), para 562 of SSR-6.

Also, during the survey, it was found that the main advantage of the SSR-6 is its brevity, which should be preserved. The paragraphs concerned by radioactive materials transport in the ADR, RID, ICAO TIs and IMDG Code are found to be often widely scattered. It is potentially quite difficult for a new comer to find the paragraphs relevant radioactive materials transport in the modal regulations, while the SSR-6 is seen as self-contained document addressing only Class 7.

4. Harmonisation of Transport Regulations between countries and their implementation in each country

In considering the manner by which Transport Regulations are developed and implemented worldwide, a very large variety of ways exists in the implementation of the regulatory requirements by the Member States. For instance:

- simply adopting the latest version of the IAEA Transport Regulations verbatim, possibly including translating them into their native language;
- adopting the Regulations directly, but adding an appendix to address country specific variations;
- adopting the Regulations by reference, using a simple legal document stating that a specific edition of the Regulations (e.g. SSR-6) is to be followed;
- adopting the modal requirements promulgated in IMDG Code, ICAO TIs, ADR, RID;
- adopting by completely re-writing the regulatory requirements in the IAEA Transport Regulations.

Countries around the world establish Transport Regulations that meet their national legislation, their particular needs and structures. As transport is international, it is sometimes burdensome for industry to address differences which do not concern safety, but are down to national practices and national bureaucratic systems. Regional agreements are being investigated and the example of the European Union Member States comes to mind. Improvements could be made to assist a State or group of States to make the regulations more user friendly, even this is a long and difficult task.

The difference is not only in the Regulatory text itself, it is also in its implementation. Some countries have only one Competent Authority, other countries have multiple Competent Authorities. The only binding overarching documents are the Conventions which support the implementation of the modal Regulations; for instance the International Convention for the Safety of Life at Sea (SOLAS) Convention for the IMO IMDG Code.

Some examples of mutual recognition do exist mainly in the approval of package design. The mutual recognition between the United Kingdom and France is a stepping stone towards a the

European guide which exists for package design safety report (PDSR) edited by the European Association of Competent Authorities. In the United States, a single point of contact provides the interpretation of the Regulations. This number can be called in and forms the official interpretation of the national Regulations. Could there be eventually a unique international call centre, who can clarify Regulations and provide a uniform interpretation, which would be accepted by all parties?

The administrative burden can sometimes act as a barrier to users who need to transport radioactive materials. It is therefore important to balance the administrative burden (documentation, filing, checks, etc.) given for a specific transport with the safety implication of such a transport. An example often given is the amount of documentation required for transporting an empty package is comparable to the documentation required for a loaded package. The level of safety required is not proportionate to the administrative burden. In fact, in some instances, a high administrative burden may be increasing the risk for human error, focusing stakeholders' attention on paperwork and details rather than guaranteeing the maintenance of a safety culture.

Even if two neighbouring countries apply the SSR-6, their individual interpretation of the requirements may differ widely. The Transport Regulations can be difficult to interpret in some instances, especially for countries that do not do a lot of radioactive material transport. It is a fact that conflicts between various forms of Regulations can increase the likelihood of delay or denial of shipments, as remarked by the IAEA Technical Meeting to Produce Consolidated Drafts of the IAEA's New Transport Safety Standards Taking into Account the Results of the 2011 International Conference on the Safe and Secure Transport of Radioactive Material, which also noted "*that overzealous scrutiny and misinterpretation by non-technical controllers can also result in denials and delays*". It is therefore important to keep the requirements simple and clarify them when necessary. The implementation of clear requirements should be done the same way in the various countries. This would contribute to the stability of the Regulations. It is important not to oppose "stability" of the Regulations and their implementation and "revision" of the Regulations, as revision can be a vehicle towards stability. However, this is not enough.

5. Implementation and timing of SSR-6 multilateral approval processes

For the international transport of packages requiring Competent Authority approval, the current regulatory framework can often be rigid and unforgiving in terms of its demands on both applicant and Competent Authority. The combination and complexities of resurrecting an expiring approval, securing multiple international validations and booking transport slots months in advance of a scheduled transports makes for a fragile system where cancelled and delayed shipments are not unheard of.

In addition, innovation may be stifled as design modifications and improvements are either delayed or permanently postponed due to their potential to disrupt and destabilise the ability to fulfil programmed transports.

When attempting to secure foreign validations, short timeframes are typically involved. This often results in difficulties for applicants to respond to any additional Competent Authority question in sufficient time to secure continued renewal. Significant resources need be diverted to monitor progress, rework transport programmes, and additional costs are incurred regarding delayed or cancelled shipments. Delayed or cancelled shipments may also result in a reduced level of confidence by carriers which has the potential to damage business relationships in the longer term.

6. The benefit of Workshops involving regulators, industry and other stakeholders

In the last two years, the WNTI has organised four workshop dedicated mainly to the transport of uranium ore concentrate (UOC), in Namibia, Russia, Kazakhstan and China, gathering Competent Authorities and industry together. Through presentations and discussions, opportunities were made to clarify the interpretation of the Regulations, allowing Competent Authorities from neighbouring countries and countries further away, regulators, Customs officials, and industry to share their understanding of the Regulations. The WNTI Industry Members really appreciated the interaction offered and are grateful for the Competent Authorities and Government Bodies represented to have contributed to these discussions.

In addition to this type of exchange, training and education are also a way to facilitate the understanding of the Regulations to new comers in both Competent Authorities and Industry. Education and training are important, to build trust between the various stakeholders and should not only be directed at the carrier, consignor or Competent Authority. The WNTI has always supported training sessions organised by the Agency by providing experts who offered the industrial perspective on the need for the Regulations and how they are implemented to ensure strict compliance.

7. Conclusion

This paper presents an industry view and suggests topics for future discussion on the need to revise the various documents covering the Regulations for the Transport of Radioactive Material so that they are less fragmented and more easily used and implemented by the various stakeholders.

In summary, the WNTI Industry Members considers that the:

- SSR-6 structure is beneficial for specialists to identify their specific requirements;
- ‘Safety benefit and implementations cost’ is a key criteria on the IAEA issues submission forms and should be given due consideration;
- work on the Technical Basis for the Transport Regulations should continue as this document plays an essential role in ‘recording the journey so far’ and ‘reflecting on what and why decisions were made’;
- the WNTI ‘outreach’ workshops have proven invaluable opportunities for sharing learning and building trust.

The WNTI would support further discussion and consideration in the following areas:

- Improve clarity and user friendliness;
- Consideration of Orange book format;
- Simplification of the IAEA guidance material;
- Country implementation, timing of multilateral approval processes;
- Administrative burden;
- Extending ‘mutual recognition’ e.g. to other European Union countries, North America and Russia.

The industries which are dependent on the transport of radioactive material, notably the nuclear power industry, are expected to expand significantly. New entrants to transport in new regions are likely to emerge.

The revisions to the Regulations proposed in this paper should not only benefit stakeholders in their implementation but also facilitate strict compliance with the Regulations and thereby contribute to ensuring that the outstanding safety record of the industry is maintained.

References

1. Regulations for the Safe Transport of Radioactive Material, 2012 Edition Specific Safety Requirements, International Atomic Energy Agency, SSR-6, 2012 Edition
2. 9th Resolution of the 56th General Conference, International Atomic Energy Agency, (English text), Measures to strengthen international cooperation in nuclear, *radiation, transport and waste safety, 2012*
3. United Nations Model Regulations: *Recommendations on the Transport of Dangerous Goods*, also called the “Orange Book”, Economic and Social Council (ECOSOC) Committee of Experts on the Transport of Dangerous Goods (TDG)
4. Submission form *Issues Identified with the Regulations for the Safe Transport of Radioactive Material and/or Supporting Documents/Proposals for Changes to the Regulations for the Safe Transport of Radioactive Material and/or Supporting Documents* for SSR-6 Version 2012 and Working Material TS-G-1.1 Draft 2.2 DS425, IAEA
5. *Final Report, Technical Meeting to Produce Consolidated Drafts of the IAEA’s New Transport Safety Standards Taking into Account the Results of the 2011 International Conference on the Safe and Secure Transport of Radioactive Material*, TM-44897, IAEA
6. *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material*, TS-G-1.1, IAEA
7. *Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition)*, Draft Safety Guide, DS461, IAEA
8. *Technical Guide - Package Design Safety Reports for the Transport of Radioactive Material, European PDSR Guide Issue 2* (September 2012)
9. *Technical Basis for the IAEA Regulations for the Safe Transport of Radioactive Material (TS-R-1)*, Support for the IAEA project “Progress and Justification of the

Technical Basis TS-R-1, April 2013 DRAFT, INF 12 Technical Basis working draft document.rbp.23april as submitted to the IAEA TRANSC 26