



## **PACKAGE TESTING TO DEMONSTRATE SAFETY WITH ADDED FEATURES**

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### **ABSTRACT**

Industry has noted that there are different views in the approach about how the transport and/or handling of frames, where they exist, should be taken into account in the safety analysis. This subject is crucial when having to comply with the requirements of paragraph 611 in the 2009 Edition of the IAEA Transport Regulations for the Safe Transport of Radioactive Material (TS-R-1): “Any features added to the package at the time of transport which are not part of the package shall not reduce its safety”.

This topic was considered in IAEA during the fifteenth meeting of the TRANsport Safety Standards Committee (TRANSSC 15) in October 2007. It was discussed during a Technical Meeting at the beginning of the year 2008 resulting in convening a Consultants Meeting in September 2008. In support of the discussions of this Consultants Meeting, members of the World Nuclear Transport Institute (WNTI) met in April 2008 to expand their common position. In the Technical Meeting held in January 2010 the output from the above meetings were further discussed and reflected in the draft of the 20xx Edition of TS-R-1, which is now subjected to the Member States and international organisations 120-day review.

The paper considers the following aspects, with an industry perspective:

- What are the technical and administrative difficulties when dealing with the requirements of paragraph 611 in TS-R-1
- What are the boundaries of the package. What is a feature added to the package at the time of transport
- How to assure safety of transports when considering the added features
- What is the outcome of the 2007 and 2009 review/revision cycle of TS-R-1
- How to go further

### **1. INTRODUCTION**

Many transports of radioactive material are made from one country to another. The international nature of these transports induces the need for regulations which are widely common to all countries. In fact, international transports of radioactive material are regulated by international modal regulations for each mode of transport (road, rail, air or sea). All these regulations are based on the “Regulations for the Safe Transport of Radioactive Material” set forth by the International Atomic Energy Agency (IAEA).

In spite of these international modal regulations, there still are national deviations. This is a burden when preparing an international shipment. But, beyond this primary issue, the harmonised interpretation and implementation of these (almost) common Regulations is an additional difficulty. The purpose of this paper is to discuss the interpretation of paragraph 611 of the IAEA Transport Regulations. This paragraph requires that “any features added to the package at the time of transport which are not part of the package shall not reduce its safety”. In some countries it is considered as



the basis to request additional assessments regarding the behaviour of the package when it is fitted with its transport and / or handling frame (where it exists).

More precisely, the paper will:

- identify the regulatory requirements
- give examples of the views in some countries, and also at different periods of time
- describe the discussions which are taking place at the international level.

## **2. WHAT IS THE SITUATION?**

Industry members have noted that there are different views in different national jurisdictions about how the transport and/or handling frames where they exist should be taken into account in the safety analysis. For a long time, there was no requirement on that topic.

It is accepted internationally that safety is vested primarily in the package that actually contains the radioactive material – not the transport conveyance, or any additional feature to the package. The transport and/or handling frame is part of the general environment of the package, as it is the case for the conveyance. As it is accepted that there is no need to assess the interaction of the conveyance with the package during accident conditions of transport, it was accepted that there was no need to assess the interaction of the transport and/or handling frame with the package as well.

Now, it appears that there are different views on that topic.

- Through paragraph 611 of the IAEA Transport Regulations which requires that “any features added to the package at the time of transport which are not part of the package shall not reduce its safety” on the one hand, and
- considering that the transport and/or handling frames should be recognised as a “feature added to the package” on the other hand,

Some authorities request that an analysis is made on the basis that the package and its transport frame as a whole should be submitted for instance to the regulatory drop tests (9-metre drop onto a flat and unyielding surface, in particular, but also punch bar test or fire test).

## **3. EXAMPLES OF APPROACHES IN SOME COUNTRIES**

**3.1** A first example appeared a few years ago when a package design approval issued in one country had to be validated in another. The package of concern is transported on a dedicated transport frame. It has to be handled also with this dedicated frame, which acts as an intermediate structure between the crane and the package itself.

- Though this frame could be considered as having the same purpose as a yoke (even if the shape is quite different from the shape of a usual yoke) when the package is handled, on the one hand, and
- though the handling of the package with its frame took place in a nuclear power plant (where the transport regulations do not apply), on the other hand,

The authority of the country where the original certificate of approval had to be validated required that an assessment was made about the behaviour of the package and its transport and handling frame. Consequently this authority issued a special authorisation for each shipment,



including restrictions about the handling of the package in the premises of the nuclear power plant.

**3.2** A second example is provided in another country where the competent authority, during a certain period of time, required for all packages handled with a handling frame to receive evidences that the behaviour of the package during a 9-metre drop is not altered when assuming the package is fitted with its handling frame. No requirement was set forth for packages which were handled without any handling frame.

Now, this competent authority has established new requirements. Whilst equipment such as ISO containers or pallets used to handle the package are excluded from any requirement, features added to the package are defined as devices which are attached or in contact or very close to the package (for instance, the four supports attached to the trunnions of a spent fuel cask).

- Then, the first step for the applicant is to define a “stowage design”: the package fitted with this stowage device must be able to withstand the regulatory accident conditions of transport (including the 9-metre drop test, in the most damaging orientation). The assessment performed by the applicant has to be accepted by the competent authority.
- Later on, the consignor and/or the carrier has to demonstrate before the transport that the real transport frame meets the requirements of the “stowage model” submitted to the competent authority.

It must be mentioned that the first step amounts to considering that the transport and/or handling frame is part of the package.

**3.3** A third example is the case of a country which in some instances requires that specific study is performed to assess the behaviour of a package with its direct environment (transport frame, container, ...) when the full set is submitted to realistic accident conditions of transport. The realistic conditions of transport includes simultaneously the height for the drop but also the nature of the target (including whether it is unyielding or not).

**3.4** There is a fourth example with countries which recommend that the equipment always becomes detached from the package during the accident conditions of transport, and the package separates from the equipment before that equipment separates from the conveyance.

**3.5** A fifth example is provided by authorities that take the position that the transport and/or handling frame is not a part of the package, and require no assessment with frame, considering that such assessment is essentially covered by the regulatory test conditions of packages.

#### **4. WNTI POSITION**

As part of the review cycle of the IAEA Transport Regulations which was initiated in 2007, the World Nuclear Transport Institute (WNTI) submitted in August 2007 an “issue”. Industry members noted that there are different approaches about how the transport and/or handling frames, where they exist, should be taken in the safety analysis.

During the meetings held by the end of 2007 and beginning of 2008 in the Agency, no significant technical progress was made. The large number of participants to those meetings did not allow for



efficient discussions, considering the original broad spectrum of views on this topic. However, the decision was taken to organise a Consultant Services Meeting during the second half of 2008.

In order to feed the discussion of this upcoming Consultant Services Meeting, industry members of WNTI met in April 2008 to develop a well identified common position.

#### **4.1 Definition of “package”**

Before discussing paragraph 611, it appeared necessary to specify how a package is defined in the regulations and what its boundaries are. As packages are transported, some structures may need to be added as an interface between the transport means – truck, train, ship, and aircraft – and the package; these structures are commonly called transport frames. Some features may be added for handling purposes: they are called handling frames. Packages may be transported in batches in a structure holding several packages. Are these structures part of the package?

In the 2009 Edition of the IAEA Transport Regulations, paragraph 230 states that:

*“package shall mean the complete product of the packing operation, consisting of the packaging and its contents prepared for transport”.*

And paragraph 231 states that:

*“packaging shall mean one or more receptacles and any other components or materials necessary for the receptacles to perform the containment and other safety functions”.*

The package designer needs to define the packaging design and the package design. It is the responsibility of the designer to provide this definition and then to demonstrate compliance with the regulatory requirements in order to prove that what is defined as the package performs the containment and other safety functions as required by paragraph 231. For transport purposes, the package could be attached to the carriage by the means of a transport frame. For handling purposes, some additional features may be added to the package at some point in time. Such a frame or additional features are not permanently attached to the package, but added to it where and when needed in specific circumstances. As this added frame/feature is not necessary to fulfil the requirements of the regulations as expressed above, they do not need to be considered as part of the package.

#### **4.2 Paragraph 611**

The operation with these frames added to the package is covered by paragraph 611, which states:

*“any features added to the package at the time of transport which are not part of the package shall not reduce its safety”.*

The interpretation of paragraph 611 among stakeholders varies greatly. Should these additional features, e.g. frames, be fully tested as the package is tested? Should they be considered under routine, normal or accident conditions of transport?

It is the WNTI understanding that the wording “any features ... shall not reduce its safety” does not mean “the assembly of the package and of any feature shall meet the regulations in full”.

First of all, it is accepted internationally that safety is vested primarily in the package that actually contains the radioactive material - not by the transport conveyance, or any additional



feature to the package. The responsibility of the package designer therefore remains to demonstrate the compliance of the package itself to the regulations and the tests requirements form part of a full measure of this demonstration. In addition, paragraph 611 is a general requirement. It addresses the safety of operations rather than the compliance with regulatory criteria.

On the basis of the above, it should be concluded that safety will be fully assured by the package itself and demonstration of compliance with paragraph 611 can be limited to routine conditions of transport and does not require any supplementary testing. For instance, dropping a package with its frame is essentially equivalent to dropping the same package onto its frame. While it is commonly accepted that dropping the package onto its frame is covered by the regulatory package tests, it should logically follow that dropping the package with its frame is intrinsically addressed.

In addition, WNTI identified many difficulties associated with the implementation of this paragraph 611 to transport and handling frame, such as:

- how to consider the transport frame for multiple small packages
- how to manage changes to the transport frame
- how to deal with multiple carriers and/or multiple modes of transport
- how can this issue be considered by common carriers such as airlines
- what are the reasonable boundaries between the features added to the package and those added to the conveyance

Furthermore, the package designer might not be aware of all of the equipment which might be added at the time of transport. This is the case, for instance, for a multi-modal journey which takes place through several different countries. It is suggested that in these circumstances the responsibility for demonstrating compliance with the paragraph 611 must rest with the consignor or the carrier.

Therefore, this requirement would be better placed in Section V (Requirements and controls for transport) of TS-R-1 than in Section VI (Requirements for packagings and packages). This would clarify the intent of this requirement: instead of a requirement applicable to the designer and to the package design, it would be a requirement to apply during the operations and would concern primarily the added features (and not the package). It would “simply” avoid placing “hazardous” components on or near the package, as already more or less explained in TS-G-1.1. Then, it would become more a requirement to implement with common sense than a quantitative requirement with precise criteria.

However, the need to evaluate, in some cases, the influence of the transport and/or handling frame and more generally all added features in realistic conditions (including different kinds of target etc.) is recognised. This can be confirmed by the safety authorities as a safety case independent of the application for a package design approval: the appropriate framework for this research is the need to periodically review the Regulations versus the real conditions of transport and handling. The participation of the industry in such research could be arranged.



## 5. IAEA CONSULTANT MEETING AND TECHNICAL MEETINGS

In September 2008, the IAEA convened a Consultant Services Meeting to deal with outstanding issues about package testing and which were not resolved during the initial meetings of the review cycle which started in 2007. This meeting was attended by representatives from France, Germany, Japan, the United Kingdom, the United States of America, and the WNTI.

One of the issues of particular interest was the transport and/or handling frames and the way they have to be considered with regard to paragraph 611 of the IAEA Transport Regulations.

The meeting concluded that there was a need to amend paragraph 611 and to provide guidance on paragraphs 230, 231 (definitions of package and packaging) and 611 for clarification, but, due to the lack of time, no conclusion was reached on a new wording for these regulatory and advisory texts. In the Technical Meeting to consider the issues and draft 20xx Edition of the Regulations in January 2010, there was an intensive discussion on this topic in a working group. Majority views on the intention or paragraph 611 were as follows:

- Paragraph. 611 applies to all package types, some of which do not require prior regulatory approval. Accident conditions mean different things for the different package types
- Paragraph 611 is a very general statement, and assurance requirements are vague. It is understood that the intent is to mean “don’t do anything stupid” in preparing a package for shipment
- Paragraph 611 was added in the 1965 Edition, originally to consider items shipped with the package. Since then the meaning has grown and changed
- the word “intended” may apply to designer, consignor, or shipper. This could limit the assessment to what the designer anticipates
- this change was created with consideration to large Type B(U) and Type B(M) packages which would be more likely to have a transport frame
- the interpretation and demonstration of compliance with paragraph 611 differs around the world. For multilateral approval, this is a challenge.

Finally the working group concluded not to change paragraph 230, 231 and 611 of the Regulations, but amended guidance for these paragraphs as follows, based on proposals from the Consultancy Meeting. This conclusion was adopted by the meeting and proposed guidance text was incorporated in the draft of “Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material” (TS-G-1.1) for the Member States and International Organizations 120-day review.

### 5.1 Definition of “package”

As stated in the WNTI position, a first aspect of the problem is the definition or the boundaries of the packaging/package. To provide clarification, the following revised guidance material about the definition of package and packaging was agreed to be forwarded to the review <Compared to the existing text in the document TS-G-1.1 (Rev. 1) published in 2008, the new or modified text is in bold type and deleted text is striked out>.

*230.1. The terms ‘package’ and ‘packaging’ are used to distinguish the assembly of components for containing the radioactive material (packaging) from this assembly of components plus the ~~radioactive~~ contents (package).*

~~230.2. A package is the **complete product of the packaging operation, consisting of the packaging and its radioactive contents prepared as presented** for transport. ~~For design and compliance assurance purposes, this includes any or all structural equipment required for handling or securing the package which is with the package.~~~~

~~230.3. ~~In order to determine which structural components should be considered part of the package, it is necessary to examine the use and purpose of such equipment with respect to transport. If a package can only be transported with certain structures then it is normal to consider those structures to be part of the packaging.~~~~

230.3 If certain equipment is attached during transport for handling purposes, it also may be necessary to consider its effect in normal and accident conditions of transport. In the case of Type B(U), Type B(M), Type C and packages designed to carry fissile material, the designer must reach agreement with the competent authority for certification

231.1 See paragraphs 230.1 and 230.2. **Other safety functions in this definition include shielding, criticality control, prevention of damage from heat and the functioning of those features required to enable the package to comply with the performance criteria specified in the regulations for routine, normal and accident conditions of transport as applicable to the package type.**

231.2 **For design and compliance assurance purposes, this may include any or all structural equipment required for handling or securing the package which is either permanently attached or assembled integral with the package.**

231.3 **In order to determine which structural components should be considered part of the package, it is necessary to examine the use and purpose of such equipment with respect to transport safety. If for safety purposes a package can only be transported with certain structures then it is normal to consider those structures to be part of the packaging. This does not mean that a trailer or transport vehicle should be considered part of the package in the case of dedicated transport. A conveyance should not be considered part of the package, even in the case of dedicated transport.**

With this wording, a transport frame or a handling frame is not part of the packaging, otherwise specified by the designer and agreed by the competent authority to be part of the packaging, sharing safety functions of the package.

## **5.2 Paragraph 611**

Regulatory text has not been changed, since the original intent of the text, which WNTI had clarified in the paper for discussion in the Consultancy Meeting, was confirmed by consensus at the Technical Meeting. The guidance text was amended to add “transport frame” to clarify that the frame was normally not part of the package as follows:

611.1. *This requirement is intended to prevent such action as placing handling tools, auxiliary equipment, **transport frames** or spare parts on or near the package in any manner such that the intended functions of packaging components could be impaired either during normal transport or in the event of an accident.*



## **6. THE PATH FORWARD**

Through discussions in the review/revision process on the TS-R-1 Regulations, the original intent of paragraph 611 has been clarified, and chances of different interpretation among authorities on this provision are reduced, but still far from being eliminated.

In the IAEA process procedure to review/revise the Transport Regulations, the 120-day review period is the last chance for the Member States and international organisations to comment on the proposed draft of Regulations and Advisory Material. WNTI will closely examine the guidance text proposed, and will comment for further improvement to eliminate cause for misinterpretation as much as possible. Some items, such as the location of the provision (i.e. in Section V or Section VI), may remain as issues for the next review/revision cycle of the Regulations.

Not limited to this issue WNTI will continue efforts to achieve harmonised implementation and interpretation among authorities and industry. It has been proposed to the Agency as one of the highest priority items to be developed in the next few years in its transport portfolio to add a casebook (list of deviations) which includes:

- list of recognised interpretations of the Regulations
- list of differing interpretations (list of the interpretations with the identification of the Member States where such or such interpretation has to be considered).

This could be a good starting point to develop better harmonisation of the implementation of the Regulations.

## **7. CONCLUSIONS**

WNTI industry members have noted that there are different views in different national jurisdictions about how the transport and/or handling frames where they exist should be taken into account in the safety analysis.

Package designers are committed to safe transport. Safety can be enhanced by harmonisation in the implementation of the Transport Safety Regulations. This is why the World Nuclear Transport Institute (WNTI) is keen to pursue the matter through liaison with competent authorities worldwide in the interest of fostering clarification regarding the way paragraph 611 - “any features added to the package at the time of transport which are not part of the package shall not reduce its safety” - must be implemented.

More generally, it appears that the origin of the difficulty with this requirement lays in its general nature: what are the limits of the features added to the package? What is the meaning of the requirement about the absence of reduction of safety? Is safety equivalent to the Regulations?

Through the discussion in the Consultancy Meeting and the Technical Meetings convened by the Agency, it is clarified that:

- the intent of paragraph 611 is to mean “don’t do anything stupid” in preparing a package for shipment, and to be applied as a very general statement to all package types, some of which do not require prior regulatory approval





- a transport frame or a handling frame is not part of the packaging, otherwise specified by the designer and agreed by the authority to be part of the packaging, sharing safety functions of the package.

Amendment of guidance text has been proposed for the Member States and international Organizations review.

Beyond this important instance, the need to avoid general requirements in the Regulations must be a continuous goal:

- the field of application of each paragraph must be clearly defined
- the criteria must be unambiguous.

Clear Regulations should be an important goal of the current and any future Regulations review/revision cycle, for which WNTI is continuously encouraging.