

Transport of Radioactive Material

PRACTICAL DOCUMENTATION FOR PROFESSIONALS

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1. Transport: Requirements

The transport of radioactive material in Spain is regulated by a series of international regulations based on the *IAEA Regulations for the Safe Transport of Radioactive Material*.

Throughout these regulations, transport safety is based fundamentally on packaging safety; operational control during shipment is secondary. Since the regulations take this point of view, they focus on packaging design requirements and the standards that must be met by the consignor of the goods, which is the party that prepares the package (packaging plus content) for transport.

The regulations set requirements pursuing these basic objectives are:

- Containment of the radioactive materials inside the packaging.
- Control of external radiation outside the packages.
- Prevention of criticality when fissile materials are transported.
- Avoidance of damage due to the heat emitted by certain types of packages.

Packaging requirements are more demanding for higher-risk contents. In addition, the higher the risk of the contents, the stricter the transport conditions that must be upheld are.

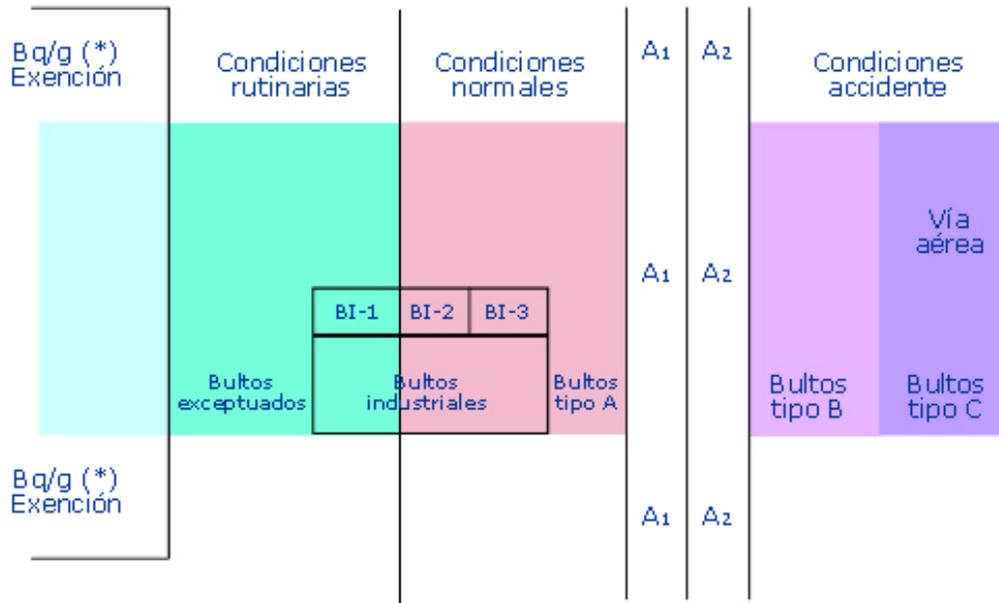
Based on these premises, packages are classified into several types:

- Excepted
- Industrial
- Type A
- Type B
- Type C

The figure describes these package types according to the transport conditions each type must withstand, which are “routine”, “normal” (minor incidents) or “accident”.

As can be seen, when the radioactive material has a certain activity level (a parameter directly related with risk), the package must be capable of withstanding a severe accident (as shown by the violet areas of the table: type B and C packages). These activity values are set individually for each radionuclide and are identified as A_1 , if the radioactive material is encapsulated in a special form, or A_2 if it is not.

Tipos de bultos de transporte de material radiactivo



(*) El valor depende del radionucléido

In the salmon-coloured area we have the package types designed to withstand normal transport conditions (A, industrial 2 and industrial 3), which comprise minor incidents. And lastly, in the green area fall the packages that contain very low-risk materials and thus have been designed to withstand only routine transport conditions. These constitute what are called “excepted packages” and “industrial packages 1”.

The area in blue indicates that if the radioactive material is below a certain activity level, it can be transported like any conventional material.

Most transport (around 90 %) involves excepted or type A packages; these packages have low-risk contents, and therefore they are not designed to withstand serious accidents. Nevertheless, transport accident statistics show that these packages have often withstood conditions more demanding than they were designed for.

In addition, specific requirements are defined for packages containing fissile material and packages containing over 0.1 kilograms of uranium hexafluoride (UF₆). Depending on the characteristics of the material, packages containing fissile material are also classified as industrial packages, type A, B or C packages or packages with UF₆.

The CSN has published a document that briefly states the requirements that the different package types must meet. This document is called: [SDB-06.1 Rev.1 \(CSN 2015\), El transporte de los materiales radiactivos](#) (only in Spanish versión).

Package and vehicle labelling, marking and placarding

There are requirements for the **marking and labelling of packages and placarding of vehicles carrying packages**. You can find information about these requirements in [issue 34 of Seguridad nuclear](#), the quarterly magazine formerly published by the CSN (only in Spanish version). The current name of this magazine is *Alfa*.

Emergency Instructions

There are requirements set for the documents that must accompany materials in a transport, which include **written emergency instructions** that the carrier must provide before departure. In addition, the consignor must attach to the transport documents supplementary information with specific instructions, appropriate to the nature of the consignment, to be followed in case of emergency. The CSN has published a safety guide about these instructions: [Safety Guide GSG-06.03](#) (only Spanish version). Also another safety guide, [Safety Guide TS-G-1.2 \(ST-3\)](#), with information on the planning and preparation of emergency response measures in transport accidents involving radioactive materials has been published by the IAEA.

Approvals and Notifications

Regulations establish a system of approvals for packages design, shipment authorisation and shipment notification, which may or may not be necessary, depending on the risk of the contents of the packages being shipped (i.e., depending on the package type) ([see Appendix I](#)).

Carriers Register

Companies that transport nuclear substances and radioactive material are subject to a declaration procedure enabling them to register with the Directorate-General for Energy Policy and Mines of the Ministry of Energy, Tourism and Digital Agenda ([Regulation on Nuclear and Radioactive Facilities](#), article 78). The **Carriers Register** can be consulted at [the web site](#).

Radiation Protection

Because the transport of radioactive material entails a risk of exposure to ionising radiations, the [Regulation on Health Protection against Ionising Radiations](#) applies in full to this activity.

The transport regulations require to companies engaging in activities related to the transport of radioactive material that involves exposure to ionising radiations to have a **Radiation**

Protection Programme (RPP), which must be kept available to the competent authority. For good guidance on how to prepare a RPP, consult the CSN [Safety Guide GSG-06.02](#) (only in Spanish version).The IAEA has also published a guide, the [Safety Guide TS-G-1.3](#).

Quality Assurance

The transport regulations require companies engaging in activities related to the transport of radioactive material (like consignors, carriers and package manufacturers and designers) to have a **Management System**, that must be kept available to the competent authority and must include a **Quality assurance programme** that applies to this activity. The CSN has published a safety guide on this subject: [Safety Guide GSG-06.01](#) (only in Spanish version) and the IAEA has published the safety guide [TS-G-1.4](#)

2. Transport: Regulations

Legislation applicable to transport

Regulations on radioactive material transport are just part of the body of general regulations applied to all dangerous goods. Radioactive material is a dangerous good, and it is identified as class 7 out of a total of nine classes. Each mode of transport (road, rail, air and sea) has its own regulations.

All transport regulations base the requirements applicable to radioactive material on the **IAEA's Regulations for the Safe Transport of Radioactive Material**, currently referred to as **SSR-6**. The latest edition of the regulations was published in 2012. You can consult them on [the IAEA's website](#) (English version) and at [SSR-6 2012](#) (Spanish version). There is also a very handy manual explaining the regulations (Advisory material), which goes by the title of [SSG-26 2012](#) (English version).

The requirements incorporated in the international regulations for the different modes of transport (ADR, RID, IMDG Code and ICAO technical instructions), which are applicable in Spain, are given in the 2012 edition of SSR-6.

The latest edition of the regulations applicable to transport by road (**ADR**) was published in Spain in [Boletín Oficial del Estado, issue 106, on 4 May 2017](#). For easier application of the ADR, you may consult the [table of equivalences between sections of the current ADR and the paragraphs of the 2012 edition of the IAEA's SSR-6](#). The changes made between the 2015 and 2017 editions of the ADR that concern the requirements specifically applicable to the transport of radioactive material are also identified.

Guide for the application of the regulatory requirements on the transport of radioactive material, G.S-06.05

The CSN has published a guide, [Guía de Seguridad 6.5](#) (only Spanish version), to make it easier for users (such as consignors, carriers, consignees and radioactive packaging designers and manufacturers) to check the ADR requirements that apply to the transport of radioactive material by road. The guide helps to classify consignments of radioactive material according to their United Nations number (UN number) and provides a summary schedule with detailed requirements applicable to each UN number. It also gives direct access to the ADR paragraphs defining the requirements.

CSN Instruction IS-34

The *Boletín Oficial del Estado* of 4 February 2012 contains the [CSN Instruction IS-34](#) establishing mandatory criteria on actions to take in connection with:

- Measurements of vehicle contamination levels.

- Unloading, haulage and movements of radioactive material during delivery to radioactive facilities.
- Actions to take and reports to submit to the CSN in the event of non-conformities.
- Availability of staff and means of help in emergencies.
- Surveillance of vehicles and their load during loading, unloading and delivery of radioactive packages. ([IS-34 English unofficial version](#))

CSN Instruction IS-35 on Design Modifications of Packages for Transport

The *Boletín Oficial del Estado* of 4 January 2014 contains the [CSN Instruction IS-35](#) establishing the mandatory procedure to follow when the design of a package for the transport of radioactive material with a certificate of approval of Spanish origin is modified or when a package's shipper makes physical or operational modifications to the packaging used. ([IS-35 English unofficial version](#))

CSN Instruction IS-38 on training

The *Boletín Oficial del Estado* of 6 July 2015 contains the [CSN Instruction IS-38](#), which defines the minimum content and frequency of the initial and periodical training of workers involved in the transport of radioactive material of consignors, carriers and consignees. ([IS-38 English unofficial version](#))

CSN Instruction IS-39 on packaging manufacture

The *Boletín Oficial del Estado* of 6 July 2015 contains the [CSN Instruction IS-39](#), regarding control and monitoring of the manufacturing of packagings for the transport of radioactive material that are fabricated in Spain. This Instruction also establishes the content of the documentation that justify the compliance with the requirements of transport regulations for a package design not requiring approval. ([IS-39 English unofficial version](#))

CSN Instruction IS-42 on criteria on notification to the Nuclear Safety Council of events in the transport of radioactive material

The *Boletín Oficial del Estado* of 22 September 2016 contains the [CSN Instruction IS-42](#), establishing the criteria for notifying the CSN the events in the transport of radioactive material. This instruction establishes the types of events that must be notified, the notification time and who must notify. Also indicates that notifications must be carried out in CSN's Emergency Room (SALEM) and the minimum information to provide. ([IS-42 English unofficial version](#))

Procedure to apply for an authorisation

Package design approval and transport authorisations are regulated by the Regulation on *Nuclear and Radioactive Facilities* (article 77). Applications must be turned in to the Directorate-General for Energy Policy and Mines of the Ministry of Energy, Tourism and Digital Agenda (Paseo de la Castellana, 160, Madrid). It is recommended to turn in two copies of the documentation; one of which will be forwarded to the CSN for examination, so it can issue the required safety report. The CSN has published a safety guide, [Guía de Seguridad 6.4 \(Spanish version\)](#), to facilitate the preparation of the supporting documents to include in the application for an authorisation: This safety guide can also be obtained in English version: [Safety Guide 6.4 \(English version\)](#)

Transport companies shall be registered in the same entity. The documents needed to apply for registration are listed in article 78 of the Regulation on Nuclear and Radioactive Facilities.

3. Summary of Regulatory Requirements to Bear in Mind when Transporting Radioactive Material in Spain

- ROAD
- AIR
- SEA
- RAIL

Some requirements are common to all kinds of transport, whether by road, rail, air or sea. The requirements given below apply to all modes of transport of radioactive material, and the requirements specific to each mode are given after these.

COMMON REQUIREMENTS FOR ALL MODES OF TRANSPORT: ROAD, AIR, SEA AND RAIL

Radiation protection

Radioactive material produces ionising radiations. Therefore, activities related to the handling of radioactive material (such as the transport of radioactive material) must adhere to standards that are designed to protect workers and the general public from the risks of ionising radiations. In Spain these standards are set in the [Regulation on Health Protection against Ionising Radiations](#). This royal decree is based on Directive 96/29/EURATOM of the Council of the European Union laying down basic safety standards for the protection of the health of workers and the general public from the risks arising from ionising radiations.

Nuclear risk insurance

According to legislation, the operator of the facility of origin or destination (as applicable) of radioactive material transported through Spanish territory must engage civil liability insurance covering nuclear damage caused by accidents during transport.

For the case of a transport of “**nuclear substances**”, 700 million euros in insurance coverage is required. However, the Ministry of Energy, Tourism and Digital Agenda may authorise a different limit (never less than 30 million euros) when the CSN considers that the associated risk does not require more coverage. This provision is established in the Additional Provision One of [Spanish Law 17/2007 \(Boletín Oficial del Estado, 05/07/2007\)](#) amending [Law 54/1997 \(Boletín Oficial del Estado, 28/11/1997\)](#) on the electricity industry.

The minimum coverage that can be required for the transport of radioactive materials that are not “**nuclear substances**” is 6,010.12 euros, according to [Royal Decree 2177/1967 \(Boletín Oficial del Estado, 18/09/1967\)](#) passing the Nuclear Risk Coverage Regulation.

For risk coverage purposes, all radioactive materials that do not fall under the definition of “nuclear substance” according to [Spanish Law 25/1964 on nuclear energy \(Boletín Oficial del Estado, 04/05/1964\)](#) are considered non-nuclear substances.

Physical protection (Security)

[Royal Decree 1308/2011 \(Boletín Oficial del Estado, 07/10/2011\)](#) on physical protection of facilities and nuclear materials and sources of radiation, establishes certain physical protection measures for the transport of nuclear material (categories I, II and III) and major sources of radiation (categories 1, 2 and 3).

The royal decree lays down a procedure of approvals of physical protection for the transport of nuclear material in categories I, II and III and notifications of transport of sources of radiation in categories 1 and 2 (according to the categories defined in the royal decree). In addition, entities transporting nuclear materials and sources of radiation in the stated categories are required to be registered with the Directorate-General for Energy Policy and Mines of the Ministry of Energy, Tourism and Digital Agenda.

For the transport of more than 500 kg of natural uranium not in the form of ore or mineral waste, notification must be reported at least ten days prior to the scheduled date of transport.

Shipments of radioactive waste and spent nuclear fuel

The authorisation procedure applied in the shipments of these materials is that defined in [Royal Decree 243/2009 \(Boletín Oficial del Estado, 02/04/2009\)](#) regulating the supervision and control of shipments of radioactive waste and spent nuclear fuel between member states or from or to locations outside the European Union, which transposes into the Spanish regulations the [Directive 2006/117/EURATOM](#) of the Council of the European Union of 20 November 2006.

ROAD

In addition to the common requirements that apply to all modes of transport, the transport of radioactive materials by road in Spain must meet the following requirements:

Transport of dangerous goods

The [European Agreement Concerning the International Carriage of Dangerous Goods by Road \(ADR\)](#) is applicable. This agreement states the requirements for transporting all classes of dangerous goods by road, including class 7, which is radioactive material.

[Royal Decree 97/2014 \(Boletín Oficial del Estado, 27/02/2014\)](#) regulating operations to transport dangerous goods by road in Spanish territory states that the ADR applies to the transport of dangerous goods by road in Spain. It includes additional provisions on certain points, such as standards for drivers, traffic rules and basic rules of action in the event of breakdown or accident, plus provisions on the control of the manufacture of packaging.

Safety advisers

Any company whose activity involves the transport of dangerous goods by road or packaging, loading, filling or unloading operations related to the transport of dangerous goods by road must designate one or more safety advisers for the transport of dangerous goods. These advisers are entrusted with helping to prevent the risks for persons, property or the environment that are inherent to these activities (ADR, section 1.8.3.). [Royal Decree 97/2014 \(Boletín Oficial del Estado, 27/02/2014\)](#), chapter V, establishes the requirements of safety advisers for the transport of dangerous goods by road.

Carrier register

Carriers of radioactive materials in non-accepted packages must declare their activity by registering in the Register of Carriers of Radioactive Materials at the Directorate-General for Energy Policy and Mines, at the Ministry of Energy, Tourism and Digital Agenda, under article 78 of the [Regulation on Nuclear and Radioactive Facilities](#).

Provisions on traffic restrictions for the transport of dangerous goods

Each year the Directorate-General of Traffic publishes its restrictions on the times, dates and itineraries that may be used by vehicles transporting goods in general and dangerous goods in particular. This information may be found at the DG's web page: [Dirección General de Tráfico](#) .

AIR

In addition to the common requirements that apply to all modes of transport, the transport of radioactive material by air in Spain must meet the following requirements:

Transport of dangerous goods

[The Technical Instructions for the Safe Transport of Dangerous Goods by Air released by the International Civil Aviation Organization \(ICAO\)](#) are applicable. These instructions state the

requirements for transporting by air all classes of dangerous goods, including class 7, which is radioactive material.

SEA

In addition to the common requirements that apply to all modes of transport, the transport of radioactive material by sea in Spain must meet the following requirements:

Transport of dangerous goods

The International Maritime Dangerous Goods Code (IMDG Code) of the International Maritime Organization, [IMO](#), states the requirements for transporting by sea all classes of dangerous goods, including class 7, which is radioactive material.

The notices that must be delivered to the authority regulating the arrival and departure in Spanish ports of ships carrying dangerous goods are regulated in [Royal Decree 210/2004, 6 Februray](#) (B.O.E. 14/02/2004).

RAIL

In addition to the common requirements that apply to all modes of transport, the transport of radioactive material by rail in Spain must meet the following requirements:

Transport of dangerous goods

[Regulations Concerning the International Carriage of Dangerous Goods by Rail \(RID\)](#) states the requirements for transporting by rail all classes of dangerous goods, including class 7, which is radioactive material.

[Royal Decree 412/2001 \(Boletín Oficial del Estado, 08/05/2001\)](#) regulating various aspects related with the transport of dangerous goods by rail states that the RID is applicable to the transport of dangerous goods by rail in Spain. It includes additional provisions on certain points, such as traffic rules and basic rules of action in the event of breakdown or accident.

Safety advisers

Any company whose activity involves the transport of dangerous goods by rail or packaging, loading, filling or unloading operations related with the transport of dangerous goods by rail must designate one or more safety advisers for the transport of dangerous goods. These advisers are entrusted with helping to prevent the risks for persons, property or the environment that are inherent to these activities (RID, section 1.8.3.). [Royal Decree 1566/1999](#),

[published in the Boletín Oficial del Estado on 20/10/1999](#), establishes the requirements of safety advisors for the transport of dangerous goods by road, rail or inland waterways.

4. Clarification of regulatory requirements

Instructions in writing according to ADR and emergency arrangements

In the event of any incident or accident happening during the transport of dangerous goods, the carrier has to know the risks of the material being carried and the emergency measures that he must take.

For this purpose, the rules and regulations on the transport of dangerous goods (including radioactive material, class 7) state that during transport the carrier must hold written instructions to help him know what to do.

In the transport by road, the regulations include a form, “**Instructions in writing according to ADR**”, which the carrier must provide to the crew of the vehicle before the shipment departs, telling them what the driver (and/or crew) must do in the event of an accident or emergency involving dangerous goods. In addition to these common actions for all classes of dangerous goods, instructions are given on the hazard characteristics and generic actions for each class. In the case of class 7 (radioactive materials), intake and external radiation are generic risks, and limiting exposure time is a generic action (ADR, section 5.4.3.).

For class 7, it is furthermore established that the consignor must add to the transport documents a statement regarding any actions the carrier has to take for the specific radioactive material that is presented for shipment. One of these documents to be furnished by the shipper is referred to as “**emergency arrangements appropriate to the consignment**” (ADR, 5.4.1.2.5.2.c). To facilitate the preparation of these arrangements, the CSN has published a safety guide: [Guía de Seguridad 6.3 GS-06.03](#) (only in Spanish version).

Therefore, if there is an emergency, the vehicle crew will know about and be furnished with the measures of action anticipated for radioactive materials and the specific measures for the radioactive material they are carrying in that particular shipment.

Transport under Exclusive Use

Knowing the meaning of the phrase “**exclusive use**”, when it is required by the regulations and what requirements it entails are issues that may not appear so obvious after you read the regulations concerning the carriage of dangerous goods. In fact, there is a certain amount of confusion over how to interpret the term.

Here is some information that may help you get a clearer picture.

According to the ADR, exclusive use is mandatory in the following cases:

- Unpackaged materials in groups LSA-I and SCO-I (see paragraph 4.1.9.2.4).
- Liquid LSA-I materials in Industrial packages type-1 (see paragraph 4.1.9.2.5. and table).

- Gaseous and/or liquid LSA-II materials in Industrial packages type-2 (see paragraph 4.1.9.2.5. and table).
- LSA-III materials in Industrial packages type-2 (see paragraph 4.1.9.2.5. and table).
- Package or overpack with an individual transport index (TI) of more than 10 or a criticality safety index (CSI) of more than 50 (see paragraphs 4.1.9.1.10 and 7.5.11.CV33 (3.4)).
- Package or overpack with a radiation level of more than 2 mSv/h in contact with the outer surface (see paragraph 4.1.9.1.11)
- Loaded vehicle or large container with a total TI sum that exceeds the values in Table D, paragraph 7.5.11.CV33 (3.3) a).
- Loaded vehicle or large container with a total CSI sum that exceeds the values in Table E, paragraph 7.5.11.CV33 (3.3) d).
- Type-B(U), type-B(M) or type-C package with a temperature of more than 50 °C on the accessible surfaces and an ambient temperature of 38 °C in the absence of solar radiation (see paragraph 6.4.8.3).

Transport that includes any of the above circumstances must abide by the ADR's definition for the mode of exclusive use, which is: *the sole use, by a single consignor, of a vehicle or of a large container, in respect of which all initial, intermediate and final loading and unloading and shipment are carried out in accordance with the directions of the consignor or consignee, where so required by ADR.*

Therefore, these conditions entail an additional requirement for each consignment or shipment under exclusive use.

Furthermore, it must be clearly understood that regular transports by a single consignor and all operations performed according to the consignor or consignee (for example, the transport of soil density and moisture gauges or gammagraphy equipment to construction sites) without any of the circumstances identified above (the circumstances requiring exclusive use) must not be classified as exclusive use, and therefore they are not obligated to meet the additional requirements set for exclusive use in the ADR.

Only for the cases required by the ADR (listed above) a shipment must be classified as exclusive use and so mentioned on the transport document. If the exclusive-use information is placed on the transport documents of a shipment for which exclusive use is not required, it means that whoever included the additional information has called for a higher degree of attention or exclusiveness than the shipment in question requires, and that constitutes misreporting.

Compliance Documentation for packages no requiring design approval

For the case of types of packages requiring a design approval according to the regulations on transport of dangerous goods (type B, type C and uranium hexafluoride and fissile material packages) the competent authority issues a certificate of approval.

For the case of packages no requiring a design approval (excepted, industrial and type A) the regulations do not require to issue a certificate, but requires the consignor has available for the competent authority documentary evidence which justifies the package design complies the applicable provisions (hereinafter "compliance documentation"). This requirement is contained in the four international regulations on the transport of dangerous goods that apply in Spain: road (ADR), rail (RID), Air (ICAO Technical Instructions) and sea (IMDG Code).

Therefore, any entity that assumes the responsibilities assigned to the consignor by transport regulations and consigns an excepted, industrial, or type A must be willing to submit to the CSN, where be required, the compliance documentation of these packages.

In that sense, it is very important to note that **anyone who acts as consignor and stating as such in the transport documents is responsible for the use of appropriate packaging and for a proper loading and preparation of the package** according to the compliance documentation of the package, which should be available for inspection by the CSN

Since in the above regulations the content of the compliance documentation of non-approval packages is not specified, the CSN has published the Instruction IS-39, which establishes in its fifth article the contents that a compliance documentation should have:

- Basic administrative information (name of package design, designer, type of package, operational restrictions and transport mode restrictions, edition of the regulations used as a reference to demonstrate compliance).
- Specifications of acceptable contents.
- Specifications of packaging defining its design, including drawings.
- Package performance characteristics. This section shall describe the main design principles and performance characteristics of the package design to meet the different safety requirements of the regulations, e.g. containment, heat removal, and shielding).
- List of the standards provisions on transport of dangerous goods applicable to the package design.
- Requirements for operation of the package.
- Requirements for package maintenance and periodic verification.
- Management system, including the quality assurance program.
- Basic illustration of the package.
- Technical analyses demonstrating the fulfilment of the standards requirements, as appropriate: structural analysis, thermal analysis, containment design analysis and external dose rate analysis.

For the preparation of this compliance documentation it is recommended to follow the *Technical Guide on Package Design Safety Reports for the transport of radioactive material*

issued by the European Association of Competent Authorities for the Safe Transport of Radioactive Material (EACA). The current edition (Issue 3, December 2014) takes into account already the last edition of the IAEA transport regulations: SSR-6. The English version of the EACA technical guide may be found in: [European PDSR Guide Issue 3, Dic 2014](#), and the Spanish version in: [Guía Europea ESDB revisión 3, Dic 2014](#).

The EACA technical guide applies to all type of packages, not only to those no subjected to an approval, but for the case of package designs requiring approval the CSN has just published the safety guide 6.4.: [Safety Guide GS-06.04](#) *to facilitate the application of regulations requirements on transport of radioactive material (Updated to ADR 2015)*. This guide already gives recommendations on the content of the Package Design Safety Report for approval packages.

5. List of Transport Packages Approved in Spain

The table in [Appendix II](#) lists the packages for the transport of radioactive material that have valid certificates of design approval in Spain. This includes packages approved in Spain as the design's country of origin and packages whose certificate of approval at origin has been validated by Spain. The table gives you access to a summary sheet on each package and the package's certificate from its country of origin (plus the package's certificate of Spanish validation, if the case).

6. Denials and Delays in radioactive material transport

Sometimes there are delays or denials of shipments of radioactive material. Often they happen without good reason, but always they pose an extra problem. These situations, known internationally as "denials and delays" or "D&D", happen fundamentally in air and sea transport, although they are known to happen in transport overland by road as well.

Since 2005 work has been under way on the development of an international IAEA-backed programme to try and solve the denial problem, and various initiatives have been launched, such as the issuance of sea and air transport training and information documents, the creation of a standing IAEA committee to draw up.

Transport is an essential activity in the development of certain applications of radioactive material in the medical and industrial sectors. Therefore, to reject these transports, not based on safety reasons or in non-compliances of transport of dangerous goods regulations, could have a significant impact on these sectors.

Each phase of the shipment is important for the radioactive material can be transferred to or from industrial facilities or medical centers authorised for using it. Although the role of the consignor of the material is critical because this entity must prepare each shipment complying the regulations requirements, an adequate intervention of carriers is also fundamental for a successful shipment, as well as other intermedium facilities such as airports, air cargo terminals, ports, customs, etc.

Requirements for the transport by land, sea and air of dangerous goods, including explosives, gases, flammable liquids, toxic, infectious materials and radioactive, are collected in regulations that are accepted worldwide. Those international regulations are fully implemented in Spain and are aimed at minimizing the risk during transport setting requirements. Many of those requirements are common to all dangerous goods and other are specific taking into account the particular characteristics of each class. Therefore, **the radioactive material should be considered as a dangerous good else, having its specific risks, and then it should not be considered more dangerous than others when transported in compliance with all regulations requirements.**

Therefore, situations that hinder the development of transport of radioactive material, as rejections or undue delay, shall be avoided, since they can have a significant impact on industry and medical sectors.

The Nuclear Safety Council, through its Area of transport of radioactive material, is available to any transport operator, airport, port or authority with competences on the transport of dangerous goods, to provide information or clarifications that they may need as well as publications edited by the CSN in this area, which may be useful in the training of workers involved in the transport of radioactive material.

7. Other Topics of Interest

INES scale for the transport of radioactive material. IAEA Manual on the International Nuclear and Radiological Event Scale – INES Manual

In 2008 the International Atomic Energy Agency (IAEA) published the revised edition of *INES: The International Nuclear and Radiological Event Scale User's Manual*. The objective of the INES is to make the safety significance of a given event understandable to different stakeholders, owners, the public and the media.

INES was introduced in 1992 exclusively for events in nuclear facilities. The big new feature of the revised 2008 edition is that it includes the technical criteria for classifying any event related with radioactive facilities and the transport of radioactive material.

After the publication of the *INES Manual* in 1992, the CSN approved the application of the INES in Spain, and ever since it has been used regularly for events in nuclear facilities. In November 2009 the CSN Plenary Session passed a motion to extend the INES to events in radioactive facilities and in transport, in application of the 2008 edition of the manual.

The scale classifies events into seven levels. The higher levels (4-7) are termed “accidents”, the lower levels (1-3) are termed “incidents”, and events having no impact on safety are classified below the scale (or level 0) and are termed “events without safety significance”.

There is an informative brochure published by the CSN: [INES Escala Internacional de Sucesos Nucleares y Radiológicos](#) (only in Spanish version), which gives the basic information about the manual's application.

If you prefer to download the full manual in English, you can get it from the IAEA's website: <http://www-pub.iaea.org/MTCD/Publications/PDF/INES2013web.pdf>.

So, now when any event occurs that affects the activities of nuclear facilities, radioactive facilities or transport, the CSN conducts an analysis of the event's classification under the INES criteria. If the analysis shows that the magnitude of the event ranks on the scale, the event is assigned one of the classification levels between 1 and 7, and it is reported publicly via a range of mechanisms (web page statement and/or press release). The reporting mechanism varies

depending on the gravity of the event, in accordance with the internal procedures approved at the CSN.

Analysis of doses in Radiopharmaceutical Transport

In the document [Dosis 2011 Sevilla](#) (only in Spanish version) is presented an analysis of the doses received by transport workers in Spain from 2003 to 2010, particularly in the carriage of radiopharmaceuticals by road. This paper was presented at the Second Joint Conference of the Spanish Society of Medical Physics and the Spanish Radiation Protection Society, which was held in Seville from 10 to 13 May 2011.

8. Appendices

Appendix I: Approval and Notification procedures in the transport of radioactive material

Package Type	Package Approval	Shipment Approval	Prior Notification of Shipment
Excepted	No	No	No
Industrial	No	No	No
Type A	No	No	No
Type B(U)	Yes (unilateral) If LDM is included ⁽¹⁾ , multilateral	No	If A > preset value ⁽⁴⁾
Type B(M)	Yes (multilateral)	If A > pre-set value ⁽⁴⁾	Yes
Type C	Yes (unilateral)	No	If A > pre-set value ⁽⁴⁾
Fissile	Yes (multilateral)	If \sum CSI > 50 ⁽²⁾	Depending on package type ⁽⁵⁾
Uranium Hexafluoride ⁽³⁾ UF ₆ (≥ 0.1 kg)	Yes (unilateral)	No	Depending on package type ⁽³⁾

(1) LDM: Material classified as low dispersion radioactive material. Its design is subject to multilateral approval.

(2) If the criticality safety index (CSI) is greater than 50 in a single container or in a single vehicle.

(3) If this is fissile material due to the enrichment of uranium, the requirements for fissile packages must also be met.

(4) If Activity > 3,000 A₁ or 3,000 A₂, as applicable, or 1,000 TBq, with the lowest of these values being the reference.

(5) Fissile packages are moreover classified as Industrial packages, type-A packages, type-B (U) packages or type-B(M) packages. As such, they may require shipment approval.

Appendix II: Table. List of Approved Packages in Spain

List of Approved Certified Packages Accepted in Spain				
Package Identification	Country of origin Certification	Spanish Approval	Expiration Date Spanish Certification	Package Contents
ENSA/DPT SHEET	E/077/B(U)F-96 (Rev.4)		31/10/2019	Irradiated uranium fuel elements (PWR)
3516A SHEET	GB/3516/AF-96 (Rev.3)	E/0092/AF-96 (Rev.7)	31/08/2018	Fresh enriched powdered uranium oxide
EMBRACE SHEET	S/50/IF-96 (Rev. 8)	E/102/IF-96 (Rev. 6)	30/08/2019	Fresh uranium fuel elements (BWR)
Enresa-B-02a SHEET	E/105/B(U)-96 (Rev.0)		01/03/2019	Radioactive sources not necessarily in special form
NPC SHEET	USA/9294/AF-96 (Rev.10)	E/108/AF-96 (Rev.3)	30/11/2020	Enriched uranium in different forms
ANF-18 SHEET	D/4343/IF-96 (Rev.5)	E/109/IF-96 (Rev.5)	31/03/2017	Fresh uranium fuel elements
TRAVELLER SHEET	USA/9297/AF-96 (Rev.5)	E/119/AF-96 (Rev.6)	31/03/2020	A fresh uranium fuel element (PWR)

List of Approved Certified Packages Accepted in Spain

Package Identification	Country of origin Certification	Spanish Approval	Expiration Date Spanish Certification	Package Contents
HI-STAR100 SHEET	E/120/ B(U)F-96 (Rev.2)		31/03/2020	Irradiated uranium fuel elements (PWR) and high-level radioactive wastes
RAJ-II SHEET	USA/9309/B(U)F-96 (Rev.5)	E/125/B(U)F-96 (Rev.3)	30/11/2019	Fresh uranium fuel elements (BWR)
R72 SHEET	F/395/B(M)F-96 (Df)	E/140/B(M)F-96(Rev.3)	30/09/2019	Irradiated fuel rods, fuel rod sections or activated or contaminated metal parts
ENUN-32P SHEET	E/141/B(U)-96 (Rev. 0)		31/05/2021	Irradiated uranium fuel elements KWU (PWR)
BU-D SHEET	D/4305/AF-96 (Rev.9)	E/145/AF-96 (Rev.0)	30/11/2018	Depleted, natural and/or enriched uranium in various compounds
ENUN-52B SHEET	E/147/B(U)-F-96 (Rev. 0)		31/05/2020	Irradiated uranium fuel elements (BWR)
TN-81 b SHEET	F/366/B(U)-F-96 (Rev.Ck)	E/160/B(U)-F-96 (Rev.0)	30/06/2017	Vitrified wastes

