AUTORITÉ DE SÛRETÉ NUCLÉAIRE

GUIDES DE L'ASN

TRANSPORT

Transport of packages or radioactive materials for civil use on public roads

Volume 1:

Applications for shipment approval and certificates

GUIDE No. 7

Revision 2 of 15th February 2016

Contents

Observations and suggestions for this guide may be sent to the ASN/DTS.

1 INTRODUCTION

There are two volumes of the Applicant Guide to applications for shipment approval and certificates for package designs or radioactive substances for civil use transported on public roads. The first volume presents the Safety Authority's recommendations to applicants, in order to facilitate the preparation of applications for shipment approval and certificates for the transport of radioactive substances for civil use.

These applications are submitted for approval to the Safety Authority by designers of packaging for the transport of radioactive substances. The "package design" refers to the packaging design, consisting of the safety support file owned by the applicant.

The second volume is applied by all competent European authorities and incorporates the European Guide on Package Design Safety Reports for the Transport of Radioactive Material (known as the PDSR guide), drawn up by the European Association of Competent Authorities for the transport of radioactive substances (EACA).

The applicable version of the PDSR Guide is Issue 3 dated December 2014. This latest revision will be published by the ASN in 2016.

A third volume presents the ASN recommendations to ensure regulatory conformity of package designs that are not subject to approval by the competent authority.

1.1 Scope

This guide applies to designs for packages or radioactive substances requiring approval from the ASN under the rules applying to transport safety on public land. It concerns the designs used for:

- radioactive materials in a special form;
- low-dispersible radioactive materials;
- excepted fissile materials covered by paragraph 417 f) of the SSR-6 document;
- packages containing 0.1 kg or more of uranium hexafluoride (UF_6);
- packages containing fissile materials (excluding exceptions allowed in the regulations);
- type B(U) and type B(M) packages;
- type C packages.

It also applies to shipment approval for the following (non-exhaustive list):

- type B(M) packages that do not comply with requirements concerning temperatures of -40°C to +70°C for all packaging components, or packages specially designed to provide the intermittent ventilation required,
- type B(M) packages containing radioactive materials with an activity in excess of 3000 A1 or 3000 A2, as the case may be, or of 1000 TBq, whichever value is lowest,
- packages containing fissile materials if the sum of the Criticality Safety Indices (CSI) within a single freight container or mode of transport is greater than 50; maritime shipments are exempt from this requirement if the sum of the CSIs is not greater than 50 for any hold, compartment or reserved deck area, providing there is at least 6 m distance between each group of packages or overpacks as provided for by the regulations,
- special arrangements.

It describes the content of safety reports that should be submitted, specifying the additional information required for any features added to packages and confined transport that fall within the scope of this guide.

This guide does not cover the following cases:

- approval of the radiation protection programme for special use vessels (in accordance with Section 802 d) of SSR-6, 2012 Edition).
- approval of the calculated basic values for radionuclides not shown in Table 2 indicated in paragraph 802 e) of SS-R-6, 2012 Edition.
- authorisations required under the INF Code (assessment of ship compliance with the INF code, issue / renewal / extension of the International Certificate of Fitness for the Carriage of INF Cargo).

1.2 Purpose of the guide

This guide (Volume 1) presents the Safety Authority's recommendations to applicants in order to facilitate the assessment of applications for shipment approval and certificates for the transport of radioactive substances for civil use.

It explains the assessment process for an application for shipment approval or certificate, procedures for submitting safety reports to the ASN and its technical support, the report structure, the contents of draft certificate of approval, operating experience feedback from previous assessments and the provisions to be implemented in the event of changes to a package design or content.

1.3 Document Status

This guide supersedes ASN Guide no. 7 entitled, "Applicant's Guide related to applications for shipment approval and certificate of package design or radioactive materials for civil usage transported by public roads, by water or by railroad", dated 28 February 2013 (Issue 1). It has been studied by applicants and IRSN.

Periodic updates are planned. The new technical subjects that were identified while updating Appendices 1 and 2 should be taken into account at the time of the next renewal of the approvals or within a timeframe agreed with the ASN according to the safety implications.

2 LEGAL CONTEXT AND SANCTIONS

2.1 Access to information

French Act no. 78-753 of 17 July 1978 introducing various measures to improve the relationship between administrative bodies and the public, and Article L124-8, as clarified in Article R. 124-5 of the French Environmental Code, define the obligations imposed by the government in terms of publishing administrative documents and data relating to the environment.

Article L.591-1 of Book I of the French Environmental Code [1] introduced the idea of transparency on nuclear issues into French law. In Article L.591-1, the code defines transparency on nuclear issues as *"all measures taken to guarantee public access to reliable and accessible information about nuclear safety."* It also extended the obligation to provide information to the public to those responsible for nuclear activity, including those responsible for the transport of radioactive substances.

For the transport of radioactive substances, Article L. 125-10 of Book 1 of the Environmental Code [1] indicates that the right of access to information applies from the moment the transported quantities exceed thresholds "*above which the transport of radioactive substances is subject to transport package design certificate or shipment approval, including special transport arrangements, from the French Nuclear Safety Authority or by a competent foreign body in the field of the transport of radioactive substances, in accordance with international conventions and regulations governing the transport of dangerous goods, the French Transport Code and the texts used for their implementation.*"

According to the provisions contained in Article L. 125-11 of the Environmental Code [1], refusal to share nuclear-related information is only possible if the consultation or communication of said information is detrimental to:

- the interests referred to in Article 6 of the 1978 Act:
  - the confidentiality of deliberations by the Government and executive authorities;
  - the confidentiality of national defence;
  - the implementation of French foreign policy;
  - State security, public safety or the safety of individuals;
  - monetary policy and public lending;
  - research into fiscal and customs infractions by the competent services;
- the interests referred to in Article L. 124-4 of the Environmental Code:
  - protection of the environment in question;
  - the interests of the person providing the information requested, without consenting to the disclosure, when not obliged to do so by any regulatory provision by an act issued by an administrative or court authority;
  - data protection provided for in Article 6 of French Act no. 51-711 of 7 June 1951 relating to statistical obligation, coordination and confidentiality.

Transport providers must have valid reasons for refusing to share information and must specify the options for appeal.

The Commission for Access to Administrative Documents (CADA), established by Article 20 of the 1978 Act, may be consulted by any person who is refused information by a nuclear operator or transport provider. The CADA must be consulted prior to any legal appeal. Litigation concerning refusal to share information may be then be brought before the administrative courts, even if they concern two private individuals or bodies.

The regulations provide that any information whose communication would be detrimental to the protection of privacy, medical confidentiality or trade and industrial secrets may only be shared with the interested party. Consequently, any information that is a trade or industrial secret may not be communicated to any third parties.

In order to preserve public order, in the event of a particularly sensitive instance of transport of radioactive substances, government services may take measures to:

- use significant means and resources to ensure the safe and successful completion of the event;
- restrict access to certain information.

2.2 Regulatory references

This guide was created using the regulatory texts in force at the Guide's date of issue. The latest revisions of the regulatory texts take precedence over this guide. It is the applicant's responsibility to check that the latest revisions to regulatory texts do not compromise this guide.

As part of its missions under the Environmental Code [1], the French Nuclear Safety Authority issues authorisations or approvals and receives declarations concerning the transport of radioactive substances (Article L.595-2).

Radioactive substances constitute Class 7 of dangerous goods and transport is regulated for each mode of transport according to international regulations or agreements, such as the ADR, RID, and ADN, the IMDG code and ICAO Technical Instructions, as referred to in references [5] to [9]. These regulations specify the package designs and material designs that require ASN approval[1]. The Order of 29 May 2009, as amended, concerning the transport of dangerous goods by land and the French Transport Code specify some implementation methods. All modal regulations are based on the IAEA Regulations for the Safe Transport of Radioactive Material, references [10] to [17].

French laws

[1] Environmental Code, Legislative Part created by Order no. 2012-6 of 5 January 2012 amending Books 1 and 5 of the Environmental Code by codifying Act no. 2006-686 of 13 June 2006, known as the "TSN Act", Act no. 2006-739 of 28 June 2006, known as the "Radioactive Materials and Waste Act", and Act no. 571 of 28 October 1943, known as the "RCN Act".

[2] Order of 29 May 2009, as amended, concerning the transport of dangerous goods by land (known as "TMD Order").

[3] Order of 23 November 1987, as amended, concerning the safety of ships, attached regulation, division 411 (RSN Order).

[4] Instruction of 26 June 2008 concerning the technical requirements and administrative procedures applicable to commercial transportation by aeroplane and Regulation No. 859/2008/EC of 20 August 2008 (EU OPS1).

International agreements and regulations for each mode of transport

[5] European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).

[6] Regulations concerning the International Carriage of Dangerous Goods by Rail (RID).

[7] European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN).

[8] IMO International Maritime Dangerous Goods (IMDG) Code;

[9] Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Technical Instructions).

Transport regulations and International Atomic Energy Agency (IAEA) guide

[10] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Standards Series, No. SSR-6, 2012 Edition.

[11] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Standards Series, No. TS-R-1, 2009 Edition.

[1] *The ADR and RID Agreements are rendered applicable by the TMD order [2]. The European ADN Agreement is published in Decree no. 2008-495 of 22 May 2008.*

[12] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Standards Series, No. TS-R-1, 2005 Edition.

[13] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Standards Series, No. TS-R-1, 1996 Edition (As Amended 2003).

[14] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Standards Series, No. TS-R-1, 1996 Edition (As Amended 2000).

[15] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Standards Series No. ST-1, 1996 Edition.

[16] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Collection No. 6, 1985 Edition (As Amended 1990).

(17] IAEA Regulations for the Safe Transport of Radioactive Material, Safety Collection No.6, 1973 Edition (As Amended 1979)

[18] Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, Specific Safety Guide, No. SSG-26, 2012 Edition.

2.3 Sanctions

Applicants for package design approval may also be involved in a transport operation. They must therefore ensure that the conditions of use are well defined in the package's certificate of approval.

The French Environmental Code [1] and Transport Code, in particular Articles L. 1252-1 to 1252-8, are the primary legal sources in terms of criminal sanctions relating to the transport of radioactive substances.
In accordance with Article L-596-27 of the Environmental Code [1], transporting radioactive substances without authorisation or approval or in violation of their specifications, is punishable by one year imprisonment and a €30,000 fine. Similarly, in accordance with Article L. 1252-5 of the Transport Code, transporting dangerous goods when their carriage has not been authorised is also punishable by one year imprisonment and a €30,000 fine.

In the event that features are added at the time of transport to a package subject to approval, ASN must be given proof of compliance with paragraph 612 of regulation [12] in accordance with the conditions set out in Section 3.3 of this guide. If a transport operation is carried out without ASN having received said proof, the party responsible for transport risks legal sanctions under Article R 1252-9 of the Transport Code for non-compliance with current regulations. In addition, depending on the impact on the assumptions outlined in the Safety Report presented to support the application for approval, the certificate obtained could be considered inappropriate for the transport performed. The party responsible for transport would thus risk legal sanctions under Article L.596-27 of the Environmental Code [1] and the Transport Code.

3 PACKAGE DESIGN APPROVAL

3.1 Assessment process and content

The development of a new package design requires that applicants provide in-depth technical justifications with a view to receiving approval. The conformity of the package design with current regulations will be assessed by the ASN and its technical support.

Any new package design is liable to be subject to assessment by the Advisory Committee for Transport.

The three main stages for the issue of a certificate of approval by the ASN for a new package design require the submission and expert assessment of the following documents, in this order:

1. **the Safety Preliminary Report;**
2. **the test programme, if planned;**
3. **the Safety Report.**

Applicants shall present a provisional schedule of the stages associated with the development of the new package design when filing the Safety Preliminary Report and if possible, the test programme. Applicants should report and track changes. The provisional schedule shall be updated and submitted at each stage (Section 3.1.1), (Section 3.1.2) and (Section 3.1.3) by identifying significant changes and outlining the applicant and operator constraints, whether of an industrial nature or related to installation safety.

After each of these stages, the ASN will issue a formal decision stating the points that have been accepted, rejected or need completing. **The deadline for issuing this decision will be defined by the ASN in agreement with the IRSN and the applicant.**

In certain cases, this 3-stage procedure may be applied to approval extensions (e.g. new version of packaging, fundamentally new contents not covered by previous safety analyses, see Section 3.5) and to applications for shipment approval (see Section 4.3 and 4.4).

3.1.1 Safety Preliminary Report

The ASN recommends that applicants submit a Safety Preliminary Report whose purpose is to present and justify the technical solutions used to ensure the various safety functions in view of regulatory requirements.

The Safety Preliminary Report describes the package's design principles and performance features that ensure that regulatory safety requirements are met (i.e. containment, heat dispersal, dose rates and criticality safety).

The Safety Preliminary Report outlines the methods that will be used to provide the main safety demonstrations: in particular, this document highlights all technical components requiring dedicated qualification tests and experiments, whether drop or fire tests on a representative specimen or characterisation tests on the mechanical or thermal properties of the materials.

The Safety Preliminary Report also describes how the assumptions and data used for the safety analysis, in particular regarding the release of radioactive substances, dose rates and criticality safety (if relevant), are deduced from the design and behaviour of the package under conditions of transport (routine, normal and accident conditions). The number of planned transport cycles for any given packaging is also taken into account, in particular to identify the necessary maintenance requirements.

The supporting letter for the Safety Preliminary Report specifies an approximate number of packaging units that will be commissioned, the planned modes of transport and a provisional number of transport operations over the likely duration of utilisation of this packaging design.

3.1.2 Regulatory test programme

Scope: A test programme shall be defined for new package designs, or where applicable, for significant design modifications (approval extension concerning package contents or packaging).

If tests are planned to demonstrate compliance of the package design with regulatory requirements, applicants shall submit the corresponding programme, taking into account any comments made during the assessment of the Safety Preliminary Report, where applicable. In order to facilitate assessment, it is strongly recommended that applicants submit the programme to the ASN for a decision before performing the tests. The ASN shall be informed of the dates chosen by applicants for the test campaign so that its services, with possible help from its technical support, can attend.

Appendix 1 Section 2.1 outlines some of the elements required during the regulatory test programme.

3.1.3 Safety Report.

A Safety Report shall be submitted to support applications for approval for:

- new package designs,
- design modifications (approval extension concerning package contents or packaging),
- approval renewals.

For new package designs, an ASN decision on the Safety Preliminary Report and ASN validation for any test programmes must be issued prior to submitting a Safety Report.

For new package designs with a certain technical complexity and significant consequences in terms of safety, interim technical reviews involving the applicant, the ASN and its technical support may be carried out at the suggestion of the applicant, the IRSN or the ASN.

The nuclear operator shall be involved in these reviews as much as is required.

The desire to harmonise practices between Member States of the European Union gave rise to a European Guide to the production of Package Design Safety Reports. For all applications concerning a package design, the Safety Report shall therefore be produced in accordance with the structure and content outlined in the European guide, which is presented in Volume 2 hereof.

Transitional provisions:

- *Compliance of the structure and content of a Safety Report with the European PDSR Guide is mandatory for all new designs undergoing an initial application for approval.*
- *For old designs, compliance of the structure and content of a Safety Report with the European Guide is recommended to facilitate assessment. Otherwise, a comparative table shall be provided comparing the structure of the European PDSR Guide with the structure used.*

Applicants shall also take account of ASN positions, of methods and reference parameters for the safety demonstrations available at the time of application for approval (see **Appendix 1**).

Experience feedback on the issues raised during assessments of Safety Reports concerning the transport of packages containing radioactive substances is given in **Appendix 2.** Applicants shall incorporate this feedback for any future applications for approval.

The experience feedback must be analysed *at least* at each renewal application (as specified in Section 3.4) and in the event of any significant event relating to utilisation or maintenance of the packaging.

The utilisation instructions relative to all operations important for safety are presented in the Safety Report. The Report also lists the required performance of the tools necessary for the use of the packagings and the particular functions or constraints to be satisfied.

The equipment or parameters (transport times, leak-tightness criteria, closing times, etc.) important for safety during transport are listed in the Safety Report chapters relating to utilisation of the packaging.

The criteria relating to the packaging safety functions during its manufacture or maintenance are identified as such in the Safety Report chapters relating to packaging manufacture and maintenance.

As of 2018, these elements must figure in the Safety Report for any application for approval of a new package design and for any renewal application. They must be updated when renewals are applied.

3.1.4 Generic studies and qualification tests

Deficiencies are often encountered when applicants carry out qualification tests prior to submission of the specifications of planned conditions for these tests, for instances when the results from generic studies are used to support the package design safety demonstrations. As with the regulatory tests, these additional tests should be performed after formal decision from the ASN, in particular concerning the test specifications.

Transitional provisions:

New package designs shall incorporate all requirements outlined in the Applicant Guide for their first application for approval.

Any new requirements introduced in an update to the Applicant Guide will have an associated implementation deadline for existing package designs (deadlines, temporary measures, etc.)

3.2 Documents to submit in support of an application for approval

All applications for design approval should be submitted as an official letter accompanied by a Safety Report, demonstrating compliance with regulatory requirements (see Section **3.1.3** and **Volume 2**) and a draft certificate, and should be sent to:

ASN
Direction du transport et des sources
15, rue Louis-Lejeune
CS70013
92541 Montrouge

in the following form: one hard copy of the Safety Report

- containing one set of drawings;
- one copy of the Safety Report in an electronic version recorded on digital medium (optical disk, USB, etc.);
- one printable electronic version of the draft certificate complying with the template document described in section 5.

In order to facilitate assessment of the reports, a copy of all applications shall be sent to ASN technical support at:

Institut de radioprotection et de sûreté nucléaire (IRSN)
PSN-EXP
B.P. 17
92262 Fontenay-aux-Roses Cedex
France

including:

- one hard copy of the Safety Report including two complete sets of drawings;
- three copies of the Safety Report in an electronic version recorded on digital medium (optical disk, USB, etc.);
- one copy of the official letter sent to the ASN;
- one printable electronic version of the draft certificate (drawn up in accordance with the template document described in section 5.

All documents submitted must be written in French. However, an English version may be submitted for foreign package designs, except for the draft certificate which must be written in French.

All the documents submitted shall be based on the International System (SI) of units.

The electronic version of the Safety Report shall include all chapters and drawings (whether revised or not). The sets of hard copy drawings shall be printed in the appropriate format (A0 if necessary). Each digital medium shall clearly state the package design and the Safety Report reference and revision that it contains, and as far as possible, the identification codes for the associated/requested certificates.

If the file format cannot be viewed on a personal computer equipped with the usual office software suites, viewing software that requires no license shall be included on all the digital media.

Applications that do not comply with these requirements will not be successful.

Acknowledgement of receipt is sent to the applicant by ASN after the application contents have been checked.

3.3 Use of features added to packages at the time of transport for transport operations in France

Features added to packages are defined in Section 2.3 of Appendix 1.

Section 612 of IAEA Regulations [10] states that *"features added to packages at the time of transport which are not part of the package shall not reduce its safety."*

Applicants must therefore perform a safety analysis to demonstrate that any features added to packages at the time of transport have no impact on the assumptions of the safety demonstration produced as part of the application for shipment approval or certificates. In addition, the impact study on the features added to packages during transport on package design safety may lead to additional requirements concerning shipment procedures.

The ASN requires that the following documents be systematically submitted 3 months before the date of the first shipment for which the added feature is used:

- the impact study on features added to the package during transport;
- depending on the results of the impact study, the resulting list of additional requirements concerning shipment procedures.

Where possible, it is better to submit to submit this analysis at the same time as the assessment of the package design Safety Report.

3.4 Application for approval renewal

ASN certificates of approval have a limited validity which is generally fixed at 5 years. In order to renew a certificate's validity, an application for approval renewal is required.

To support applications for approval renewal, applicants shall submit the following documents to the ASN (addressed to *Direction du transport et des sources - see address in Section* 3.2): the Safety Report that shall take into account ASN positions, the methods and reference parameters for safety demonstrations (see Appendix 1) and operating experience feedback on the issues raised during appraisals (see Appendix 2), operating experience feedback to justify and confirm the relevance of operation, maintenance and manufacturing specifications (including minor packaging changes). Operating experience feedback relating to packaging use and maintenance shall be addressed in a detailed study tracking anomalies or any non-compliance and the corrective actions implemented or proposed.

The utilisation and maintenance instructions shall be updated if necessary to integrate experience feedback relating to packaging utilisation and maintenance.

As stated in Section 3.1.3, it is recommended that the structure and content of the Safety Report comply with the European PDSR Guide in order to facilitate assessment (a comparative table comparing the structure of the European PDSR Guide and the Safety Report structure is desirable if the PDSR structure is not used).
Changes in best practice should be taken into account for applications for approval renewal. Applicants shall identify any changes planned in the renewal application. Similarly, applicants should submit the corresponding justifications well before the date of expiry of the current certificate of approval, in order to prevent late discovery of lengthy assessment requirements for a demonstration application. Renewals are dealt with using the applicable version of the guide when the application is submitted. The applicable practices are formalised in Appendices 1 and 2.

3.5 Package design approval extension or modification

Any modification to the package design may affect the specifications outlined in the certificate of approval or call into question the demonstrations provided in the Safety Report.

Modifications to package designs are sometimes planned in order to transport new contents or to change the shipment approval (see Sections **4.3** and **4.4**) associated with the certificate of approval. In these cases, applicants are obliged to request an approval extension (Section 3.5.1).

Other approved package design modifications can be envisaged to allow a change in the package design and/or can result from experience feedback from the package manufacturing process or their utilisation (including significant events).

In order to specify the process applicable to these modifications, they can be classified in three categories: M1, M2 and M3, in a similar way to modifications to basic nuclear installations as referred to in Decree no. 2007-1557 of 2 November 2007, as amended, known as the "procedures" decree.

In this case the modifications in categories M1 and M2 (see Section 3.5.1 and 3.5.2) come under approval extension. All of these modifications shall be subject to tracking, which may be inspected by the ASN.

These M1, M2 or M3 classification provisions are not applicable to modifications of content or to shipping approvals or validations

3.5.1 Approval extension and major modifications (Category M1)

Modifications that significantly affect package design safety are processed as major modifications. For a major change, a new certificate of approval must be issued following expert assessment of the corresponding Safety Report. To this end, applicants shall submit an approval extension application.

In this context, approval extension applications submitted to the ASN shall clearly specify any differences from the scope of the valid approval in order to limit the new safety analysis to the modifications to the package design. An analysis of the impact of the package design modification on the safety demonstration is enclosed with the Safety Report.

3.5.2 Ordinary modifications (Category M2)

An ordinary modification refers to any situation where applicants are able to demonstrate, using the same demonstration procedure (same logic and "sequence"), that the design modification maintains a safety margin comparable to that presented in the Safety Report and used for the valid certificate of approval. This margin must remain significant.

For ordinary modifications, applicants shall inform the ASN of any modifications by submitting documents demonstrating that the design safety is not compromised. An analysis of the impact of the package design modification on the safety demonstration is enclosed with the Safety Report. Any modifications to components included in the certificate of approval are considered to be at least category M2.

If the documents submitted confirm that the modification is correctly classified, applicants shall make an approval extension request, which will then be rapidly processed. If not, the ASN will issue notification of reclassification and the change shall be processed as major (M1).

3.5.3 Minor modifications (Category M3)

Modifications that do not affect safety are considered to be minor. For example, they include changes to material grades due to procurement issues, provided that the material's properties with the new grade comply with the specifications for the old grade.

These modifications shall be documented in accordance with quality assurance rules. The ASN may inspect these documents. Applicants shall keep an up-to-date list of minor modifications and report them at each application for approval renewal.

3.6 Indicative examination time frames

The following minimum examination time frames are to be taken into consideration by the applicant, for guidance purposes only:

- first-time approval: 12 months (counting from the date of submission of the complete Safety Report);
- approval renewal: 12 months;
- approval extension: 6 months;

- validation of an approval already obtained in another country: 6 to 12 months, depending on the complexity of the examination procedure;
- approval of shipment under special arrangement: 6 months;
- other shipment approval: 3 months;
- study of the impact on package safety of adding features to the package (if this study is independent of the Safety Report): 3 months;
- test programme (regulatory tests or qualification tests): 6 months;
- safety options file: 3 months;
- excepted fissile material certificate: 6 months.

4 SPECIAL CASES

4.1 Validation of approval granted by a foreign authority

For applications for the validation of an approval obtained in a foreign country, applicants shall submit the following in addition to the Safety Report and the French draft certificate (in accordance with the template described in Section 5):

- information on the actual use of packages in France or for transit across French territory only;
- the certificate of approval issued by the country's competent authority and its French translation in its original form;
- certificate validations that the applicant possesses from countries other than the issuing country.
- experience feedback to justify and confirm the relevance of the utilisation, maintenance and manufacturing specifications.

4.2 "Grandfather" clause

The IAEA Regulations for the Safe Transport of Radioactive Material allow for transitional provisions for packages or materials whose designs have been approved under the 1973, 1973 (as amended) [16], 1985 and 1985 (revised in 1990) [15] editions of these regulations. These packages may still be used, provided in particular that multilateral package design approval is granted and that a mandatory quality assurance programme is applied. This clause is known as the Grandfather Clause.

The assessment of approval renewal applications for package designs approved under the 1973 and 1973 (as amended in 1979) editions of the IAEA Regulations for the Safe Transport of Radioactive Material has often highlighted failings, in particular with regards to quality assurance.

In this context, the ASN has not renewed certificates of approval for package designs approved under the 1973 editions of the IAEA Regulations for the Safe Transport of Radioactive Material since 31 December 2010, considering that demonstration of compliance with regulations can no longer be given due to inadequate quality assurance.

In addition, from 2006, the ASN suggested that applicants develop new designs or alternatively revise their Safety Reports during the 2006-2010 transition period, in order to fully comply with the requirements of the 1996 or later editions of IAEA Transport Regulations. In 2007, the ASN also asked applicants to create an analogous action plan for package designs that comply with the 1985 editions of IAEA transport regulations, in order to stop issuing approvals under the 1985 editions of IAEA Regulations for the Safe Transport of Radioactive Material by 2020.

4.3 Applications for shipment approval under special arrangement

Shipments that cannot comply with any one of the requirements for the relevant package designs may only be transported under special arrangements. Compensatory measures shall be proposed and systematically justified to guarantee an overall level of safety equivalent to the level that would be ensured if all applicable requirements were complied with.

The documents to be submitted in support of applications for shipment approval under special arrangements are the same as those for approval applications (see Section **3.2**). These applications shall be made on an exceptional basis for a one-off shipment or a series of multiple shipments scheduled over a limited period of time. This period of time can for example correspond to the time required to bring the package design back into compliance with the applicable regulations.

4.4 Other applications for approval from the Competent Authority

The regulations define the other cases requiring approval from the competent authority. These cases include in particular:

- shipment of type B(M) packages that do not comply with requirements concerning temperatures of -40°C to +70°C for all packaging components, or that have been especially designed to provide the intermittent ventilation required;
- shipment of type B(M) packages containing radioactive materials with an activity in excess of 3000 A1 or 3000 A2 depending on the case, or of 1000 TBq, whichever value is lowest;
- shipment of packages containing fissile materials if the sum of the CSIs for packages within a single freight container or mode of transport is greater than 50; Maritime shipments are excluded from this requirement if the sum of the CSIs is not greater than 50 for any hold, compartment or dedicated deck area providing there is at least 6 m distance between each group of packages or overpacks.

Applications for shipment approval submitted to the ASN (addressed to *Direction du transport et des sources* - see address in Section 3.2), shall clearly specify conditions of transport and shall be accompanied by a justifying Safety Report and a draft certificate of approval (see Section **5**).

For the shipment of packages containing fissile materials, for which the sum of the CSIs (Criticality Safety Index) for packages within a single freight container or mode of transport is greater than 50, the substantiating documents required must specify the procedures implemented to comply with regulations and the stowage and loading/unloading procedures, and the instructions to be followed for any interim storage during transit to be followed. Emergency response measures that take into account the nature of the shipment must also be attached to the application.

Applications for shipment approval may be combined with applications for a certificate of approval. In this case, the justifications provided in the same Safety Report and draft certificate cover both the certificate of approval and shipment approval.

5 CERTIFICATES OF APPROVAL TEMPLATES

Applicants shall submit a draft certificate of approval (for a package or material design) or for shipment approval in electronic form, printable, in French, in accordance with the template provided in **Appendix 3 hereof**. The ASN strongly recommends that confidential information concerning intellectual property and public safety are not included in certificates.

The certificate layout must comply strictly with the template provided on the ASN website:

http://professionnels.asn.fr/Media/Files/00-Guides/Modele-de-certificat-d-agrement-modele-de-colis

In order to limit errors both in the writing and utilisation of the certificates, particular attention shall be paid to their presentation. Thus, sections 1 to 1.4 (description of the packaging other than "Safety functions") should fit into a single page; the section "Additional requirement for confined transport" should only provide operational information. It also seems necessary to distinguish the assumptions made for the safety demonstration (e.g. for the criticality study: compliance or not with the geometrical integrity of fuel assemblies or rods under accident conditions of transport, water ingress into all the voids, etc.) which must remain in the Safety Report, and the applicable criteria resulting from these assumptions, which should figure in the certificate. Moreover, these criteria must always be expressed in International System (SI) units. Lastly, with regard to appendix "t", the criteria relative to the conditions of transport must remain simple in order to preclude any ambiguity in their interpretation.

A certificate comprises a certificate body signed by the Authority and, where applicable, Appendix "t" containing shipment procedures, Appendix 0 describing the packaging and appendices describing the permitted contents.

All pages of the certificate shall display the certificate code in the top right-hand corner. It consists of the following: Indicator/Number/Type Code:

- the indicator is F for France;
- the number is unique to each package design;
- the type code is:
    - either S, S-85 or S-86 for materials in a special form, under the various editions of the IAEA Regulations for the Safe Transport of Radioactive Material;
    - or, for package designs for non-fissile or fissile excepted uranium hexafluoride if none of the other type codes apply:
        - H(M)-96 for multilateral approval under the IAEA Regulations - 1996 Edition;
        - H(U)-96 for unilateral approval;
    - or package type, followed by the letter T if the certificate includes shipment approval:
        - IF-85 or IF-96 for an industrial package carrying fissile materials, approved under the different editions of the IAEA Regulations;
        - AF-85 or AF-96 for a type A package carrying fissile materials, approved under the different editions of the IAEA Regulations;

- B(M)-85 or B(M)-96 for multilateral approval of a type B package, approved under the different editions of the IAEA Regulations;
- B(M)F-85 or B(M)F-96 for multilateral approval of a type B package carrying fissile materials, approved under the different editions of the IAEA Regulations;
- B(U)-85 or B(U)-96 for unilateral approval of a type B package approved under the different editions of the IAEA regulations;
- B(U)F-85 or B(U)F-96 for unilateral approval of a type B package carrying fissile materials, approved under the different editions of the IAEA regulations;
- C-96 for type C packages, approved under the IAEA Regulations - 1996 Edition;
- CF-96 for a type C package carrying fissile materials, approved under the IAEA Regulations - 1996 Edition.

Purpose of issue	Body	Appendix 0	Appendix 1
French approval	F/336/B(U)F-96 (Ab) Page x/y	F/336/B(U)F-96 0a Page x/y	F/336/B(U)F-96 1b Page x/y
Validation	F/543/B(U)F-85 (a) D/4229/B(U)F-85 (rev. 6) Page x/y	F/543/B(U)F-85 0a D/4229/B(U)F-85 (rev. 6) Page x/y	F/543/B(U)F-85 1a D/4229/B(U)F-85 (rev. 6) Page x/y

Examples of revision history:

Purpose of issue	Body	Appendix t	Appendix 0	Appendix 1
Initial approval	Code (Aa)		Code 0a	Code 1a
Extension for modified packaging	Code (Ab)		Code 0b	Code 1a
Extension of content 1	Code (Ac)		Code 0b	Code 1c
Renewal	Code (Bd)		Code 0d	Code 1d
Approval with approval of shipment procedures	F/number/type/ T(Be)	Code te	Code 0d	Code 1d
Shipment approval under special arrangements (number only used once)	F/number/X		F/number/X 0	F/number/X 1
Radioactive material in a special form	F/number/S-96 (Aa)		F/number/S-96 0a	F/number/S-96 1a

Validation/Purpose of issue	Certificate body	Appendix 0: Additional specifications	Appendix 1: French translation of certificate of approval from country of origin	Appendix 2: Certificate of approval from country of origin
1st validation	(a)	0a	1a	2a
2nd validation	(b)	0b	1b	2b

6 PACKAGING

6.1 Responsibilities of the applicant with respect to package design

It is recommended for the designer to involve the users in defining the package performance and in the design of the tools intended for its utilisation.

6.2 Responsibilities of the applicant with respect to packaging manufacture

The Safety Report should indicate that the following requirements must be included in the quality assurance system for the package design:

ASN shall be informed:

- of the manufacturing programmes for packagings subject to ASN approval or shipping approval before the start of manufacture;
- of the manufacturer and tier-1 subcontractors involved in the packaging manufacturing process, before the start of manufacture;
- of the nonconformities detected during manufacture and how they are dealt with when this leads to design modifications that would be classified at least as M2 (see Sections 3.5.1 and 3.5.2), before the packaging is put into service;
- of any repairs that could significantly affect the safety of the package, before they are carried out.

When making a renewal application, the applicant submits the list of repairs having been carried out that could affect one of the safety functions defined in the Safety Report.

6.3 Applicant responsibilities concerning packaging use and maintenance.

The performance of dry-run tests before using the new packaging is a good practice which should be encouraged.

Applicants shall systematically inform the relevant users (clients, partners or subcontractors) of updates to safety requirements concerning use or maintenance of the packages described in the Safety Report and referenced in the applicable certificate. This information sharing shall comply with quality assurance rules and may be the subject of inspections.

.

APPENDIX 1
ASN positions, methods and reference parameters
for safety demonstrations

Appendix 1 presents a list of ASN positions and of the methods and reference parameters that have been deemed applicable to the safety demonstrations for all approval applications.

This appendix shall be subject to changes and additions for each new edition of the Applicant Guide, in order to take into account advances in technology and practices and current or future generic studies (brittle fracture, radiolysis, criticality, leak-tightness verificatioin standards, etc.)

1. LIST OF LETTERS SUPERSEDED BY THE APPLICANT GUIDE

- Letter DGSNR/SD1/0265/2006 of 31 March 2006 (Applications for shipment approval and design certificates for packages or radioactive materials for civil use transported on public roads);
- Letter DGSNR/SD1/0552/2006 of 1 August 2006 (Package designs approved under the 1973 Editions of the IAEA Regulations for the Safe Transport of Radioactive Material);
- Letter ASN/DIT/0703/2007 of 27 November 2007 (Approval of IAEA 73 and IAEA 85 package designs);
- Letter ASN/DIT/0182/2008 of 7 April 2008 (Approval and shipment approval on the Safe Transport of Radioactive Material).
- Letter DSIN/FAR/SD1/no. 11352/99 of 6 December 1999 (Multiple high standard water barriers);
- Letter DSIN/FAR/SD1/no. 11082/01 of 14 November 2001 (Generic studies);
- Letter ASN/DIT/0063/2009 of 28 January 2009 (Transport of radioactive materials, impact of frames/stowage and handling devices);
- Letter ASN/DIT/0657/2009 of 19 November 2009 (Package stowage (*Deceleration levels*));
- Letter ASN/DIT/2010-040980 of 22 July 2010 relating to the incorporation of "delayed impacts".

2. GENERIC THEMES AND ASN POSITIONS

2.1. Regulatory test programme

The regulatory drop tests as defined in SSR-6 shall be performed on a horizontal, flat surface such that if its resistance to displacement or deformation upon impact from the specimen increased, the damage incurred by the specimen would not be significantly aggravated.

In this context:

- the target consists of a steel plate at least 40 mm thick, fixed to a concrete slab on a hard or rocky floor;
- the geometric form of the target shall be as close as possible to a cube
- unless another mass can be justified, the mass of the test specimens used shall be limited to 10% of the total mass of the target, except for type C packages, for which it is limited to 1%;
- the hardness of the metal plate is taken into account for test specimens with hard surfaces. If the thickness or fracture resistance of a specimen's high-strength thick metal components (trunnions or other handling or stowage components, anti-puncture plates, metal shock

absorbing devices, etc.) is greater than that of the target steel plate in terms of the surfaces impacted, the target deformations should be assessed prior to the tests. These deformations must not have any influence on the specimen's behaviour.

The following must be defined in particular during the relevant test programmes:

- any temperature-control devices (heating, cooling) and the associated monitoring procedures where applicable;
- the planned geometric and mechanical characteristics of the puncture bar(s) used;
- accelerometric measurement equipment, which must not be piezoelectric sensors, because these devices may cause phenomena such as leaks and zero-drift that could distort measurements. The use of piezoresistive or piezoelectric instruments with integrated corrective electronics should not present this type of risk;
- methods and criteria for the leak tests;
- the dropping system used if it is different to the one defined in the testing facility conformity report (provide the corresponding qualification report),

and mention in the drop test reports the uncertainty ranges for the angle and height measurement equipment used and the environmental conditions encountered (ambient temperature, tape measure expansion, instability of settings due to wind, etc.)

The representativeness of specimens/test models shall be justified in the test programme with regards to the expected demonstrations (see in particular Section 5.1.3 of Appendix 2).

The Safety Reports submitted in support of an application for a certificate of approval or shipment approval shall identify the target used during drop tests, where applicable.

A file justifying compliance of the target with the above requirements shall be submitted in support of the report relating to the drop test programme.

When a target is regularly used for tests, the dossier may also be submitted to the ASN for a decision, independently of applications for certificates of approval in order to reduce the justifications required for said applications. Applicants shall state the existence of this ASN decision granted prior to use of the slab, when submitting later test programmes using this target.

Application for an ASN decision has already been made for the following drop test targets and they satisfactorily meet regulatory requirements, for packages (other than type C) whose test specimen has a mass lower than the maximum mass indicated below:

Owner	Site	Max. mass	Letter
Robatel	Genas (target no. 2)	5 tonnes	DSND/ASND/2010-00802
Daher	Montrichard	5 tonnes	ASN/DIT/0034/2009
Metropack	Reims	5.5 tonnes	CODEP-DTS-2013-051010
TN International	Laudun	6 tonnes	CODEP-DIT-2010-041010
CEA	Barp (Cesta)	14 tonnes	CODEP-DTS-2011-008414
RIBA	Rosières	50 tonnes[2]	CODEP-DTS-2013-051131

When the regulatory thermal test is performed using a hydrocarbon fire, applicants shall particularly ensure that the specimen is maintained in the flames for at least 30 minutes with flame thickness of at least 1 metre on the specimen's lateral surfaces.

2.2. Choice of packaging technology to guarantee no water in-leakage for packages containing fissile materials: acceptance of single-body structures

(Interpretation of paragraph 680 a) of SSR-6, 2012 Edition)

Paragraph 680 a) of the IAEA Regulations [10] authorises the assumption of no water in-leakage in criticality analyses even in the event of an error if the design has special features designed to prevent water in-leakage. Such special features include *"multiple high standard water barriers, not less than two of which would remain watertight if the package were subject to the tests prescribed in Para. 685 b), a high degree of quality control in the manufacture, maintenance and repair of packaging, and tests to demonstrate the closure of each package before each shipment"*.

Packaging designs that include two distinct water barriers placed in series along the entirety of the water leakage path that would potentially exist due to a design, manufacturing or operation/maintenance quality control failing meet the requirements of paragraph 680a) of document [10].

Packaging designs with only one physical barrier can meet the requirements of paragraph 680a) providing that the risk of barrier failure is demonstrated to be low, i.e.:

- a thick base and a thick steel shell, with the base/shell connection made by a full-penetration weld, and a closure system consisting of two lids each equipped with seals;
- maintaining the leak-tightness criterion given in the safety demonstration for each seal in normal and accident conditions of transport;
- rigorous quality control inspections in the production, maintenance and repair of seals and seal seating surfaces;
- a test for each lid to ensure proper closure, as defined as closure that guarantees compliance with the leak-tightness criterion for each lid in normal and accident conditions of transport (NCT and ACT);
- that the safety demonstrations show comfortable margins with respect to the risk of shell and base failure in normal and accident conditions of transport throughout the regulatory temperature range.

Errors that could lead to water in-leakage shall be systematically identified and assessed, and double checking systems shall be implemented to prevent risks of the presence of water following a single error.

[2] Only for the tests from 1.20 metres

2.3. Features added to the package

A feature added to the package is any component that is added to the package at the time of transport that is not an integral part of the package.

The features added to the package therefore determine the immediate environment surrounding the package during transport, whose mechanical or thermal effects can have consequences for the level of package safety:

- features added to the package with a potential mechanical impact that must be considered are features attached to a package or placed in contact or almost in contact with the package (equipment to be considered includes "top level" functional assemblies, such as an assembly of 4 trunnion support brackets or a storage rack within which the packages are placed in cells). Equipment that complies with a standard that is widely used in transport (ISO container, handling pallets (other than pallets with raised edges) and stowage straps, for example), need not necessarily be included in this analysis. If necessary, additional information may be requested when examining the application file.

- features added to the package with a thermal impact are linked to the walls that enclose the package(s) within a confined space:
  - under a tarpaulin cover for road transport;
  - in an overpack body (vessel, container, etc.) for all modes of transport;
  - under a canopy for rail transport;
  - in a ship's hold, etc.

  or to walls that partially confine packages by reducing heat exchanges:
  - thermal barriers;
  - additional radiation protection shields, etc.,

  These types of feature(s) added to the package may create a harsher thermal environment than considered in the surrounding environmental conditions defined by the SSR-6 report, 2012 edition, in normal and accident conditions of transport.

By extension, the concept of a feature added to a package also covers the notion of confined transport.

Features added to package at the time of transport that are not an integral part of the package must not reduce its level of safety.

To this end, the additional information required in Section 3.3 of the guide shall include:

- a description of features added to the package, devices and transport equipment whose use is anticipated;
- safety demonstrations that guarantee that safety is not compromised by features added to the package at the time of transport (as much from the mechanical impact as the thermal impact aspects). If the weight of the added features does not exceed about 10% of the weight of the package, it can be considered that the added weight will have no impact on the mechanical resistance of the package. Packages with a power flux density of less than 15 W/m^2 do not undergo a thermal impact analysis.

Particular attention shall be paid to:

- confined transport means (tarpaulin covers, containers, canopies, ship holds, etc.) as the heat dissipation mechanisms may change or even deteriorate;
- transport frame, stowage and handling systems used during transport that have potentially hazard-causing features.

2.4. Stowage

Stowage component refers to the part of the package that contributes to the package's stowage function. Stowage components are therefore an integral part of the package.

Stowage system or equipment refers to any equipment that connects the stowage components to the anchoring points on a vehicle or mode of transport.

In routine conditions of transport (RCT), stowage components and equipment or systems must not be deformed, with maximum transient stresses and fatigue phenomena taken into account (see Section 2.4.1 and 2.4.2 of Appendix 1).

Additional safety objectives may also be assigned to package stowage components, if their breakage or behaviour in accident transport conditions, as the case may be, could compromise certain safety functions.

2.4.1. Reference acceleration levels to be taken into account for the design of package stowage components and systems

The design of stowage components and equipment requires the use of reference acceleration values that are representative of the regular and maximum stresses encountered in routine conditions of transport.

The values shown in Table IV.I of Appendix IV of SSG-26 [18] are not binding figures, but remain the IAEA reference values.

Other values claiming to be representative of routine conditions of transport are presented in the following recommendations or directives that apply to the transport of dangerous goods:

- The European Commission Code of Best Practice, IMO/ILO/UNECE Directives and EN 12195 standards for road transport;
- UIC Directives (Appendix II of the RIV regulations), IMO/ILO/UNECE Directives and EN 12195 standards (combined piggyback transport) for rail transport;
- IMO/ILO/UNECE Directives and the INF code for maritime transport;
- ISO standards, IATA regulations and standards for air transport;
- ISO standards, CSC Conventions and IMO/ILO/UNECE Directives for the transport of containers;
- ISO 10276:2010(F) - Nuclear Energy - Fuel technology - Trunnions for packages used to transport radioactive material.

Pending a technical decision to be issued in France or an update to the SSG-26 guide values by international consensus, the ASN recommends that applicants use the values found in Table IV.I for the safety demonstrations. ***Any deviations from these reference values or the use of other reference values must be justified.***

2.4.2 Mechanical strength

Pending the development of a technical decision in France concerning the design of stowage components or the updating of the appendix of the SSG-26 guide addressing this point by international consensus, the maximum stresses induced in the package stowage components and other safety devices shall maintain a safety margin with respect to the elastic limit of the material at the maximum temperature of the studied component (the required approximate margin is 50%). In addition, the fatigue resistance of these devices under the stress of loads representative of routine conditions of transport must be assessed.

2.5. Delayed impact on content

The configurations that could shift content position inside the cavity and cause, during the regulatory nine-metre drop test, a delayed impact on one of the package containment system components must be studied to guarantee that all package safety functions are maintained.

The safety demonstration for new package designs should therefore consider this type of configuration in order to:

- assess the consequences of an impact between the contents and surrounding components (in particular the containment system lid) on the mechanical resistance of containment system components (in particular the closure system), using the worst-case scenario for shifting of contents before the drop.
- take into account the delayed impact phenomenon in justification of the closure system from the package design stage. Where necessary, provisions may be implemented to prevent the risk of delayed impact in the event of a drop in accident conditions of transport, such as internal shock absorbers or restraint systems.

To assess the sensitivity of the package design to this phenomenon, and the modification possibilities, the maximum clearance - particularly the longitudinal clearance - at the temperatures reached under normal conditions of transport and the minimum clearance at the temperatures reached under accident transport conditions are specified for each component of the load, taking into account the manufacturing tolerances and the thermal expansion of the materials. For approval renewals, assessment of this type of configuration will also be considered if the initial design is sensitive to the phenomenon of the contents delayed impact.
Where applicable, the concept modifications (such as the optimisation of clearances) that might prove necessary shall be assessed in terms of safety benefits.

For approval extensions (especially Category M1 and M2 modifications), the delayed impact phenomenon will be assessed in the safety demonstration if the proposed modification seems to lead to a less favourable configuration with regard to this phenomenon.

2.6. Components subject to the risk of brittle rupture

With components in which defect size is a parameter that can guarantee the absence of any risk of brittle rupture (carbon steels, cast iron, etc.), the general ultrasonic inspection methodology must use criteria for the rating, acceptance and investigation of defects and anomalies that are at least equivalent to those provided for quality class 3 of standard NF EN 10228-3 in effect at the time of manufacture. Transitional measures may be envisaged where the manufacture of an already approved package design is concerned.

2.7. Containment seals

2.7.1 Thermal expansion coefficients of elastomer seals

For any new packaging design, and for any packaging for which an approval renewal is requested, the thermal expansion coefficients of the elastomer seals taken into account in the safety demonstrations must be justified on the basis of experimental results for the grades used.

2.7.2 Seal groove filling percentage

The problem of excessive seal groove filling is posed for closing system components equipped with elastomer seals.
For any new packaging design, and for any packaging for which an approval renewal is requested, the filling percentage for grooves equipped with elastomer seals must not exceed 100% under normal conditions of transport (NCT) or accident conditions of transport (ACT), taking into consideration the worst-case geometrical tolerances of the grooves and seals and the maximum corresponding temperature. However, under accident transport conditions (ACT), a maximum filling percentage exceeding 100% may be accepted if the applicant demonstrates through representative tests that there is no risk of seal extrusion.

2.8. Continuation of combustion of wooden impact limiters

Continuation of partial combustion of the blocks of wood constituting the impact limiters beyond the 30 minutes of the regulatory fire test could, under the effect of the associated heat input, significantly increase the temperature of the seals of the package containment system closure components which are situated near the impact limiters.

For any new packaging design, and for any packaging for which an approval renewal is requested, the safety demonstration shall take this phenomenon into account. Thus, the applicant will assess the seal temperature margins for the package containment system closing components in order to demonstrate that the package design has sufficient margins with respect to the maximum temperatures of the containment system seals to guarantee that they will not be damaged: this assessment can be done by calculation or by tests simulating this combustion phenomenon.

2.9 Transport time

The transport times on the public highway to be taken into account in the safety demonstrations, unless other regulatory limits are specified, are respectively:

- one year under routine and normal conditions of transport,
- one week under accident conditions of transport

These times are defined so as to cover respectively the duration provided for in paragraph 229 of regulation [10], relative to the defining of the normal maximum service pressure (P_{UNM}), and the time necessary to recover a package involved in a severe accident. A shorter maximum transport time under routine or normal conditions of transport may nevertheless be specified in the shipping conditions defined under a multilateral approval certificate.

APPENDIX 2
EXPERIENCE FEEDBACK ON POINTS RAISED DURING APPRAISALS

Alongside Appendix 1, this appendix presents a list of technical difficulties with the safety demonstration, identified during the expert appraisal process, for which the analyses were repeatedly either missing from Safety Reports or were inadequate. This list is organised by safety function, in the following order:

Abbreviations

RCT: routine conditions of transport
NCT: normal conditions of transport
ACT: accident conditions of transport
≠ : indicates a change of meaning[1] in the formulation of a technical point
+ : indicates addition of a technical point
- : indicates deletion of a technical point

[1] With regard to the previous version of this guide (ASN Guide No. 7, Revision 0 of 7 April 2009).

0. GENERAL

≠ **0.1.** **The Safety Report shall include a list of regulatory requirements applicable to the package model, with reference to the sections of the Safety Report that substantiate compliance.**

The equipment or parameters (transport times, sealing criteria, closing times, etc.) important for safety during transport are listed in the chapter of the Safety Report relative to the utilisation of the packaging.
The criteria associated with the safety functions of the packaging during its manufacturer or maintenance are listed in the chapters of the Safety Report relating to the manufacture and maintenance of the packaging.

≠ **0.2** **The Safety Report shall include a comprehensive list of internal design features and contents.** The description must include the adequate information, as necessary for assessing the risks related to package safety.

≠ 0.2.1 Description, design drawing and material of the baskets, spacers, cladding, capsules, cylinders, etc. The mechanical and thermal properties of the materials shall be given for temperatures between -40°C and the maximum temperatures reached under normal conditions of transport.

≠ 0.2.2 Nature, material, composition and weight of hydrogenated materials (resins, foams, covers, etc.)

≠ 0.2.3 Description and drawing (with dimensions) of fuel assemblies, rods, guide tubes, grids, top and bottom nozzles, "combs" and sleeves, with the number of bolted rods (in particular in assembly end plates), grade of all materials, cladding type, minimum mechanical properties required for cladding and nozzle materials (yield strength, ultimate strength, ultimate elongation, resilience or any other properties that can be used to characterise the risk of brittle fracture in the event of impact).

\+ 0.2.4 Where applicable, description of changes to dimensions and mechanical characteristics of the irradiated fuel assemblies.

≠ **0.3** **The contents and their physical, chemical and radioactive forms shall be described accurately enough to ensure the loss of containment, radiation protection, subcriticality and heat protection risks can be assessed.**

0.3.1 Risks related to segregation phenomena occurring during evaporation processes shall be properly taken into account, e.g. for uranium decay products or fission products during successive draining operations of uranium hexafluoride (UF_6) transport cylinders (when the cylinder is drained in gaseous phase, non-volatile compounds remain in the cylinder), or dissolved salts precipitation processes.

0.3.2 Conformity with regulatory provisions on fissile excepted materials shall be justified, where applicable.

≠ 0.3.3 For packages carrying fissile materials, the Safety Report shall include the information required in order to define the fissile media, in particular:

0.3.3.1. <u>All media</u>

- fissile material (uranium, plutonium, actinides, etc.),
- physical and chemical nature,
- isotopic compositions (^{235}**U** enrichment of the uranium, isotopic vector of the plutonium, ratio of Pu / (U+Pu) by mass,
- any specific assumptions about density, alloy composition, presence of inert substances, etc.

0.3.3.2. <u>Homogeneous media</u>

- any limitations in mass,
- any limitation in moderation,
- any neutron poisons that may be present.

≠ 0.3.3.3. <u>Media comprising cladded fuel rods or pins (UO_2, UO_2-PuO_2, etc.)</u>

- pellet diameter taking manufacturing tolerances into account,
- outer diameter of fuel rods taking manufacturing tolerances into account,
- nature and thickness of cladding taking procurement and manufacturing tolerances into account,
- maximum fission section, if applicable, with regard to the envelope geometry of the bundles of rods or, if not applicable, the lattice pitch and number of rods per edge, taking the maximum manufacturing tolerances into account,
- any distinction between zones with different compositions,
- any specific moderation assumptions (presence of water and/or minimum and maximum number of rods),
- any neutron poisons that may be present.

≠ 0.3.3.4. <u>Media comprising cladded fuel plates</u>:

- general arrangement and overall dimensions of the plate lattice
- nature and thickness of cladding,
- maximum fission cross-section, if applicable, with regard to the envelope geometry of fuel plate lattice or, if not applicable, the lattice pitch and number, taking the maximum manufacturing tolerances into account,
- overall dimensions and dimensions of the active part,
- any distinction between zones with different compositions,
- any specific density assumptions,
- any specific moderation assumptions (presence of water and/or minimum and maximum number of plates per lattice),
- any neutron poisons that may be present.

0.3.3.5. <u>Any specific conditions or assumptions</u>:

- non-uniform distribution of fissile materials and/or moderation,
- irradiated fissile materials (average minimum burn-up, and burn-up at ends).

+ 0.4 **With package designs for which there are no conditions of shipment relative to a transport time limitation, the transport times to be taken into account in the safety demonstrations are:**

- **one year under NCT,**
- **one week under ACT,**

in order to cover paragraph 229 of the IAEA Regulations for the Safe Transport of Radioactive Materials, 2012 Edition, and the time necessary to recover a package in a severe accident situation.

+ 0.5 **Precise specification of all the welds contributing to a safety function, particularly those of the containment system:**

- **type of weld, dimensions, conformance with a manufacturing code,**
- **type of manufacturing and maintenance inspections, extent and conformance with a manufacturing code (see Section 1.7 in particular).**

1. CONTAINMENT

(For type B and C type package, except Section 1.2.1.2., which is for IP and A type packages carrying fissile materials)

≠ **1.1.** **The existence of a containment system shall be justified, in particular in accident conditions of transport (ACT).**
All components and their performance, in particular mechanical and thermal performance, shall be accurately described.
Containment is based on positive closure devices which are reliable even under conditions of mechanical impact or strong vibration; devices such as single latches, single spring clips, etc., are not taken into consideration in the containment demonstrations unless otherwise specified.

≠ **1.2.** **Demonstration of compliance with containment criteria in NCT and ACT:**
All possible releases, in gaseous, liquid, solid or aerosol form shall be taken into account. Radioactive gas releases due to elastomer seal permeability shall be considered.
For aerosols, all isotopes, fission products, activation products and actinides shall be considered.
Risks of failure (locked open) of self-sealing coupling or other equivalent system that is part of the containment system shall be taken into account deterministically, in NCT and ACT.

1.2.1. Compliance with containment criteria under NCT.

≠ 1.2.1.1. Transport of irradiated fuel assemblies: the cladding failure rate used under NCT shall be justified, considering in particular their creep

≠ 1.2.1.2. For IP or A type packages, the absence of content dispersal or loss shall be demonstrated. The demonstration may be based on a quantitative criterion to guarantee that the committed dose for any person close to the package complies with a certain fraction of the regulatory annual individual dose limits.

≠ 1.2.1.3. Transport of irradiated fuel assemblies: bounding characteristics for activity releases shall be taken into account (burn-up, enrichment, cooling time, fission gas release rate, free volume of rods).

≠ 1.2.1.4. The maximum temperature of containment seals shall be taken into account, which is often obtained in confined transport conditions (under a tarpaulin or canopy).

≠ 1.2.2. Compliance with release criteria under ACT.

≠ 1.2.2.1. Resistance of the fuel assemblies under ACT and the cladding failure rate used under ACT shall be justified, in particular considering cladding creep.

≠ 1.2.3. The permeation coefficients taken into account in NCT and ACT shall be justified, according to the gas in question and elastomer seal material grade.

≠ 1.2.4.3.1. The ageing of the seals and the scatter of permeation characteristics of the elastomer blend shall be taken into account according to the possible variations in formulation and seal manufacturing and process.

≠ 1.2.4. When the activity is heterogeneously distributed through the content, the maximum specific activity shall be taken into account for the release calculations for aerosols suspended inside the packages in NCT and ACT.
In particular for waste, the local maximum specific activity of substances likely to be present in the waste shall be considered.

≠ 1.3. Justification of the fraction of fission gases released out of the irradiated fuel material.

1.4. Systematic leak test after loading, consistent with justifications required in point 1.2.

≠ 1.4.1. If a seal that is not part of the containment system but is located inside it forms a boundary for part of the internal volume of the containment system, it shall be demonstrated that failure of the containment seal can be detected during the pre-shipment leak test. In the event of such failure, the seal inside the containment system is likely to mask this failure by substituting for the function of the seal to be tested.

≠ 1.5. Justification of containment system resistance if it contains sharp or pointed internal components that could damage it.

≠ 1.6. Performance of leak tests on specimens having undergone drop tests consistent with 1.2.

≠ 1.7. Justification of weld quality on the containment system in design, manufacture and repair, in conformity with a manufacturing code

≠ 1.7.1. Welds must be full penetration welds, authorised by a building code to the maximum quality level.

1.7.2. 100% weld inspection (e.g. X-ray or ultrasound volume testing).

≠ 1.8. Demonstration that the free volume of the grooves of the seals or control joints installed on the constituents of the containment system or water sealing barriers is sufficient to allow thermal expansion of the elastomer seals under normal and accident conditions of transport.
If not, demonstration that the cover is sufficiently rigid to guarantee ring bending of less than 0.1 mm at the seal grooves under the bolt tightening loads and the seal reaction loads, by using an experimental method to characterise the three-dimensional compressibility of the elastomer.

≠ 1.9. **For packages transported with a cavity containing liquid, it is demonstrated that the presence of liquid does not invalidate the containment system leak test, by clogging the leak paths for example.**

1.10. **Justification of containment for external pressure of 0.6 bar absolute (compliance with the conclusions of the GP/CST meeting on 24/01/2003).**

1.11. **If sources are transported in packaging that has no qualified containment system, the source leak-tightness must have been tested (e.g. by helium impregnation or hot bubble testing). If not, additional examinations shall be performed prior to transportation (e.g. full visual inspection to confirm there is no mechanical, thermal or corrosion damage; swab testing across the whole surface area of the sources, in particular weld beads; dye penetrant or X-ray testing of the weld beads), and checks shall be made to ensure the source has never been involved in an incident or accident.**

2. RADIATION PROTECTION

≠ **2.1. Definition in the Safety Report of potential radiation peak zones to be tested before shipment.**

≠ **2.2. Demonstration that the increase in maximum radiation level under NCT remains lower than 20%, taking account of possible motion affecting the radioactive contents inside the package,** in particular for bulk-loaded contents (e.g. decommissioning waste, sealed sources, etc.) that could be reshuffled in the event of impact.

2.3. Risks related to segregation phenomena occurring during evaporation processes (e.g. precipitation of dissolved salts, UF6 tank bottoms) shall be taken into account.

≠ **2.4. The maximum dose rates around the package shall be estimated under routine and accident conditions of transport, for content characteristics that are bounding for those defined in the certificate of approval.**

2.5. Justification that the sources remain held securely in storage position inside the irradiators (in sequential drop conditions).

≠ **2.6. For dose rate estimates in ACT, geometrical changes and content movements after the ACT representative tests shall be taken into account.**

≠ **2.7. Justification of the absence of local melting of materials ensuring radiation protection at the time of the thermal test, taking into account in particular the effects of the puncture drop conditions and possible eutectics of metal alloys (e.g. antimony in lead), or the limitation of melting to a volume compatible with regulatory criteria for intensity of radiation under ACT.**

≠ **2.8.** **Assessment of the risks of lead protection detachment in the event of slump, using free**
\+ **drop tests that are representative of ACT, taking into account adhesion stresses between the lead and the steel shells, temperature-driven variation in the behaviour of lead and the worst-case temperatures for lead under normal conditions of transport. If this estimate is based on drop tests with a small-scale model, the effects of scale on the adhesion stresses shall be taken into account. The consequences on dose rates around the package shall be assessed.**

3. CRITICALITY SAFETY

(For packages carrying fissile materials)

≠ **3.1 General**

≠ 3.1.1 The isolation system shall be described in the Safety Report.

3.1.2 For criticality safety studies on foreign package designs, diagrams of design configurations (with dimensions) and the chemical composition of the materials shall be made available.

≠ 3.1.3 If the applicant substitutes air for certain scattering media or dehydrogenated media, verifications shall be performed to ensure this assumption is appropriate, in particular for package arrays.

≠ 3.1.4 For assemblies that include dummy rods made of a "neutron transparent" material, it shall be proven that these dummy rods have no impact on reactivity.

3.2 Contents: Accurate description of the contents and all variants (see 0.3.3)

3.2.1. Justification covering all possible cases, taking into account the various physical and geometric characteristics (dimensional tolerances, component positions), if it is conceivable that the powder density could increase under normal or accident conditions of transport, the worst-case density shall be taken into account for the criticality calculations.
Nuclides that can support a chain reaction and which are not defined as fissile materials shall also be taken into account: where some nuclides may be present in sufficient quantity or concentration to increase the neutron multiplication factor, their concentration and/or quantity shall be defined.

≠ 3.2.2. If the contents include materials with hydrogen concentration higher than that of water, the criticality safety demonstration shall take account of these materials.

≠ 3.2.3. If the quantity of fissile material allowed in the package is expressed in uranium 235 mass, without mention of the total uranium mass, and without restriction on the possible presence of multiple enrichments, subcriticality shall be justified by considering, in addition to the mass of uranium 235, any mass of natural uranium at the worst-case location.

3.2.4. It is prohibited to classify any part of the contents as fissile excepted material for a package carrying non-excepted fissile material. All fissile material present in the contents shall be taken into account in the criticality safety demonstrations, including any natural or depleted uranium, where applicable.

3.3 Comprehensive nature of justifications

≠ 3.3.1. Do not omit any configurations in the analysis (isolated damaged package, undamaged package, array of 5N undamaged packages and 2N damaged packages).

≠ 3.3.2. For fissile material transport packages approved under the IAEA Regulations for the Safe Transport of Radioactive Material **1985 Edition,** as amended in 1990 (SS no. 6) taken in isolation, whose subcriticality is demonstrated by taking into account the absence of water leakage or partial water leakage into the package (under Section 565 b), the Safety Report and draft certificate of approval shall describe the special package leak-tightness conditions.

\+ 3.3.2.1. The quantity of water in void spaces of the package taken into account in criticality calculations must be assessed by considering the least favourable of the conditions below (see Section 564 b of IAEA SS No. 6, 1985 Edition, as amended in 1990):

- either the condition of the package following tests representative of NCT followed by the immersion test in 15 m of water, considering the guaranteed leak rate in this configuration,
- or the condition of the package following the combination of tests representative of NCT followed by mechanical and thermal tests representative of ACT and the water leak test in 0.9 m of water, considering the guaranteed leak rate in this configuration,

The regulatory immersion test duration is 8 hours.

The estimation of the quantity of water entering the package also takes account of the influence of seal temperature on the water viscosity.

Any special characteristics specified shall be independently double-tested with respect to package sealing operations (presence of components and inspection of their condition, tightness of containment system fasteners, leak testing, dewatering checks).

≠ 3.3.3. For fissile material transport packages approved under IAEA Transport Regulations No. ST-1, **1996 and later editions**, the provision of the previous paragraph (see Section **3.3.2**) is restated in Section 680 a) of SSR-6, provided that the package features multiple water barriers, each of which would remain watertight under ACT. Having muliple barriers (two barriers *at least*) is a requirement for all leak paths from the containment systems, except where special provisions are made for thick-shell packs in **Appendix 1, Section 2.2**.

\+ *3.3.3.1.* Each of the containment barriers shall be independently tested with respect to package sealing operations (presence of components and inspection of their condition, tightness of containment system fasteners, leak testing, dewatering checks, see Section 7.1.2).
The quantity of water in void spaces of the package taken into account in criticality calculations for a damaged package in isolation shall be assessed by considering the least favourable of the conditions below (see Section 682 c) and 685 b) of SSR-6):
- either the condition of the package following tests representative of NCT followed by the immersion test in 15 m of water, considering the guaranteed leak rate in this configuration,
- or the condition of the package following the combination of tests representative of NCT followed by mechanical and thermal tests representative of ACT and the water leak test in 0.9 m of water, considering the guaranteed leak rate in this configuration,
The regulatory immersion test duration is 8 hours.
The estimation of the quantity of water entering the package also takes account of the influence of seal temperature on water viscosity.

3.3.4. If special measures are not taken into consideration when preparing the packages (see Section 7.1.2 of this appendix), the quantity of water to be considered in the criticality-safety analyses cannot be limited.

3.3.5. Any residual humidity liable to be in contact with the fissile medium during transport shall be taken into account, including the partial pressure of water vapour, the quantity of water present in any hydrated salts formed during dewatering operations, the quantity of residual liquid water if the dewatering operation is not completely successful, especially if water traps are present, such as guide tubes without holes at bottom and non-watertight fuel rods.

≠ 3.3.6. For transport by air, the IAEA Regulations for the Safe Transport of Radioactive Material, SSR-6, 2012 Edition, require a specific configuration to be considered in criticality assessment. This assessment consists of studying the damaged package in isolation (damage resulting from "Type C" tests specific to transport by air), assuming reflection by at least 20 cm of water but no water in-leakage. If there is no demonstration of the mechanical behaviour of the contents, the first pessimistic configuration consists of considering the fissile material dry in spherical form, with reflection by 20 cm of water. Other configurations may however be more pessimistic scenarios. The two configurations below (non-exhaustive) could lead to an increase in reactivity:
- dry fissile material in spherical form, surrounded by reflective materials from the packaging (e.g. steel, lead) and reflected by 20 cm of water,
- fissile material mixed with moderator materials from the packaging, reflected by the packaging materials and by 20 cm of water.

≠ 3.4 Justification of the selected methodology

3.4.1. All structural elements made of steel or other structural materials (aluminium, titanium, etc.) that could have an impact on neutron multiplication must be taken into account.

≠ 3.4.2. The qualification of the criticality calculation tools shall be justified for the configurations studied. Representative critical experiments of the studied transport configuration shall be detailed. Particular attention should be paid to media for which the qualification base is not very extensive (low-moderated media, plate fuel assemblies, etc.) For these media, sufficiently pessimistic numerical models (calculation assumptions) with safety margins are required in order to compensate for the lack of qualification, where applicable.
The qualification of the evolution codes should also be checked when a burn-up rate is required for the fuel carried.
Likewise, the qualification of structural materials or the impact of the presence of impurities shall be taken into account in assessing the criteria used, in particular when the impact of these structural materials is important in terms of criticality.

3.4.3. If burn-up is taken into account in the justifications, it is not allowable to consider the average burn-up rate on the least-irradiated 50 cm over the height protruding above the poisoned structures if that height is less than 50 cm.

≠ 3.4.4. If the mode of reactivity control imposes a limit on mass and geometry, the justifications shall take into account the full possible range of masses and moderations (consider a maximum mass of fissile material with a variable moderation value and then a lower mass of fissile material when the cavity is filled with a moderator).

≠ 3.4.5. The impact of the density variations in the fissile medium should be studied for certain configurations in which the interactions can be predominant.

3.4.6. Criticality calculations shall be performed in consideration of the heterogeneous forms of the fissile materials carried, for uranium enrichments of less than 30% and for plutonium isotopic vectors containing plutonium 240.

In particular, modelling the total or partial destruction of fuel rods or pins by an equivalent homogeneous environment does not necessarily constitute a bounding assumption in terms of criticality.

3.4.7. In the event of limited presence or in-leakage of water, a potentially non-homogeneous distribution of water should be considered (this applies especially to UF6 containers).

≠ 3.4.8. When the transported fuel elements are liable to have been irradiated and the criticality safety demonstration is based on a calculation with non-irradiated fuel elements, justification shall be provided that the non-irradiated fuel elements are more reactive than the irradiated fuel elements (irradiation assumptions shall be consistent with the reactor type in question: PWR, BWR, FBR, etc.).

≠ 3.4.9. The validity of the average enrichment assumption for BWR-UOX fuel assemblies shall be justified if used in the subcriticality demonstration, especially if the geometry of the assemblies can change under regulatory test conditions.

≠ 3.5 Justification of damage to be considered

≠ 3.5.1. If necessary, justification shall be provided of the absence of damage to internal design features and spacers under ACT (e.g. baskets for fuel assemblies and fuel rod boxes, etc.). Justifications are often based on a pseudo-static evaluation with as loading condition the accelerations recorded during drop tests and then filtered. This method alone does not cover the real dynamic behaviour of the package component subjected to the real impact. For some materials, such as aluminium, used for internal design features and spacers, the maintenance of high temperatures long periods can lead to changes in the mechanical characteristics. These modified characteristics shall therefore be taken into consideration for ACT.

≠ 3.5.2. Damage conditions after ACT testing shall be taken into account, e.g. degradation of hydrogenated materials in the thermal test or deformation of the compartments.

≠ 3.5.3. The risk of direct impact from the puncture bar on fissile materials shall be assessed in the event that the packaging is punctured by the bar (for some obliquely-orientated packages).

≠ 3.5.4. The resistance of fuel rods in fire conditions shall be assessed (risk of heat bursting under pressure), taking into account as necessary the geometry of the assemblies after ACT mechanical tests (rods closer together or closer to the walls).

3.5.5. The risk of differential draining (pressure difference) shall be assessed if water is present in the package cavity.

3.5.6. For uranium hexafluoride transport cylinders, the minimum thickness of the metal wall allowable under ISO 7195 shall be taken into account, or a less pessimistic value if it is guaranteed in use.

3.5.7. The elongation under irradiation of the active length of the fuel rods shall be taken into account as the maximum value considered in the event of differential sliding of the rods in a fuel assembly.

≠ 3.5.8. If a neutron-absorbing material (resin, etc.) is taken into account in the criticality calculations under ACT, the burned thickness and the chemical composition of the remaining material shall be justified.

4. OTHER RISKS

≠ **4.1.** **For all cases in which water or hydrogenated materials (celluloses, plastics, hydrocarbons, lubricants, aqueous or organic solutions) are present, the risks of accumulation and production of combustible gases above the flammability concentration limit shall be assessed.**

≠ **4.2.** **The use of calculation codes to justify the absence of any risk associated with radiolysis in a package is acceptable if these codes are qualified on the basis of experimental measurements taken under representative conditions, taking into account the precise chemical composition of the considered medium and the physical parameters, such as temperature, pressure, filling gas, etc. Otherwise, a prudent progressive approach shall be used based on experimental testing at an appropriate reduced power, for example during the first transport operations in order to readjust the codes used.**

≠ **4.3.** **……...**

When the maximum authorised transport duration has to be limited, the maximum authorised duration must be reduced firstly by a time allowance for potential contingencies resulting from operational difficulties, and secondly by the regulatory time allowance for accident situations.

The time allowance for operational contingencies, which depends on the type of transport operation, is at least:

- **7 days for national transport operations,**
- **15 days for intra-continental transport operations,**
- **30 days for inter-continental transport operations.**

The time allowance for accident situations is at least 7 days and can start at any time during the transport operation.

If the cause of the limitation on the maximum authorised transport duration is the release of inflammable gaseous substances (by radiolysis or thermolysis), the transport duration is counted from the moment the containment system is closed.

≠ **4.4.** **If non-tight fuel rods and/or cladding are carried, any water that might be contained in the fuel elements shall be taken into account, unless appropriately justified.**

≠ **4.5.** **The impact of all subsidiary risks on the performance required for the relevant package type shall be taken into account: pyrophoricity, flammability, explosiveness, corrosion, oxidation and all physical or chemical transformations.**

\+ **4.6** **If applicable, the risks of deterioration of the gaseous inerting implemented to prevent the subsidiary risks shall be analysed under all conditions of transport.**

5. MECHANICAL ISSUES

5.1. Comprehensive nature of analysis in accident mechanical test conditions

≠ 5.1.1. Justify the integrity of the closing system retention bolts in the different drop test configurations.

≠ 5.1.1.1. In the event of dropping on a corner of the cover beside the closing system, check that there is no plastic behaviour (which would require complex additional justifications related to fracture mechanics, seal behaviour in the event of seating detachment or dust penetration, etc.).

5.1.1.2. The behaviour of support washers under the bolt head shall be taken into account for the calculation-based assessment of bolted assembly behaviour.

≠ 5.1.2. Analyse the most severe drops for containment.

≠ *5.1.2.1.* Drops that maximise acceleration (flat, whip action, etc.) at constant rigidity per unit of surface area: the larger the impact surface, the harder the impact will be.

≠ *5.1.2.2.* Drops that maximize deformation (on corners, edges, etc.): the smaller the impact surface area, the greater the compression.

5.1.2.3. Drops that maximise damage to openings, in particular with a puncture bar.

≠ *5.1.2.4.* Drops that maximise the risk of perforation by a puncture bar: the impact surface is oblique with respect to the surface of the end of the puncture bar; the initial impact thus takes place on a segment of the circular edge of the punch and the risk of perforation is much higher. If the risk of perforation is estimated by calculations rather than by testing, the "perforation by puncture bar" computational model used shall be sufficiently precise to model the 6 mm fillet radius of the puncture bar and shall be qualified for the configurations studied.

≠ *5.1.2.5.* Drops that maximise damage to the contents. The damaged geometry of the fuel rod claddings, assemblies, sources, etc. after the drop sequence shall be used later on.

≠ *5.1.2.6.* Resistance of metal seals to horizontal drop. The metal seals are sensitive to vibration phenomena which can cause abrasion damage to their sealing membrane (made of soft metal, such as aluminium, silver or copper). This is particularly true if the package falls in the horizontal position, when the force of inertia of the lid is higher than the force of friction between the lid and its flange generated by the tightening force of the lid retention bolts.

5.1.2.7. Mechanical strength of pipes with complex geometry, in particular lead-encapsulated pipes, taking into account any stress concentration areas (geometric discontinuities, presence of bolts, etc.).

5.1.2.8. Preservation of the leak-tightness of the drain plugs on 48-inch and 30-inch uranium hexafluoride (UF_6) cylinders.

≠ *5.1.2.9.* For packages concerned by plate drop, the configurations of a plate offset from the centre of gravity of the package shall be studied (the plate's centre of gravity remains above the package's).

≠ *5.1.2.10.* Additional assessment of the effects of the dynamic compression test on package designs whose apparent density is slightly higher than 1 but for which this test is not formally required.

5.1.2.11. Analyse the influence of features added to the package at the time of transport on the safety performance required for the package, particularly the influence of the frames under regulatory drop conditions.

5.1.2.12. For new package designs and old designs sensitive to this phenomenon, If all or part of the load (internal fittings and content) can move freely within the cavity when the package is dropped, assess the consequences on the mechanical resistance of containment system components (in particular the closure system) of impact between the contents and surrounding elements (in particular the containment system cover), using the worst-case scenario for shifting of contents before the drop, particularly when the package is dropped in a vertical or oblique position on the closing system side (see Appendix 1, Section 2.5)..

5.1.2.13. Assess any resonance effects on the containment closure system from a package drop from a height of 9 m.

≠ 5.1.3. Justify the representative nature of drop specimens, including, if scale specimens are used, the accuracy of homothetic ratios used as necessary, for the following points:

5.1.3.1. The fasteners, including washers, with tightening torques in compliance with the laws of similitude. The tightening torque is determined taking into account uncertainties with respect to the tightening torques applied to the tested specimens, as well as to the actual packages, including those associated with variations in the friction coefficient due to surface conditions and any lubricant used.

5.1.3.2. Elastomer seals, particularly the grade or at least the compression rate and the hardness of the seal

5.1.3.3. Metal seals: seals of identical design, with the same materials and homothetic elastic restitution

5.1.3.4. Seal grooves

5.1.3.5. Geometry of all components of the containment system.

5.1.3.6. Welds.

≠ *5.1.3.7.* Contents: geometry, mechanical properties of the materials (yield strength, ultimate strength, ultimate elongation, resilience), threaded fasteners, characteristics of fuel assemblies, rods, their top or bottom plates, fuel pellets (hardness, fragmentation) at temperatures achieved under NCT.

≠ *5.1.3.8.* The actual mechanical properties of the drop specimen materials under test conditions shall be representative of those of the package design components, taking into account the regulatory temperature range and the tolerances on procurement, particularly for shock absorbing materials (wood, foam, etc.).
If there are significant differences between the actual mechanical properties of the specimen and the minimum guaranteed properties of the package design components, an impact study on the required safety performance aspects shall be performed.

5.1.3.9. The mechanical characteristics of some materials (e.g. resins and aluminium) may change under the effect of ageing, due particularly to thermal cycles. The evolution of these characteristics in operation shall be integrated in the design of the test specimens.

5.1.3.10. Mechanical clearances that could have an impact on safety, especially where any changes could lead to variations in bolt stresses, particularly in the impact limiter, lid or plug, or on the displacement of surfaces in contact with the metal seals.

≠ 5.1.4. Justify the representative nature of the drop heights for drop tests on a reduced-scale specimen.

5.1.4.1. Increase the drop height to simulate the total energy received by the package, corresponding to the sum of the drop height and the compression depth, or verify that the increase in drop height would not have an impact on the mechanical strength of the package.

≠ 5.1.5. Ensure that acceleration values are recorded

≠ *5.1.5.1.* Accelerometers shall not be placed on parts that are liable to be deformed.

5.1.5.2. Check that the area under the accelerogram represents a coherent impact speed (of the order of 13.3 m/s for a 9 m drop with no rebound) and that the signal shows no zero drift.

≠ **5.1.6.**

Verify during the drop tests that no test station component other than those mentioned in the applicable transport regulations has interacted with the specimen unless it is proved that such interaction has had no impact.

≠ **5.2** **The variation in the effectiveness of the shock absorbers (wood, polymers, plaster, cement, etc.) in the range of temperatures considered (T_{min} = −40°C, T_{max} in NCT) and the foreseeable relative humidity range given the package manufacturing, servicing and maintenance specifications, shall be taken into account.**
If the drop energy absorbed by the shock absorbent material is estimated on the basis of an analytical model, the volumes of materials not compressed by rigid components shall not be taken into account.
The variation in performance of metal (aluminium) shock absorbers shall be taken into account in the range of specified mechanical properties (yield strength, ultimate strength, ultimate elongation)

≠ 5.3 **The absence of risk of brittle rupture of the containment system component materials and the anti-perforation protections (carbon steels, cast iron) at -40°C, taking into account stress concentration areas (geometrical features, presence of bolts, tappings, grooves, etc.).**

\+ 5.3.1. Justify the size of the reference defect consistently with the performance of the manufacturing processes and the non-destructive tests.

≠ **5.3.2** Justify the dynamic toughness values of the materials concerned at -40°C (if they are used in the demonstration that there is no risk of brittle rupture).
If dynamic toughness is taken as a safety criterion, justify its representativeness with respect to manufacturing scatter (for example on the contents of the chemical constituents of the steel and the heat treatment parameters).

≠ **5.4** **Justification of the resistance of special form sources taking into account the temperature and pressure of the source in the package under NCT**

≠ **5.5.** **Justification of containment system resistance to the maximum pressure under ACT (taking account of the effects of thermal testing, radiolysis, physical transformations, chemical reactions, etc.**

≠ **5.6.** **Justification of containment system resistance to the immersion test under 200 m head of water for packages containing irradiated fuel (activity higher than 37 PBq), under IAEA Regulations for the Safe Transport of Radioactive Material, 1985 Edition, or for packages containing activity higher than 10^5 A_2 , under IAEA Regulations for the Safe Transport of Radioactive Material, 1996 and later Editions.**

≠ **5.7.** **Stresses due to thermal expansion under NCT and ACT shall be taken into account.**

+ 5.7.1. The influence of differential expansion under RCT and NCT shall be taken into account for the design of the attaching components of the containment closure system, the impact limiters and the stowage and handling components.
The impact of thermal transients during pre-shipment preparation and during transport on the final tightness of these components shall be taken into account.

≠ **5.8. Study of the resistance of stowage and handling components under RCT.**

+ 5.8.1. Justify the intensity of loads transmitted by stowage systems taken into account for the different directions.
For vertical loads, the effect of gravity shall be taken into account.

≠ 5.8.2. Justify that there is no fatigue damage to stowage and handling components, taking into account the sum of transport (and handling) operation cycles and the planned modes of transport.

≠ 5.8.3. In the calculation of resistance to handling and stowage stresses in trunnions for packages held horizontally by 4 trunnions, the vertical loads shall be assumed to be borne by 2 trunnions only, due to the hyperstatic nature of the configuration, unless otherwise justified.
This also applies to the fatigue calculation.

≠ 5.8.4. For design calculations on handling and stowage points, the combination of the accelerations in directions that are liable to be applicable simultaneously shall be taken into account.
The criterion used shall be a fraction of the yield strength of the material.

+ 5.8.5. Justify the bounding nature of the handling stresses used, taking into account any impacts from sudden setting down and "snatch" lifting of the package.
For the mechanical strength calculations of the handling components, the weight of auxiliary equipment attached to the package (frame) shall be taken into account, where applicable.

+ 5.8.6. Check the acceptability of loads induced by stowage and handling stresses inside the containment system, considering fatigue damage where applicable.

+ 5.8.7. For bolted trunnions, verify the strength of the trunnion retention bolts.

6. THERMAL ISSUES

6.1. Unless appropriately justified, insolation over a 12-hour period shall be taken into account. Insolation shall not be taken as an average over 24 hours.

6.2. The presence of protection systems that could hinder thermal dissipation under NCT: tarpaulins, canopies, thermal barriers, additional radiation protection shields, overpacks (containers, vessels, etc.), hold in a ship, etc.

6.2.1. Assess the effects of ageing on the thermal properties of tarpaulins used in transport (solar absorptivity and emissivity).

≠ **6.3. Any simplifying assumptions used for calculations under NCT and ACT shall be justified (e.g. absences of trunnions).**

≠ **6.4. The worst-case package positions (horizontal or vertical) shall be taken into account during and after thermal testing (ACT), assuming that the convection coefficient and absorbed solar flux index depend on the package position.**

≠ **6.5. Under IAEA Regulations for the Safe Transport of Radioactive Material, 1996 and later Editions, insolation is to be taken into account before and after thermal testing.**
Under the IAEA Regulations for the Safe Transport of Radioactive Material, 1985 Edition (as amended 1990) and previous revisions, insolation can be ignored before and during thermal testing but shall be taken into account for the subsequent assessment of the thermal behaviour of the package.

≠ **6.6. During thermal testing, the absorptivity coefficient of the package external surface shall not be less than 0.8 and not less than the maximum possible value under routine conditions. The value of 0.8 takes account of soot deposits on the package surface; the use of any other value requires justification.**
When the demonstration of resistance to thermal testing is based on the results of a test, the test conditions shall be such to guarantee an average heat flux that complies with regulations; the previous drop test sequence which the specimen was submitted to, must have led to maximum damage (e.g. to the impact limiters).

≠ **6.7. Assessment of the minimum and maximum temperatures of different package components under NCT and ACT shall take into account:**
- all possible positions of radioactive contents and internal design features (longitudinal and radial positions),
- the damage to the internal design features
- the worst-case rearrangement of the contents, in particular if in bulk.

\+ **6.8. Any heterogeneity in the thermal power of the contents shall be taken into account.**

≠ 6.8.1. The power profile of irradiated fuel shall be taken account in the thermal studies.

+ 6.8.2. If the power profile considered is established on the basis of a burn-up profile, the proportionality between the two profiles shall be justified, taking into account the characteristics of the content carried.

≠ **6.9. For packages transported with water in their cavity, the maximum internal pressure shall be evaluated using the maximum cavity temperature obtained in the worst-case configuration, taking into account the partial pressure of water vapour.**

6.10. If justifications are based on tests performed under thermal barriers (tarpaulin, canopies, etc.), the test results must have been obtained at thermal equilibrium.

≠ **6.11. If the thermal test is performed in a furnace, the oxygen concentration in the furnace atmosphere shall be controlled to comply with the oxygen concentration expected in an open air hydrocarbon fuel fire.**

≠ **6.12. Safety margins must be included if a numerical model is used in the thermal demonstrations. This margin may be reduced if the calculations are benchmarked using experimental tests.**

≠ **6.13. Analyse the influence of the transport frame during thermal testing on the required safety performance for the package.**

≠ **6.14. In event of damage to wooden impact limiters, the risk of combustion of the impact limiter wood after the fire has stopped shall be analysed to determine the maximum temperature of sensitive package components.**

≠ **6.15. Forced convection shall be assumed in the analysis of package behaviour in thermal test conditions.**

+ 6.15.1. If cooling fins are not modelled, a justified coefficient of convection shall be taken into account. On a pessimistic basis, a coefficient of convection corrected by the ratio of surface areas with and without fins can be used.

+ **6.16. For the thermal analyses, if the cavity or the clearance spaces in the body of the packaging are assumed to be filled with a specific gaseous composition, particularly helium, the absence of other gases that could change the thermal transfer characteristics inside the package (gases from resin gas release, free water evaporation, leakage, etc.) shall be justified.**

+ **6.17. The influence of the transformation of foams or other insulating compounds above 300°C on the models used in numerical simulations of the thermal test shall be analysed.**
In this context, compression of the foam following drop tests to simulate NCT and ACT, and any fusion, thermolysis, pyrolysis reactions, etc., and the associated gas releases shall be taken into account.

7. OPERATION – MAINTENANCE

+ 7.1. Operating instructions for all safety-important operations shall be presented in the Safety Report.

≠ 7.1.1. For packages that are transported dry after vacuum dewatering of the cavity, unless appropriately justified, it shall be specified that throughout the dewatering period the pressure in the cavity shall remain at least at 6 mbar to prevent any risk of ice formation clogging the vacuum line.

+ 7.1.2. If a limited quantity of water is considered in the package cavity for the criticality safety studies (see Section 565 of the IAEA Regulations, 1985 Edition or Section 680 a) of the IAEA Regulations, 2012 Edition), it shall be demonstrated that special provisions have been made to prevent the single-error risk during package preparation that could lead to water in the cavity in quantities greater than those taken into account in the safety demonstration (see Section 3.3.4).

For packages approved in accordance with the 1985 Edition, these provisions concern the following operations:

- verification of the presence, the condition and the cleanness of the closing system components of each sealing barrier, especially the seals and their seating surfaces,
- verification of draining and dewatering if applicable,
- verification of the closing and attachment of the closure system of each sealing barrier (tightness of threaded fasteners),
- verification of the leak-tightness of each sealing barrier.

The special provisions are to be adapted to the type of operations to carry out and the associated safety risks to guarantee the safety of a transport operation. For example:

- cross-checking: performance of the required operations by an operator X and verification of the conformity of these operations with requirements by an operator Y,
- independent verifications by two different operators (verification carried out first by an operator X using tool X, then by an operator Y using tool Y).

The special provisions for packages approved in accordance with the 1996 and later editions and equipped with multiple barriers are, for example:

- if the quantity of water is assessed considering the two barriers simultaneously, the special provisions shall be identical to those for packages approved in accordance with the 1985 edition and described above;
- if the quantity of water is assessed considering a single barrier when the package features two sealed barriers, only the operations involving the possibility of common mode failures shall be examined.

In other words, the operations in which a single error leads to the same failure, whatever the barrier, shall be subject to exactly the same special provisions as the packages approved in accordance with the 1985 edition, as described above.

≠ 7.1.3. Define provisions to prevent the presence of foreign matter in the package. Otherwise, assess the consequences of their presence on package safety.

+ 7.1.4. Specify the order in which bolted elements are tightened (e.g. star tightening pattern for some bolted flange assemblies).

+ 7.1.4.1. Present the thermal equilibrium criteria to be verified before the final tightening of threaded fasteners.

+ 7.1.4.2. Define the type of lubrication used for bolts, indicating where the lubricant is to be applied.

+ 7.1.4.3. Define the allowable tolerances with the tightening torques to be used, in keeping with the tolerances considered in the bolt strength demonstrations.

7.1.5. Include in the draft certificate the fact that, before transporting any gamma ray source, the key that locks the source in safe position shall be removed from the device.

+ 7.1.6. Specify operational measures, in usage and/or in maintenance to control the contents of void spaces (excluding the cavity) in the package, in particular with respect to water ingress.
If the thermal study assumes that these void spaces are filled with a specific gaseous mixture, particularly helium, the nature of the gases actually present in these voids must be guaranteed (see Section 6.16).

+ 7.1.7 The measurement uncertainties are taken into consideration when the leak-tightness verifications, or failing this, the operational criteria, are redefined accordingly.

+ 7.2. Maintenance instructions for all safety-important components shall be presented in the Safety Report.

≠ 7.2.1. Metal containment seals with a soft metal lining (silver, aluminium, etc.) shall be replaced each time the port they seal is opened.

7.2.2. The frequency of elastomer seal replacement shall take account of their compression set in particular.

7.2.3. In maintenance, an overall check of the containment system leak-tightness shall be planned. If not, justify why this check is not performed.

≠ 7.2.4. Justify the frequency of containment seal replacement in the Safety Report, along with the frequency of stowage and handling component inspections, lid retention bolt inspections, plug and impact limiter inspections and containment seal system inspections, in particular weld inspections.

7.2.5. Justify the frequency of inspection of other safety-important components (condition of wood, foam, resin, etc.)

+ 7.2.6. Periodic inspection of enclosures containing wood for mechanical shock absorption purposes (e.g. impact limiters) shall be planned, in order to guarantee the shock absorption performance of the wood over time (leak test and/or humidity measurements).

- **7.3. Provide a summary sheet in the maintenance manual, containing a parts list with the characteristics (mechanical properties, dimensions, etc.) of all safety-important parts that require inspection, with the associated frequency.**

+ **7.4 The exceptional provisions specific to the package design to be applied in an emergency situation are described in the Safety Report chapter relating to the utilisation instructions, for example, the prohibition to spray packages containing UF_6 with water. The provisions that are generic to a given type of package are not to be repeated in the Safety Report.**

8. QUALITY ASSURANCE

8.1. Description of the quality assurance principles that have been and will be applied for any activity related to the transport of radioactive and/or fissile materials in the package studied (design, qualification, safety analyses, manufacturing, commissioning, loading, carriage, break of bulk, unloading, maintenance).

8.1.1. Actions performed to verify compliance between the Safety Report (package design definition and safety demonstrations) and the relevant operational documents (manufacturing specifications and processes, "manufacturer documentation", test and calculation results, operations manuals, maintenance programmes, user procedures and processes, etc.) shall be defined, including for documents issued by companies other than the designer.

8.1.2. In this context, responsibilities for verifications shall be defined, in particular the verification of compliance of documents prepared by companies other than the designer.

+ 8.1.3. The procedure for handling any non-compliance detected in any activity that could have an impact on transport safety (design, manufacture, operations, maintenance) shall be presented. In particular, criteria shall be defined for classifying non-compliances as safety-related.

+ 8.1.4 Describe the measures taken, as applicant, designer or owner of packages, to inform the customers or partners who are directly or indirectly concerned by the utilisation or maintenance of the packages, of the safety requirements relating to these activities described in the Safety Report, and their updating.

8.2. Definition of all safety-important components along with, for each component, the associated safety functions and parameters to be guaranteed to maintain these functions.

8.3. Classification of all parts shall be classified by their safety-importance and information given as to the associated level of inspection in manufacturing and maintenance.

8.4. Presentation of the design code validation data in the scope of application of the Safety Report.

8.5. The compliance of all package components, including canisters, cylinders, spacers etc. with the design defined in the Safety Report and the certificate shall be guaranteed.
The compliance of features added to the package that could modify its performance (tarpaulin, canopies, overpack, etc.) with the design drawing shall be guaranteed.

APPENDIX 3
TEMPLATE FOR A DRAFT CERTIFICATE

An up-to-date electronic version is available at:
http://professionnels.asn.fr/Media/Files/00-Guides/Modele-de-certificat-d-agrement-modele-de-colis

[The following certificate will be submitted in French, as required by Section 3.2]
*****

AUTORITÉ DE SÛRETÉ NUCLÉAIRE

DIRECTORATE OF TRANSPORT AND SOURCES

CERTIFICAT D'AGRÉMENT D'UN MODÈLE DE COLIS

[Pour mieux distinguer les champs : choisir dans Outils/Options/Affichage : "Champ avec trame = toujours"]
[Autres titres :

- Certificat d'approbation d'expédition ;
- Certificat d'approbation d'expédition sous arrangement spécial ;
- Certificat d'agrément d'un modèle de colis et d'approbation d'expédition ;
- Certificat de validation d'agrément d'un modèle de colis ;
- Certificat de validation d'agrément d'un modèle de colis et d'approbation d'expédition ;
- Certificat d'homologation d'un modèle de colis pour transport interne ;
- Certificat d'approbation d'expédition sous arrangement spécial pour transport interne ;
- Certificat d'agrément de matière radioactive sous forme spéciale ;
- Certificat d'agrément de matière radioactive faiblement dispersable.]

L'Autorité compétente française,

Vu la demande présentée par la société **[société requérante]** par la lettre [référence et date de la lettre de demande],

Vu le dossier de sûreté [référence et date du dossier de sûreté],

[Sauf arrangement spécial]Certifie que le modèle de colis constitué par l'emballage **[nom usuel de l'emballage]** décrit ci-après [sauf validation] dans l'annexe 0 à l'indice [indice de l'annexe] et :

- chargé :
  - de [description sommaire du premier contenu], [sauf validation]tels que décrits en annexe [numéro de l'annexe] à l'indice [indice de l'annexe] ;
  - ou de [description sommaire du deuxième contenu], [sauf validation]tels que décrits en annexe [numéro de l'annexe] à l'indice [indice de l'annexe] ;
  - etc.,
  - ou de [description sommaire du dernier contenu], [sauf validation]tels que décrits en annexe [numéro de l'annexe] à l'indice [indice de l'annexe],

  est conforme en tant que modèle de colis de type [type : IP-1, IP-2, IP-3, A, B(U), B(M) ou C] [le cas échéant] chargé de matières fissiles ;

- [le cas échéant]vidé, contaminé ou non, muni ou non de ses aménagements internes, est conforme en tant que modèle de colis de type [type de colis],

aux prescriptions des règlements, accords ou recommandations ci-après énumérés :

[Arrangement spécial]Autorise les transports de l'emballage **[nom usuel de l'emballage]** chargé de [description sommaire du contenu], dans les conditions définies dans l'annexe 0 ci-jointe, conformément aux prescriptions des règlements, accords ou recommandations ci-après énumérés :

[Effacer ceux qui ne sont pas applicables :]

[transport sur la voie publique]
- règlement de transport des matières radioactives de l'Agence internationale de l'énergie atomique, collection sécurité n°6, édition de 1985 (revue en 1990) ;
- règlement de transport des matières radioactives de l'Agence internationale de l'énergie atomique, collection normes de sûreté, N°TS-R-1, édition de 1996 (révisée) ;
- règlement de transport des matières radioactives de l'Agence internationale de l'énergie atomique, collection normes de sûreté, N°TS-R-1, édition de 1996 (amendée 2003) ;
- règlement de transport des matières radioactives de l'Agence internationale de l'énergie atomique, collection normes de sûreté, N°TS-R-1, édition de 2005 ;
- règlement de transport des matières radioactives de l'Agence internationale de l'énergie atomique, collection normes de sûreté, N°TS-R-1, édition de 2009 ;
- accord européen relatif au transport international des marchandises dangereuses par route (ADR) ;
- règlement concernant le transport international ferroviaire des marchandises dangereuses (RID) ;
- accord européen relatif au transport international des marchandises dangereuses par voies de navigations intérieures (ADN) ;
- code maritime international des marchandises dangereuses (code IMDG de l'OMI) ;
- instructions techniques pour la sécurité du transport aérien des marchandises dangereuses (IT de l'OACI) ;
- arrêté du 29 mai 2009 modifié relatif aux transports de marchandises dangereuses par voies terrestres (arrêté TMD) ;
- arrêté du 23 novembre 1987 modifié relatif à la sécurité des navires, division 411 du règlement annexé (arrêté RSN) ;
- instruction du 26 juin 2008 relative aux règles techniques et procédures administratives applicables au transport commercial par aéronef et le règlement CE N°859/2008 du 20 août 2008 (EU OPS1).

[Validation]La présente décision est la validation du certificat [origine du certificat : allemand, britannique, …] [cote complète du certificat validé, révision comprise] joint en annexe 1 à l'indice [indice de l'annexe] et dont la traduction française est jointe en annexe 2 à l'indice [indice de l'annexe]. Les spécifications complémentaires sont indiquées en annexe 0 à l'indice [indice de l'annexe]. En cas d'incompatibilité, les exigences de l'annexe 0 prévalent.

[Approbation d'expédition]La présente décision contient l'approbation des modalités d'expédition en annexe t à l'indice [indice de l'annexe].

[Homologation]Autorise **[société]** à effectuer des transports sur site de colis constitués par l'emballage **[nom usuel de l'emballage]** tel que décrit à l'annexe 0 à l'indice [indice de l'annexe] et chargé de [description sommaire du contenu]. Cette autorisation est valable **sur le site de [nom du site]** et a été délivrée conformément aux prescriptions des règlements, accords ou recommandations ci-après énumérés :

[transports internes CEA]
- Règles Générales de Transports Internes, 5e édition, CEA/DPSN/SSR/001 – Ind.1 du 30 novembre 2005 (RGTI) ;
- recommandations du groupe permanent chargé des transports et de la commission de sûreté des transports du 19 octobre 2001 relatives au RGTI transmises par la lettre DSIN/FAR/SD1/n°11137/2001 du 2 novembre 2001.

[Arrangement spécial, le cas échéant]Toutes les exigences du certificat [cote du certificat étranger], joint en annexe 1 et dont la traduction française est jointe en annexe 2, non contradictoires avec les exigences de l'annexe 0 doivent être respectées. En cas d'incompatibilité, les exigences de l'annexe 0 prévalent.

[transport sur la voie publique]Le présent certificat ne dispense pas l'expéditeur d'observer les prescriptions établies par les autorités des pays à travers ou vers le territoire desquels le colis sera transporté.

[transports internes]Le présent certificat ne dispense pas l'expéditeur d'observer les prescriptions particulières du centre où est utilisé le colis.

La validité du présent certificat expire le : **[à compléter par l'ASN]** [validation] ou lorsque le certificat [cote complète du certificat validé] est annulé.

Numéro d'enregistrement : **[à compléter par l'ASN]**

Paris, le **[à compléter par l'ASN]**

RÉCAPITULATIF DES ÉMISSIONS DU CERTIFICAT

[Applicable aux certificats ASN]
[À remplir en prenant en compte l'historique des agréments]
[Non applicable pour les certificats d'approbation d'expédition sous arrangement spécial]

émission	expiration	type d'émission et modifications apportées	Autorité	cote du certificat	indice de révision							
					corps	t	0	1	2	3	4	5
		Nouvel agrément	DGSNR		Aa	-	a	a	-	-	-	-
		Prorogation	DGSNR		Bb	-	b	b	-	-	-	-
		Extension aux contenus n° 2, 3, 4, 5, 6, 7 et 8	ASN		Bc	-	b	-	c	c	c	c
		Prorogation	ASN		Cd	-	c	d	d	d	d	d

[Le cas échéant, s'il y a plus de 5 annexes prolonger le tableau comme suit :]

indice de révision																													
corps	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Aa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bc	c	c	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cd	d	d	d	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ANNEXE t

MODALITÉS D'EXPÉDITION

Contenus concernés : [numéros des contenus concernés et restrictions éventuelles]

Restrictions quant au mode de transport :

Limitations de la température ambiante admissible :
Aucun transport ne sera effectué si la température ambiante prévue risque d'être inférieure à [température minimale admissible (°C)] sur l'itinéraire au moment du passage ou de l'entreposage du colis chargé.

Limitation de la durée de transport :
Afin de limiter la production de gaz inflammables dans la cavité de l'emballage, le temps prévu pour le transport, compté à partir du moment de la fermeture de l'enveloppe de confinement de l'emballage, ne doit pas dépasser [durée maximale admissible]. À l'issue des [durée maximale admissible], il est admis une période complémentaire de [durée d'aléas] pour tenir compte d'aléas. L'expéditeur devra alors prendre les dispositions nécessaires pour que la durée totale de transport, comptée à partir de la fermeture de l'enveloppe de confinement, ne dépasse pas [durée maximale admissible + aléas].

Instructions d'itinéraire :

Dispositions spéciales pour l'arrimage :

Opérations spéciales pour la manutention :

Opérations spéciales pour le chargement et le déchargement :

Distances de séparation entre les lots de colis :

Mesures à prendre en cas d'urgence

ANNEXE 0 [SAUF ARRANGEMENT SPÉCIAL ET VALIDATION]
EMBALLAGE [NOM USUEL DE L'EMBALLAGE]
[CAS GÉNÉRAL]

1. DEFINITION DE L'EMBALLAGE

L'emballage est conçu, fabriqué, inspecté, testé, maintenu et utilisé en conformité avec le dossier de sûreté [référence du dossier de sûreté].

L'emballage, de [forme générale cylindrique, forme générale cubique, etc.], est présenté sur la figure 0.1.

Le plan de concept de l'emballage est [référence du plan de concept].

Les dimensions extérieures hors tout de l'emballage sont :
- longueur : [à préciser] mm ;
- diamètre externe : [à préciser] mm.

La masse maximale admissible de l'emballage chargé en transport est de[à préciser] kg. [Le cas échéant]Les masses maximales en fonction de l'irradiateur chargé dans la coque.

L'emballage est constitué des principaux sous-ensembles précisés ci-après.
[vérifier ceux qui sont utiles (coque = amortisseurs par exemple)]

1.1 Corps

[Description des viroles, fond, bride]

1.2 Système de fermeture

[Description du couvercle]

1.3 Systèmes amortisseurs

[Description des systèmes amortisseurs]

1.4 Éléments de manutention et arrimage

[Description des tourillons, oreilles, etc.]

1.5 Fonctions de sûreté et éléments importants pour la sûreté

Les principales fonctions de sûreté et principaux éléments importants pour la sûreté sont :
- **le confinement** assuré par l'enveloppe de confinement de l'emballage constituée par [mention de chaque élément de l'enveloppe de confinement, en spécifiant les matériaux, avec tous les orifices, leurs joints (nature des joints), et leurs assemblages (vis) ; les éléments déjà donnés plus haut ne sont pas à répéter. ;
- **la protection radiologique** assurée par [couches de protection neutron et gamma] ;
- **la sûreté criticité** assurée par le système d'isolement qui est composé des éléments décrits dans les annexes de contenus et de
[énumération des composants de l'emballage faisant partie du système d'isolement et description succincte] ;
- **la dissipation de la puissance interne** assurée par [description : ailettes, etc.] ;
- **la protection contre les chocs** assurée par [mention ou description] ;
- **la protection contre l'incendie** assurée par [description].

2 MESURES QUE L'EXPÉDITEUR DOIT PRENDRE AVANT L'EXPÉDITION DU COLIS

L'emballage doit être utilisé suivant des procédures conformes aux instructions d'utilisation du chapitre [référence du chapitre, indice de révision] du dossier de sûreté.
[Le cas échéant, en cas de modification par rapport au dossier de sûreté :] De plus, les actions suivantes doivent également être effectuées

3 PROGRAMME D'ENTRETIEN

L'entretien de l'emballage est décrit au chapitre [référence du chapitre, indice de révision] du dossier de sûreté.
[Le cas échéant, en cas de modification par rapport au dossier de sûreté :] De plus, les actions suivantes doivent également être effectuées

4 NOTFIFICATION ET ENREGISTREMENT DES NUMEROS DE SÉRIE

Toute mise hors d'usage ou tout changement de propriétaire d'un emballage devra être porté à la connaissance des autorités compétentes. À cet effet, le propriétaire qui se dessaisit d'un emballage transmettra le nom du nouvel acquéreur.

5 ASSURANCE QUALITÉ

Les principes d'assurance de la qualité à appliquer lors de la conception, la fabrication, l'inspection, les essais, la maintenance et l'utilisation du colis doivent être conformes à ceux décrits dans le chapitre [référence du chapitre, indice de révision] du dossier de sûreté.

6 PRESCRIPTION COMPLÉMENTAIRE EN CAS DE TRANSPORT CONFINE

[si le dossier de sûreté donne les éléments nécessaires]Lorsque les colis sont transportés dans un moyen de transport fermé (véhicule bâché, caisson de transport, canopies, etc.) la dissipation de la chaleur est susceptible d'être modifiée. La puissance thermique doit alors être telle que /qu'indiquée dans la description des contenus/ ou /à partir d'une mesure de température sur [un composant de référence accessible à la mesure] il puisse être vérifié que la température maximale [des composants sensibles de l'emballage] reste inférieure à [température maximale admissible]°C en prenant en compte les conditions d'ambiance réglementaires après instauration de l'équilibre thermique. [La température à mesurer doit être celle d'une surface accessible.]
[La température limite mesurée sur la surface accessible doit garantir que la température maximale admissible des composants sensibles du colis n'est pas dépassée avec les conditions d'ensoleillement réglementaires.]

7 [LE CAS ÉCHÉANT] RAISONS DE L'APPROBATION MULTILATÉRALE

Le transport en moyen de transport confiné n'est pas autorisé, sauf autorisation de l'Autorité compétente.

[le cas échéant]Le modèle de colis n'est pas conçu pour des températures ambiantes inférieures à [température minimale]°C.

[le cas échéant]Le modèle de colis n'est pas conçu pour des trajets excédant [durée maximale] à compter de la date de fermeture de l'enveloppe de confinement.

[le cas échéant]La pression d'utilisation normale du colis est de [pression (en kPa) si cette pression est > 700 kPa] kPa.

FIGURE 0.1
SCHÉMA DE L'EMBALLAGE

[Schéma indiquant les principaux composants, si possible 3D éclaté, avec dimensions les plus importantes reportées]

[LE CAS ECHEANT, IRRADIATEUR OU CONTENEUR DANS UNE COQUE DE TRANSPORT]

FIGURE 0.2
SCHÉMA DE L'ARRIMAGE DE LA COQUE

ANNEXE 0

[CAS D'UNE APPROBATION D'EXPÉDITION SOUS ARRANGEMENT SPECIAL]

1. RAISONS JUSTIFIANT L'ARRANGEMENT SPÉCIAL

[Lister les raisons justifiant l'arrangement spécial]

2. CONDITIONS DE TRANSPORT AUTORISEES

2.1 Intervenants

Expéditeur (ou destinataire retour) : [noms et adresses]
Destinataire (ou expéditeur retour) : [noms et adresses]
Transporteurs : [noms et adresses]

2.2 Modalités

Moyen de transport :
Itinéraire :
Nombre maximum de transport(s) :
Notification préalable :
Étiquetage :

3. DEFINITION DE L'EMBALLAGE

L'emballage est conçu, fabriqué, inspecté, testé, maintenu et utilisé en conformité avec le dossier de sûreté [référence du dossier de sûreté].

L'emballage est présenté sur la figure [numéro de la figure]. Il est de [forme générale cylindrique/cubique, etc.]. Le plan de concept de l'emballage est [référence du plan de concept].

Les dimensions extérieures hors tout de l'emballage sont :
- longueur : [à préciser] mm ;
- diamètre externe : [à préciser] mm.

La masse maximale admissible en charge de l'emballage est de [à préciser] kg.

L'emballage est constitué des principaux sous-ensembles précisés ci-après.

3.1 Corps

[Description des viroles, fond, bride]

3.2 Système de fermeture

[Description du couvercle]

3.3 Systèmes amortisseurs

[Description des systèmes amortisseurs]

3.4 Éléments de manutention et arrimage

[Description des tourillons, oreilles, …]

3.5 Fonctions de sûreté et éléments importants pour la sûreté

Les principales fonctions de sûreté et principaux éléments importants pour la sûreté sont :

− **le confinement** assuré par l'enveloppe de confinement de l'emballage constituée par [mention de chaque élément de l'enveloppe de confinement, en spécifiant les matériaux, avec tous les orifices, leurs joints (nature des joints), et leurs assemblages (vis) ; les éléments déjà donnés plus haut ne sont pas à répéter] ;

− **la protection radiologique** assurée par [couches de protection neutron et gamma] ;

− **la sûreté criticité** assurée par le système d'isolement qui est composé des éléments décrits dans les annexes de contenus et de [énumération des composants de l'emballage faisant partie du système d'isolement et description succincte] ;

− **la dissipation de la puissance interne** assurée par [description : ailettes, etc.] ;

− **la protection contre les chocs** assurée par [mention ou description] ;

− **la protection contre l'incendie** assurée par [description].

4. DEFINITION DU CONTENU

4.1 Contenu autorisé

[…]

4.2 Conditions de chargement

[…]

4.3 Aménagements internes

[…]

4.4 Étude de criticité

Indice de sûreté-criticité (CSI) :

5. MESURES QUE L'EXPEDITEUR DOIR PRENDRE AVANT EXPEDITION

[…]

6. PROGRAMME D'ENTRETIEN

L'entretien de l'emballage est décrit au chapitre [référence du chapitre, indice de révision] du dossier de sûreté.
[Le cas échéant, en cas de modification par rapport au dossier de sûreté ->]De plus, les actions suivantes doivent également être effectuées :

7. MESURES COMPENSATOIRES

[…]

8. MARQUAGE

Tout emballage circulant sous couvert de ce certificat devra porter sur la surface externe, de manière lisible et durable :

- sa masse brute admissible ([masse brute admissible]) ;
- la cote ([indiquer la cote]) ;
- l'identification de l'expéditeur ou du destinataire ou des deux à la fois ;
- le numéro de l'Organisation des Nations unies (numéro ONU) précédé des lettres « UN », et la désignation officielle de transport.

[La cote et le numéro ONU seront celui du pays d'origine du modèle de colis et devront être utilisés par les pays de départ, traversés et d'arrivée. Le numéro UF_6 prévaut le cas échéant.
Dans le cas d'un transport national français, la cote à indiquer est la cote de l'arrangement spécial]

9. ASSURANCE QUALITE

Les principes d'assurance de la qualité à appliquer lors de la conception, la fabrication, l'inspection, les essais, la maintenance et l'utilisation du colis doivent être conformes à ceux décrits dans le chapitre [référence du chapitre, indice de révision] du dossier de sûreté.

FIGURE 0.1
SCHÉMA DE L'EMBALLAGE

[Schéma indiquant les principaux composants, si possible 3D éclaté, avec dimensions les plus importantes reportées]

ANNEXE [NUMÉRO DE L'ANNEXE]

ASSEMBLAGES COMBUSTIBLES REP, REB OU MOX NEUFS OU IRRADIÉS, DANS UN PANIER TYPE […]

COMBUSTIBLES TRIGA DANS UN PANIER TYPE […]

ASSEMBLAGES DE PLAQUES DANS UN PANIER TYPE […]

CRAYONS DANS UN PANIER TYPE […]

Le dossier de sûreté justifiant ce contenu est [référence du dossier de sûreté].

1. DÉFINITION DU CONTENU AUTORISÉ

Le contenu radioactif autorisé, décrit au chapitre [numéro du chapitre] du dossier de sûreté, est constitué d'assemblages combustibles irradiés, issus des réacteurs à eau [sous pression ou bouillante], tels que décrits ci-après :

Caractéristiques des assemblages avant irradiation :	
Type de réseau	
Pas nominal du réseau (mm)	
Masse totale maximale de l'assemblage avec ou sans grappe (kg)	
Masse maximale de métal lourd par assemblage (kg)	
Longueur active maximale (mm)	
Position nominale de la longueur active par rapport :	
– à l'extrémité haute de l'assemblage avec ou sans grappe (mm)	
– au plan de dépose de l'assemblage (mm)	
Nombre maximal de crayons combustibles	

Caractéristiques des crayons combustibles avant irradiation :	
Gaine :	
– matériau	
– épaisseur minimale (mm)	
– diamètre extérieur minimal (mm)	
Pastilles :	
– forme chimique	
– diamètre maximal (mm)	
– densité maximale de l'oxyde	
– enrichissement initial maximal ($^{235}U/U_{total}$) (%)	
Caractéristiques des assemblages après irradiation :	
Taux de combustion moyen maximal (MWj/tU)	
Puissance thermique maximale par assemblage (W) :	
– emballage équipé de joints [nature des joints]	
– emballage équipé de joints [nature des joints]	
Durée de refroidissement minimale (jours)	

Activité maximale : [à préciser] Bq
État physique : [à préciser]
Forme chimique : [à préciser]
Forme spéciale : [à préciser]

2. CONDITIOND DE CHARGEMENT

Tous les assemblages d'un chargement doivent vérifier une seule et même condition parmi celles définies dans le tableau ci-dessous, à savoir : même enrichissement initial maximal, même nombre minimal de crayons par assemblage et même taux de combustion minimal.

Type d'assemblage	Nombre maximal d'assemblages autorisé au chargement	Enrichissement initial maximal par crayon de chaque assemblage du chargement ($^{235}U/U_{total}$)	Nombre minimal de crayon de chaque assemblage du chargement (2)	Taux de combustion minimal à garantir pour chaque assemblage du chargement (MWj/tU) (1)

(1) Le taux de combustion considéré ici est le taux de combustion moyenné sur les 50 cm d'extrémité de la partie active de chaque assemblage du chargement.

(2) Les assemblages peuvent être équipés de barres en acier (ou Zy) contenant éventuellement un poison neutronique. On entend par l'appellation « nombre de crayons par assemblage » le nombre total de crayons combustibles et de barres en acier (ou Zy).

(3) Pour ces chargements, un des logements centraux (numéro 4, 5, 8 ou 9 sur la figure 1.1) sera condamné par un masque tel que décrit au paragraphe 2.2.
(4) Pour ces chargements, l'exploitant nucléaire du réacteur doit garantir qu'un cycle normal d'irradiation entraîne un taux de combustion moyen sur les 50 cm d'extrémité de la partie active supérieur ou égal à 3 200 MWj/tU, et que les assemblages à transporter ont subi au moins un cycle d'irradiation. L'état irradié de chaque assemblage doit être contrôlé en piscine au moment du chargement dans l'emballage.
(5) Pour ces chargements, une mesure du taux de combustion est imposée pour chaque assemblage avant le chargement. Cette mesure doit être effectuée sur les 50 cm d'extrémités de la partie active et la moyenne de taux de combustion sur les 50 cm d'extrémités doit être supérieure à la limite requise pour la composition du chargement prévu. La concordance de la mesure avec les données de la fiche d'exploitation du combustible doit être vérifiée.

[Le cas échéant]Le mélange d'assemblages […] n'est pas autorisé au sein d'un même chargement.

[Le cas échéant]Les assemblages peuvent être transportés avec ou sans grappe de contrôle et doivent être non encapsulés.

[Le cas échéant]Tous les assemblages du chargement, sauf un, peuvent être remplacés par des squelettes d'assemblages (assemblages ne possédant aucun crayon combustible) du même type, ou par des étuis ou des carquois contenant des déchets activés (ne possédant aucune matière fissile ni aucune matière hydrogénée). Les caractéristiques de ces déchets métalliques, détaillées dans le chapitre [à préciser] du dossier de sûreté, sont rappelées dans le tableau ci-après :

Caractéristiques	**Étuis / Carquois**
longueur totale maximale avec ou sans cale de pied (mm) côté de la section droite nominale (mm) masse linéique sur la paroi du logement (kg/m)	*

* Si les étuis et carquois sont disposés sur une cale de pied, alors la condition du paragraphe 2.2 doit être respectée.

[Le cas échéant]Pour le cas de l'emballage équipé de joints élastomères fluorocarbonés type FKM, la puissance thermique chargée par secteur de panier délimité par la croix centrale doit être au minimum de […] W.
Le taux de combustion et la durée de refroidissement des assemblages à transporter devront être tels que la puissance résiduelle maximale autorisée et les limites admissibles de débit de dose autour du colis ne soient pas dépassées.

[Le cas échéant]Avant chargement, l'absence de crayons ruptés devra avoir été vérifiée sur tous les assemblages du chargement prévu.

[Le cas échéant]La présence de matériaux plus hydrogénés que l'eau dans l'emballage n'est pas autorisée.

[Pour les REB et les MOX, le type des assemblages avec une cartographie type]
[Pour les REB, l'indication de la localisation des trous d'eau]

[Le cas échéant]Description succincte des capsules ou des boîtes, matériau, épaisseur.

3. AMÉNAGEMENT INTERNES

Les aménagements internes sont décrits au chapitre [à préciser] du dossier de sûreté.

3.1 Panier, casier

Le panier [à préciser] constitué de [à préciser] logements de section carrée, de section utile [à préciser] mm².
[Description, matériau]
Ce panier est représenté sur la figure 1.1. [référence du plan de concept].

3.2 Verrous, masques de logement

[Description, matériau]
[Préciser quand ces verrous ou masques sont obligatoires. Préciser s'ils sont retirés ou non lors du transport]
[référence du plan de concept]

3.3 Cales
[Description, matériau]
[référence du plan de concept]

Les assemblages doivent être disposés sur une cale de pied, telle que décrite sur le schéma de principe du chapitre [numéro du chapitre] du dossier de sûreté, dans chacun des logements du panier, dont la hauteur est telle que les conditions suivantes soient respectées :

– longueur totale des assemblages après irradiation (avec ou sans grappe de contrôle) avec leur cale de pied (mm) – position nominale de l'extrémité inférieure de la longueur active des assemblages par rapport au plan de dépose des cales de pied (mm) – hauteur minimale des cales de pied (mm)	

[Le cas échéant]Les squelettes d'assemblages et les étuis et carquois contenant des déchets activés peuvent être disposés sur une cale de pied, telle que décrite sur le schéma de principe du chapitre [numéro du chapitre] du dossier de sûreté, dans chacun des logements du panier, et dans ce cas, la condition suivante doit être respectée :

– longueur totale des étuis et carquois avec leur cale de pied (mm)	

3.4 [le cas échéant (assemblages neufs)]Housses
Les assemblages combustibles peuvent/doivent être conditionnés dans une housse en [matériau].
[Le cas échéant, préciser la masse maximale de la housse, son matériau, une spécification d'approvisionnement.]

4. ETUDE DE CRITICITE

Elle fait l'objet de la note [référence de la note] du dossier de sûreté.

Les hypothèses prises en compte sont les suivantes :
– respect ou non de l'intégrité géométrique des assemblages ou des crayons en conditions accidentelles de transport ;
– vidange différentielle ;
– [pénétration d'eau dans tous les espaces vides].

Indice de sûreté-criticité (CSI) : [à préciser]

Précautions particulières à prendre au moment du chargement au réacteur : [à préciser]

Précautions particulières à prendre au cours du transport : [à préciser]
[Le cas échéant]Les hypothèses et conclusions précédentes s'appuient sur l'absence de dégradation de la géométrie du contenu de l'emballage dans les conditions des épreuves réglementaires de chutes. Comme cette condition n'a pas été entièrement démontrée, la sous-criticité peut encore être garantie en prenant en compte la capacité de l'emballage à limiter la pénétration d'eau dans sa cavité. Dans ce cas, l'application du paragraphe 565 b) du règlement de transport des matières radioactives de l'AIEA (édition de 1985, revue en 1990) nécessite l'approbation des autorités concernées. L'absence d'eau est garantie initialement par le drainage de la cavité et son séchage sous vide qui est contrôlé avant transport. Les mesures spéciales de confinement d'eau sont garanties par la présence de l'enveloppe de confinement qui a été conçue et qualifiée pour résister aux conditions accidentelles de transport et dont la réalisation et les contrôles avant chaque expédition sont effectués en respectant un système d'assurance de la qualité. Des calculs ont montré que ces mesures garantissent que la quantité d'eau qui peut pénétrer dans le colis dans les conditions accidentelles de transport est limitée à [quantité maximale d'eau pouvant pénétrer] et il a été confirmé que cette quantité d'eau n'engendre pas de risque de criticité.
Le système d'isolement considéré est [définition du système d'isolement lié au contenu].

FIGURE [NUMÉRO DE L'ANNEXE].1
SCHÉMA DU PANIER

FIGURE [NUMÉRO DE L'ANNEXE].2 [LE CAS ÉCHÉANT (COMBUSTIBLE PLAQUE)]
SCHÉMA DU COMBUSTIBLE

[Si les plaques de rive sont utilisées dans la démonstration de sûreté-criticité, description et schéma]

ANNEXE [NUMÉRO DE L'ANNEXE]

[IRRADIATEUR OU CONTENEUR DANS UNE COQUE DE TRANSPORT]

IRRADIATEUR TYPE […] OU CONTENUR TYPE […]

Le dossier de sûreté justifiant ce contenu est [référence du dossier de sûreté] [à rappeler dans tous les cas].

[Présentation sommaire de l'ensemble « irradiateur + matières (forme spéciale ou pas) et définition des termes] [spécifiques au contenu (cibles, …).]

1. DESCRIPTION DE L'IRRADIATEUR

[…]

2. CARACTERISTIQUE DE LA MATIERE

[…]

3. DESCRIPTION DU PANIER / PORTE SOURCES

[…]

4. PRESCIPTION AVANT TRANSPORT

4.1 Chargement de la matière dans l'irradiateur

[Rappeler la référence de la procédure]

4.2 Avant le chargement de l'irradiateur dans la coque

[Rappeler la référence de la procédure]

4.3 Chargement de l'irradiateur dans la coque

[Rappeler la référence de la procédure]
[Rappeler la référence du calage à utiliser]

5. ASSURANCE QUALITE

Les principes d'assurance qualité à appliquer lors de la conception, la fabrication, l'inspection, les essais, la maintenance et l'utilisation du colis doivent être conformes à ceux décrits dans le chapitre [référence du chapitre, indice de révision] du dossier de sûreté.

[Rappeler les restrictions éventuelles sur les numéros de série]

FIGURE [NUMÉRO DE L'ANNEXE].1
SCHÉMA DE L'IRRADIATEUR [OU DU CONTENEUR]

FIGURE [NUMÉRO DE L'ANNEXE].2
SCHÉMA DU PANIER [OU DE L'EMPILEMENT DES SOURCES/CIBLES DANS LA CAVITÉ]

FIGURE [NUMÉRO DE L'ANNEXE].3
SCHÉMA DU CALAGE DE L'IRRADIATEUR OU DU CONTENEUR DANS LA COQUE

ANNEXE [NUMÉRO DE L'ANNEXE]

CONTENU N°[NUMÉRO DU CONTENU]

POUDRE

1 DÉFINITION DU CONTENU AUTORISÉ

1.1 Forme physique :

[Oxyde d'uranium, de plutonium ou oxyde mixte en poudre]

1.2 Composition isotopique et masse maximale admissible

[Enrichissement de l'uranium en ^{235}U]
[Teneur en plutonium et vecteur isotopique enveloppe (criticité) pour le plutonium…]
[Éventuellement, possibilité de transporter d'autres éléments tels que C, CH_2, Be, etc.]
[Densité maximale de la poudre]

1.3 Puissance calorifique maximale

Puissance	Watt
Par boîte	[à préciser]
Par colis	[à préciser]

1.4 Activité maximale

L'activité maximale de ce contenu est de [à préciser] Bq.

1.5 Masse maximale de poudre

Ce contenu a une masse totale maximale de [à préciser] kg.

2 CONDITIONNEMENT

[Conteneur principal]
[Joint]
[Housse éventuelle (description succincte, matériau, quantité maximale)]
[Conteneurs internes]
Les dimensions et les matériaux des aménagements internes sont conformes aux données suivantes :

Aménagement	Dimensions nominales (mm)			Matériau
	ϕ_{int}	ϕ_{ext}	h	

ϕ : diamètre sur corps ; h : hauteur hors tout

3 ÉTUDE DE CRITICITÉ

Elle fait l'objet de la note [référence de la note] du dossier de sûreté [références du dossier de sûreté] [peut être différent de celle de l'annexe 0].

Le système d'isolement considéré est [définition du système d'isolement lié au contenu].

Les hypothèses prises en compte sont les suivantes :
- [à préciser] ;
- [à préciser].

Précautions particulières à prendre au moment du chargement : [à préciser].

Précautions particulières à prendre au cours du transport : [à préciser].

Indice de sûreté-criticité (CSI) : [à préciser].

Remarque : la pénétration d'eau et de matière hydrogénée dans l'emballage est autorisée.

FIGURE [NUMÉRO DE L'ANNEXE].1
SCHÉMA

ANNEXE [NUMÉRO DE L'ANNEXE]

CONTENU N°[NUMÉRO DU CONTENU]
HEXAFLUORURE D'URANIUM

1. DÉFINITION DU CONTENU AUTORISÉ

[Pour le conteneur plein ou les pieds de cuve :]
Les paramètres essentiels du contenu pour la sûreté sont les suivants :
- masse d'UF_6 admissible : mini/maxi [à préciser] ;
- enrichissement maximal en ^{235}U : [à préciser] % ;
- activité spécifique maximale du contenu :[à préciser] Bq/g, [à préciser] A_2/g ;
- [autres].

[Pour le conteneur plein :]
- pureté minimale de l'UF_6 transporté : [à préciser] % [par référence à une norme] ;
- puissance thermique maximale dégagée par le contenu : W ;
- nature de l'uranium [naturel / retraité]

2. [LE CAS ÉCHÉANT (ENRICHISSIMENT > 1 %)] ETUDE DE CRITICITE

Elle fait l'objet du chapitre [à préciser] du dossier de sûreté [référence du dossier de sûreté] [peut être différent de celle de l'annexe 0].

Le système d'isolement considéré est [définition du système d'isolement lié au contenu].

Les hypothèses prises en compte sont les suivantes :
- [à préciser] ;
- [à préciser].

Indice de sûreté-criticité (CSI) : [à préciser].

Précautions particulières à prendre au moment du chargement : [à préciser].

Précautions particulières à prendre au cours du transport : [à préciser].

[Pour les colis contenant plus de 0,1 kg d'hexafluorure d'uranium, une déclaration mentionnant les prescriptions du 6.4.6.4 de l'ADR qui s'appliquent, et, le cas échéant, tout renseignement complémentaire pouvant être utile à d'autres autorités compétentes doit être indiqué :
6.4.6.4 Sous réserve de l'accord de l'Autorité compétente, les colis conçus pour contenir 0,1 kg ou plus d'hexafluorure d'uranium peuvent être transportés si :
a) les colis sont conçu suivant les normes internationales ou nationales que le norme ISO 7195 :1993 à conditions qu'un niveau de sûreté équivalent soit maintenu ;
b) Les colis sont conçus pour résister sans fuite et sans défaut inacceptable à une pression d'épreuve inférieure à 2,76 MPa, comme indiqué au 6.4.21.5 ; ou
c) Pour les colis conçus pour contenir 9 000 kg ou plus d'hexafluorure d'uranium, les colis ne satisfont pas aux prescriptions du 6.4.6.2 c).
Il doit être satisfait à tous égards aux prescriptions énoncées aux 6.4.6.1 à 6.4.6.3.]

ANNEXE [NUMÉRO DE L'ANNEXE]

CONTENU N°[NUMÉRO DU CONTENU]

DÉCHETS
[OU TOUT TYPE DE CONTENU NE RENTRANT PAS DANS LES CATÉGORIES PRÉCÉDENTES]

1. DÉFINITION DU CONTENU AUTORISÉ

[Description du contenu admissible]
[Masse admissible]
[Puissance thermique admissible]
[Quantité totale de métal lourd admissible]
[Référence au type de verre, plâtre… etc. (référence garantissant la composition)]
[Possibilité de présence d'éléments tels que C, Be, CH_2, etc.]
[Référence renvoyant au procédé de fabrication garantissant l'homogénéité]

2. AMENAGEMENTS INTERNES ET CONDITIONNEMENT

[Description des aménagements internes]

3. [LE CAS ÉCHÉANT] ETUDE DE CRITICITE

Elle fait l'objet du chapitre [à préciser] du dossier de sûreté [référence du dossier de sûreté] [peut être différent de celle de l'annexe 0].

Le système d'isolement considéré est [définition du système d'isolement lié au contenu].

Les hypothèses prises en compte sont les suivantes :
- [à préciser] ;
- [à préciser].

Indice de sûreté-criticité (CSI) : [à préciser].

Précautions particulières à prendre au moment du chargement : [à préciser].

Précautions particulières à prendre au cours du transport : [à préciser].

FIGURE [NUMÉRO DE L'ANNEXE].1
SCHÉMA

ANNEXE 0 [POUR VALIDATION]

SPÉCIFICATIONS COMPLÉMENTAIRES [COTE DU CERTIFICAT ÉTRANGER]

ANNEXE 1 [ARRANGEMENT SPÉCIAL OU VALIDATION]

CERTIFICAT ÉTRANGER [COTE DU CERTIFICAT ÉTRANGER]

ANNEXE 2 [ARRANGEMENT SPÉCIAL OU VALIDATION]

TRADUCTION FRANÇAISE DU CERTIFICAT ÉTRANGER [COTE DU CERTIFICAT ETRANGER]

AUTORITÉ DE SÛRETÉ NUCLÉAIRE
www.asn.fr

15, rue Louis Lejeune
92120 Montrouge
Téléphone 01 46 16 40 16
info@asn.fr