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**COMMITTEE OF EXPERTS ON THE TRANSPORT
OF DANGEROUS GOODS AND ON THE GLOBALLY
HARMONIZED SYSTEM OF CLASSIFICATION
AND LABELLING OF CHEMICALS**

Sub-Committee of Experts on the
Transport of Dangerous Goods

REPORT OF THE SUB-COMMITTEE OF EXPERTS
ON ITS TWENTY-NINTH SESSION
(Geneva, 3-11 July 2006)

Addendum 2

Annex 3: Draft amendments to the provisions of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations (14th revised edition) concerning radioactive material

Annex 3

DRAFT AMENDMENTS TO THE PROVISIONS OF THE UN RECOMMENDATIONS ON THE TRANSPORT OF DANGEROUS GOODS, MODEL REGULATIONS (14th revised edition) CONCERNING RADIOACTIVE MATERIAL

PART 1

Chapter 1.1

Section 1.1.2 Delete. Renumber 1.1.3 as 1.1.2 and 1.1.3.1 as 1.1.2.1.

Consequential amendments:

2.0.4.2 and 3.1.2.6 Replace "1.1.3" with "1.1.2".

Chapter 1.2

1.2.1 Insert the following new definitions in alphabetical order:

"Approval

Multilateral approval, for the transport of Class 7 material, means approval by the relevant competent authority of the country of origin of the design or shipment, as applicable, and also, where the consignment is to be transported through or into any other country, approval by the competent authority of that country. The term "through or into" specifically excludes "over", i.e. the approval and notification requirements shall not apply to a country over which radioactive material is carried in an aircraft, provided that there is no scheduled stop in that country;

Unilateral approval, for the transport of Class 7 material, means an approval of a design which is required to be given by the competent authority of the country of origin of the design only;

Confinement system, for the transport of Class 7 material, means the assembly of fissile material and packaging components specified by the designer and agreed to by the competent authority as intended to preserve criticality safety;

Containment system, for the transport of Class 7 material, means the assembly of components of the packaging specified by the designer as intended to retain the radioactive material during transport;

Criticality safety index (CSI) assigned to a package, overpack or freight container containing fissile material, for the transport of Class 7 material, means a number

which is used to provide control over the accumulation of packages, overpacks or freight containers containing fissile material;

Design, for the transport of Class 7 material, means the description of special form radioactive material, low dispersible radioactive material, package or packaging which enables such an item to be fully identified. The description may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements, and other relevant documentation;

Exclusive use, for the transport of Class 7 material, means the sole use, by a single consignor, of a conveyance or of a large freight container, in respect of which all initial, intermediate and final loading and unloading is carried out in accordance with the directions of the consignor or consignee;

Maximum normal operating pressure, for the transport of Class 7 material, means the maximum pressure above atmospheric pressure at mean sea-level that would develop in the containment system in a period of one year under the conditions of temperature and solar radiation corresponding to environmental conditions in the absence of venting, external cooling by an ancillary system, or operational controls during transport;

Radiation level, for the transport of Class 7 material, means the corresponding dose rate expressed in millisieverts per hour;

Radioactive contents, for the transport of Class 7 material, mean the radioactive material together with any contaminated or activated solids, liquids, and gases within the packaging;

Transport index (TI) assigned to a package, overpack or freight container, or to unpackaged LSA-I or SCO-I, for the transport of Class 7 material, means a number which is used to provide control over radiation exposure;"

Amend the definition of "*Competent authority*" to read as follows:

"*Competent authority* means any body or authority designated or otherwise recognized as such for any purpose in connection with these Regulations;"

Amend the definition of "*Freight container*" to read as follows:

"*Freight container* means an article of transport equipment that is of a permanent character and accordingly strong enough to be suitable for repeated use; specially designed to facilitate the transport of goods, by one or other modes of transport, without intermediate reloading; designed to be secured and /or readily handled, having fittings for these purposes. The term "freight container" includes neither vehicle nor packaging. However a freight container that is carried on a chassis is

included. For freight containers, for the transport of Class 7 material, a freight container may be used as a packaging.

A small freight container is that which has either any overall outer dimension less than 1.5 m, or an internal volume of not more than 3 m³. Any other freight container is considered to be a large freight container."

Delete the note after the definition of "*Package*".

Amend the definition of "*Packaging*" to read as follows:

"*Packaging* means one or more receptacles and any other components or materials necessary for the receptacles to perform its containment and other safety functions."

Chapter 1.5

Add a new Chapter 1.5 to read as follows:

"CHAPTER 1.5

GENERAL PROVISIONS CONCERNING CLASS 7

1.5.1 Scope and application

1.5.1.1 These Regulations establish standards of safety which provide an acceptable level of control of the radiation, criticality and thermal hazards to persons, property and the environment that are associated with the transport of radioactive material. These regulations are based on the IAEA Regulations for the Safe Transport of Radioactive Material [(2005 Edition)]. Explanatory material on TS-R-1 can be found in "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material [(1996 Edition)]", Safety Standard Series No. TS-G-1.1 (ST-2), IAEA, Vienna.

1.5.1.2 The objective of these Regulations is to protect persons, property and the environment from the effects of radiation during the transport of radioactive material. This protection is achieved by requiring:

- (a) Containment of the radioactive contents;
- (b) Control of external radiation levels;
- (c) Prevention of criticality; and
- (d) Prevention of damage caused by heat.

These requirements are satisfied firstly by applying a graded approach to contents limits for packages and conveyances and to performance standards applied to package designs depending upon the hazard of the radioactive contents. Secondly, they are satisfied by imposing requirements on the design and operation of packages and on the maintenance of packagings, including a consideration of the nature of the radioactive contents. Finally, they are satisfied by requiring administrative controls including, where appropriate, approval by competent authorities.

1.5.1.3 These Regulations apply to the transport of radioactive material by all modes on land, water or in the air, including transport which is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with and involved in the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, transport including in-transit storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied to the performance standards in these Regulations that is characterized by three general severity levels:

- (a) Routine conditions of transport (incident free);
- (b) Normal conditions of transport (minor mishaps);
- (c) Accident conditions of transport.

1.5.1.4 These Regulations do not apply to:

- (a) Radioactive material that is an integral part of the means of transport;
- (b) Radioactive material moved within an establishment which is subject to appropriate safety regulations in force in the establishment and where the movement does not involve public roads or railways;
- (c) Radioactive material implanted or incorporated into a person or live animal for diagnosis or treatment;
- (d) Radioactive material in consumer products which have received regulatory approval, following their sale to the end user;
- (e) Natural material and ores containing naturally occurring radionuclides which are either in their natural state, or have only been processed for purposes other than for extraction of the radionuclides, and which are not intended to be processed

for use of these radionuclides provided the activity concentration of the material does not exceed 10 times the values specified in 2.7.2.2.1 (b), or calculated in accordance with 2.7.2.2.2 to 2.7.2.2.6;

- (f) Non-radioactive solid objects with radioactive substances present on any surfaces in quantities not in excess of the limit set out in the definition for "contamination" in 2.7.1.2.

1.5.1.5 *Specific provisions for the transport of excepted packages*

1.5.1.5.1 Excepted packages which may contain radioactive material in limited quantities, instruments, manufactured articles and empty packagings as specified in 2.7.2.4.1 may be transported under the following conditions:

- (a) The applicable requirements specified in 2.0.3.2, 2.7.2.4.1.2 to 2.7.2.4.1.6 (as applicable), 4.1.9.1.2, 5.2.1.1, 5.2.1.2, 5.2.1.5.1 to 5.2.1.5.3, 5.4.1.4.1 (a), 7.1.8.5.2;
- (b) The requirements for excepted packages specified in 6.4.4;
- (c) If the excepted package contains fissile material, one of the fissile exceptions provided by 2.7.2.3.5 shall apply and the requirement of 6.4.7.2 shall be met; and
- (d) The requirements in 1.1.1.6 if transported by post.

1.5.1.5.2 The following provisions do not apply to excepted packages and the controls for transport of excepted packages: Chapter 1.4, 2.7.4.1, 2.7.2.3.3.2, 4.1.9.1.3, 4.1.9.1.4, 4.1.9.1.6, 4.1.9.1.7, 5.1.3.2, 5.2.2.1.12.1, 5.4.1.5.7.1, 5.4.1.5.7.2, 5.4.1.6, 6.4.6.1, 7.1.7.5.1, 7.1.7.5.3 to 7.1.7.5.5, 7.1.8.1.1, 7.1.8.1.3, 7.1.8.3.1, 7.1.8.6.1 and section 7.2.4.

1.5.2 Radiation protection programme

1.5.2.1 The transport of radioactive material shall be subject to a radiation protection programme which shall consist of systematic arrangements aimed at providing adequate consideration of radiation protection measures.

1.5.2.2 Protection and safety shall be optimized in order that the magnitude of individual doses, the number of persons exposed, and the likelihood of incurring exposure shall be kept as low as reasonably achievable, economic and social factors being taken into account, and doses to persons shall be below the relevant dose limits. A structured and systematic approach shall be adopted and shall include consideration of the interfaces between transport and other activities.

1.5.2.3 The nature and extent of the measures to be employed in the programme shall be related to the magnitude and likelihood of radiation exposures. The programme shall incorporate the requirements in 1.5.2.2, 1.5.2.4 to 1.5.2.7. Programme documents shall be available, on request, for inspection by the relevant competent authority.

1.5.2.4 For occupational exposures arising from transport activities, where it is assessed that the effective dose:

- (a) Is likely to be between 1 and 6 mSv in a year, a dose assessment programme via workplace monitoring or individual monitoring shall be conducted;
- (b) Is likely to exceed 6 mSv in a year, individual monitoring shall be conducted.

When individual monitoring or workplace monitoring is conducted, appropriate records shall be kept.

***NOTE:** For occupational exposures arising from transport activities, where it is assessed that the effective dose is most unlikely to exceed 1mSv in a year, no special work patterns, detailed monitoring, dose assessment programmes or individual record keeping need be required.*

1.5.2.5 In the event of accidents or incidents during the transport of radioactive material, emergency provisions, as established by relevant national and/or international organizations, shall be observed to protect persons, property and the environment. Appropriate guidelines for such provisions are contained in "Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material", Safety Standard Series No. TS-G-1.2 (ST-3), IAEA, Vienna.

1.5.2.6 Emergency procedures shall take into account the formation of other dangerous substances that may result from the reaction between the contents of a consignment and the environment in the event of an accident.

1.5.2.7 Workers shall receive appropriate training concerning the radiation hazards involved and the precautions to be observed in order to ensure restriction of their exposure and that of other persons who might be affected by their actions.

1.5.3 Quality assurance

1.5.3.1 Quality assurance programmes based on international, national or other standards acceptable to the competent authority shall be established and implemented for the design, manufacture, testing, documentation, use, maintenance and inspection of all special form radioactive material, low

dispersible radioactive material and packages and for transport and in-transit storage operations to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared to provide facilities for competent authority inspection during manufacture and use and to demonstrate to any cognizant competent authority that:

- (a) The manufacturing methods and materials used are in accordance with the approved design specifications; and
- (b) All packagings are periodically inspected and, as necessary, repaired and maintained in good condition so that they continue to comply with all relevant requirements and specifications, even after repeated use.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the quality assurance programme.

1.5.4 Special arrangement

1.5.4.1 Special arrangement shall mean those provisions, approved by the competent authority, under which consignments which do not satisfy all the requirements of these Regulations applicable to radioactive material may be transported.

1.5.4.2 Consignments for which conformity with any provision applicable to Class 7 is impracticable shall not be transported except under special arrangement. Provided the competent authority is satisfied that conformity with the Class 7 provisions of these Regulations is impracticable and that the requisite standards of safety established by these Regulations have been demonstrated through alternative means the competent authority may approve special arrangement transport operations for single or a planned series of multiple consignments. The overall level of safety in transport shall be at least equivalent to that which would be provided if all the applicable requirements had been met. For international consignments of this type, multilateral approval shall be required.

1.5.5 Radioactive material possessing other dangerous properties

1.5.5.1 In addition to the radioactive and fissile properties, any subsidiary risk of the contents of a package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall also be taken into account in the documentation, packing, labelling, marking, placarding, stowage,

segregation and transport, in order to be in compliance with all relevant provisions for dangerous goods of these regulations.

1.5.6 Non-compliance

1.5.6.1 In the event of a non-compliance with any limit in these Regulations applicable to radiation level or contamination,

- (a) the consignor shall be informed of the non-compliance
 - (i) by the carrier if the non-compliance is identified during transport; or
 - (ii) by the consignee if the non-compliance is identified at receipt;
- (b) the carrier, consignor or consignee, as appropriate, shall:
 - (i) take immediate steps to mitigate the consequences of the non-compliance;
 - (ii) investigate the non-compliance and its causes, circumstances and consequences;
 - (iii) take appropriate action to remedy the causes and circumstances that led to the non-compliance and to prevent a recurrence of similar circumstances that led to the non-compliance; and
 - (iv) communicate to the relevant competent authority(ies) on the causes of the non-compliance and on corrective or preventive actions taken or to be taken; and
- (c) the communication of the non-compliance to the consignor and relevant competent authority(ies), respectively, shall be made as soon as practicable and it shall be immediate whenever an emergency exposure situation has developed or is developing."

PART 2

Chapter 2.7

Amend Chapter 2.7 to read as follows and amend all references to renumbered paragraphs of Chapter 2.7, as appropriate (*apply to 1.1.1.6 (b), 3.3.1 SP290, 4.1.1.9, 4.1.9.2.3 (b) and (c), 5.2.2.1.12.1, 5.2.2.1.12.2 (a)(i), 6.4.8.8, 6.4.10.3, 6.4.12.1, 6.4.12.2, 6.4.14, 6.4.24.1, 6.4.24.2 and 6.4.24.3*):

"CHAPTER 2.7

CLASS 7 - RADIOACTIVE MATERIAL

Introductory note

NOTE: For Class 7 the type of packaging may have a decisive effect on classification.

2.7.1 Definitions

2.7.1.1 *Radioactive material* means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 2.7.2.2.1 to 2.7.2.2.6.

2.7.1.2 *Contamination:*

Contamination means the presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters, or 0.04 Bq/cm² for all other alpha emitters.

Non-fixed contamination means contamination that can be removed from a surface during routine conditions of transport.

Fixed contamination means contamination other than non-fixed contamination.

2.7.1.3 Definitions of specific terms

A_1 and A_2

A_1 means the activity value of special form radioactive material which is listed in the Table in 2.7.2.2.1 or derived in 2.7.2.2 and is used to determine the activity limits for the requirements of these Regulations.

A_2 means the activity value of radioactive material, other than special form radioactive material, which is listed in the Table in 2.7.2.2.1 or derived in 2.7.2.2 and is used to determine the activity limits for the requirements of these Regulations.

Fissile material means uranium-233, uranium-235, plutonium-239, plutonium-241, or any combination of these radionuclides. Excepted from this definition is:

- (a) Natural uranium or depleted uranium which is unirradiated; and
- (b) Natural uranium or depleted uranium which has been irradiated in thermal reactors only.

Low dispersible radioactive material means either a solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form.

Low specific activity (LSA) material means radioactive material which by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding materials surrounding the LSA material shall not be considered in determining the estimated average specific activity.

Low toxicity alpha emitters are: natural uranium; depleted uranium; natural thorium; uranium-235 or uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical and chemical concentrates; or alpha emitters with a half-life of less than 10 days.

Specific activity of a radionuclide means the activity per unit mass of that nuclide. The specific activity of a material shall mean the activity per unit mass of the material in which the radionuclides are essentially uniformly distributed.

Special form radioactive material means either:

- (a) An indispersible solid radioactive material; or
- (b) A sealed capsule containing radioactive material.

Surface contaminated object (SCO) means a solid object which is not itself radioactive but which has radioactive material distributed on its surfaces.

Unirradiated thorium means thorium containing not more than 10^{-7} g of uranium-233 per gram of thorium-232.

Unirradiated uranium means uranium containing not more than 2×10^3 Bq of plutonium per gram of uranium-235, not more than 9×10^6 Bq of fission products per gram of uranium-235 and not more than 5×10^{-3} g of uranium-236 per gram of uranium-235.

Uranium - natural, depleted, enriched means the following:

Natural uranium means uranium (which may be chemically separated) containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238, and 0.72% uranium-235 by mass).

Depleted uranium means uranium containing a lesser mass percentage of uranium-235 than in natural uranium.

Enriched uranium means uranium containing a greater mass percentage of uranium-235 than 0.72%. In all cases, a very small mass percentage of uranium-234 is present.

2.7.2 Classification

2.7.2.1 General provisions

2.7.2.1.1 Radioactive material shall be assigned to one of the UN number specified in Table 2.7.2.1.1 depending on the activity level of the radionuclides contained in a package, the fissile or non-fissile properties of these radionuclides, the type of package to be presented for transport, and the nature or form of the contents of the package, or special arrangements governing the transport operation, in accordance with the provisions laid down in 2.7.2.2 to 2.7.2.5.

Table 2.7.2.1.1		Assignment of UN numbers
Excepted packages (1.5.1.5)		
UN 2908	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - EMPTY PACKAGING	
UN 2909	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM	
UN 2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - LIMITED QUANTITY OF MATERIAL	
UN 2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - INSTRUMENTS or ARTICLES	
Low specific activity radioactive material (2.7.2.3.1)		
UN 2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile-excepted	
UN 3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), non fissile or fissile-excepted	
UN 3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), non fissile or fissile-excepted	
UN 3324	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), FISSILE	
UN 3325	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY, (LSA-III), FISSILE	
Surface contaminated objects (2.7.2.3.2)		
UN 2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), non-fissile or fissile-excepted	
UN 3326	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), FISSILE	

Table 2.7.2.1.1		Assignment of UN numbers	
Type A packages (2.7.2.4.4)			
UN 2915	RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non-fissile or fissile-excepted		
UN 3327	RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE, non-special form		
UN 3332	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, non fissile or fissile-excepted		
UN 3333	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE		
Type B(U) package (2.7.2.4.6)			
UN 2916	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, non-fissile or fissile-excepted		
UN 3328	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, FISSILE		
Type B(M) package (2.7.2.4.6)			
UN 2917	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, non-fissile or fissile-excepted		
UN 3329	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, FISSILE		
Type C package (2.7.2.4.6)			
UN 3323	RADIOACTIVE MATERIAL, TYPE C PACKAGE, non fissile or fissile-excepted		
UN 3330	RADIOACTIVE MATERIAL, TYPE C PACKAGE, FISSILE		
Special arrangement (2.7.2.5)			
UN 2919	RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, non-fissile or fissile-excepted		
UN 3331	RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, FISSILE		
Uranium hexafluoride (2.7.2.4.5)			
UN 2977	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE		
UN 2978	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, non-fissile or fissile-excepted		

2.7.2.2 *Determination of activity level*

2.7.2.2.1 The following basic values for individual radionuclides are given in Table 2.7.2.2.1:

- (a) A_1 and A_2 in TBq;
- (b) Activity concentration for exempt material in Bq/g; and
- (c) Activity limits for exempt consignments in Bq.

Table 2.7.2.2.1: Basic radionuclides values for individual radionuclides

[Insert here the Table of existing 2.7.7.2.1 with its footnotes (a) – (g).]

2.7.2.2.2 For individual radionuclides which are not listed in Table 2.7.2.2.1 the determination of the basic radionuclide values referred to in 2.7.2.2.1 shall require multilateral approval. It is permissible to use an A₂ value calculated using a dose coefficient for the appropriate lung absorption type as recommended by the International Commission on Radiological Protection, if the chemical forms of each radionuclide under both normal and accident conditions of transport are taken into consideration. Alternatively, the radionuclide values in Table 2.7.2.2.2 may be used without obtaining competent authority approval.

Table 2.7.2.2.2: Basic radionuclide values for unknown radionuclides or mixtures

Radioactive contents	A ₁	A ₂	Activity concentration for exempt material	Activity limit for exempt consignments
	(TBq)	(TBq)	(Bq/g)	(Bq)
Only beta or gamma emitting nuclides are known to be present	0.1	0.02	1 x 10 ¹	1 x 10 ⁴
Alpha emitting nuclides but no neutron emitters are known to be present	0.2	9 x 10 ⁻⁵	1 x 10 ⁻¹	1 x 10 ³
Neutron emitting nuclides are known to be present or no relevant data are available	0.001	9 x 10 ⁻⁵	1 x 10 ⁻¹	1 x 10 ³

2.7.2.2.3 In the calculations of A₁ and A₂ for a radionuclide not in Table 2.7.2.2.1, a single radioactive decay chain in which the radionuclides are present in their naturally occurring proportions, and in which no daughter nuclide has a half-life either longer than 10 days or longer than that of the parent nuclide, shall be considered as a single radionuclide; and the activity to be taken into account and the A₁ or A₂ value to be applied shall be those corresponding to the parent nuclide of that chain. In the case of radioactive decay chains in which any daughter nuclide has a half-life either longer than 10 days or greater than that of the parent nuclide, the parent and such daughter nuclides shall be considered as mixtures of different nuclides.

2.7.2.2.4 For mixtures of radionuclides, the determination of the basic radionuclide values referred to in 2.7.2.2.1 may be determined as follows:

$$X_m = \frac{1}{\sum_i \frac{f(i)}{X(i)}}$$

where,

f(i) is the fraction of activity or activity concentration of radionuclide i in the mixture;

X(i) is the appropriate value of A₁ or A₂, or the activity concentration for exempt material or the activity limit for an exempt consignment as appropriate for the radionuclide i; and

X_m is the derived value of A₁ or A₂, or the activity concentration for exempt material or the activity limit for an exempt consignment in the case of a mixture.

2.7.2.2.5 When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest radionuclide value, as appropriate, for the radionuclides in each group may be used in applying the formulas in 2.7.2.2.4 and 2.7.2.4.4. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest radionuclide values for the alpha emitters or beta/gamma emitters, respectively.

2.7.2.2.6 For individual radionuclides or for mixtures of radionuclides for which relevant data are not available, the values shown in Table 2.7.2.2.2 shall be used.

2.7.2.3 *Determination of other material characteristics*

2.7.2.3.1 *Low specific activity (LSA) material*

2.7.2.3.1.1 (Reserved)

2.7.2.3.1.2 LSA material shall be in one of three groups:

(a) LSA-I

(i) uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring

radionuclides which are intended to be processed for the use of these radionuclides;

- (ii) Natural uranium, depleted uranium, natural thorium or their compounds or mixtures, providing they are unirradiated and in solid or liquid form;
 - (iii) radioactive material for which the A_2 value is unlimited, [excluding fissile material in quantities not excepted under 6.4.11.2][excluding material classified as fissile according to 2.7.2.3.5]¹; or
 - (iv) other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in 2.7.2.2.1 to 2.7.2.2.6, [excluding fissile material in quantities not excepted under 6.4.11.2][excluding material classified as fissile according to 2.7.2.3.5]¹;
- (b) LSA-II
- (i) water with tritium concentration up to 0.8 TBq/L; or
 - (ii) other material in which the activity is distributed throughout and the estimated average specific activity does not exceed 10^{-4} A_2/g for solids and gases, and 10^{-5} A_2/g for liquids;
- (c) LSA-III - Solids (e.g. consolidated wastes, activated materials), excluding powders, in which:
- (i) the radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.);
 - (ii) the radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble matrix, so that, even under loss of packaging, the loss of radioactive material per package by leaching when placed in water for seven days would not exceed 0.1 A_2 ; and

¹ *Second option proposed by the secretariat.*

- (iii) the estimated average specific activity of the solid, excluding any shielding material, does not exceed $2 \times 10^{-3} \text{ A}_2/\text{g}$.

2.7.2.3.1.3 LSA-III material shall be a solid of such a nature that if the entire contents of a package were subjected to the test specified in 2.7.2.3.1.4 the activity in the water would not exceed 0.1 A_2 .

2.7.2.3.1.4 LSA-III material shall be tested as follows:

A solid material sample representing the entire contents of the package shall be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the 7 day test period the free volume of the unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6-8 and a maximum conductivity of 1 mS/m at 20 °C. The total activity of the free volume of water shall be measured following the 7 day immersion of the test sample.

2.7.2.3.1.5 Demonstration of compliance with the performance standards in 2.7.2.3.1.4 shall be in accordance with 6.4.12.1 and 6.4.12.2.

2.7.2.3.2 *Surface contaminated object (SCO)*

SCO is classified in one of two groups:

- (a) SCO-I: A solid object on which:
 - (i) the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 0.4 Bq/cm^2 for all other alpha emitters; and
 - (ii) the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ for all other alpha emitters; and
 - (iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ for all other alpha emitters;

- (b) SCO-II: A solid object on which either the fixed or non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I in (a) above and on which:
- (i) the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 400 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 40 Bq/cm^2 for all other alpha emitters; and
 - (ii) the fixed contamination on the accessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8 \times 10^5 \text{ Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $8 \times 10^4 \text{ Bq/cm}^2$ for all other alpha emitters; and
 - (iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8 \times 10^5 \text{ Bq/cm}^2$ for beta and gamma emitters and low toxicity alpha emitters, or $8 \times 10^4 \text{ Bq/cm}^2$ for all other alpha emitters.

2.7.2.3.3 *Special form radioactive material*

2.7.2.3.3.1 Special form radioactive material shall have at least one dimension not less than 5 mm. When a sealed capsule constitutes part of the special form radioactive material, the capsule shall be so manufactured that it can be opened only by destroying it. The design for special form radioactive material requires unilateral approval.

2.7.2.3.3.2 Special form radioactive material shall be of such a nature or shall be so designed that if it is subjected to the tests specified in 2.7.2.3.3.4 to 2.7.2.3.3.8, it shall meet the following requirements:

- (a) It would not break or shatter under the impact, percussion and bending tests 2.7.2.3.3.5 (a) (b) (c), 2.7.2.3.3.6 (a) as applicable;
- (b) It would not melt or disperse in the applicable heat test 2.7.2.3.3.5 (d) or 2.7.2.3.3.6 (b) as applicable; and
- (c) The activity in the water from the leaching tests specified in 2.7.2.3.3.7 and 2.7.2.3.3.8 would not exceed 2 kBq; or alternatively for sealed sources, the leakage rate for the volumetric leakage assessment test specified

in ISO 9978:1992 "Radiation Protection - Sealed Radioactive Sources - Leakage Test Methods", would not exceed the applicable acceptance threshold acceptable to the competent authority.

2.7.2.3.3.3 Demonstration of compliance with the performance standards in 2.7.2.3.3.2 shall be in accordance with 6.4.12.1 and 6.4.12.2.

2.7.2.3.3.4 Specimens that comprise or simulate special form radioactive material shall be subjected to the impact test, the percussion test, the bending test, and the heat test specified in 2.7.2.3.3.5 or alternative tests as authorized in 2.7.2.3.3.6. A different specimen may be used for each of the tests. Following each test, a leaching assessment or volumetric leakage test shall be performed on the specimen by a method no less sensitive than the methods given in 2.7.2.3.3.7 for indispersible solid material or 2.7.2.3.3.8 for encapsulated material.

2.7.2.3.3.5 The relevant test methods are:

- (a) Impact test: The specimen shall drop onto the target from a height of 9 m. The target shall be as defined in 6.4.14;
- (b) Percussion test: The specimen shall be placed on a sheet of lead which is supported by a smooth solid surface and struck by the flat face of a mild steel bar so as to cause an impact equivalent to that resulting from a free drop of 1.4 kg through 1 m. The lower part of the bar shall be 25 mm in diameter with the edges rounded off to a radius of (3.0 ± 0.3) mm. The lead, of hardness number 3.5 to 4.5 on the Vickers scale and not more than 25 mm thick, shall cover an area greater than that covered by the specimen. A fresh surface of lead shall be used for each impact. The bar shall strike the specimen so as to cause maximum damage;
- (c) Bending test: The test shall apply only to long, slender sources with both a minimum length of 10 cm and a length to minimum width ratio of not less than 10. The specimen shall be rigidly clamped in a horizontal position so that one half of its length protrudes from the face of the clamp. The orientation of the specimen shall be such that the specimen will suffer maximum damage when its free end is struck by the flat face of a steel bar. The bar shall strike the specimen so as to cause an impact equivalent to that resulting from a free vertical drop of 1.4 kg through 1 m. The lower part of the bar shall be 25 mm in diameter with the edges rounded off to a radius of (3.0 ± 0.3) mm;

- (d) Heat test: The specimen shall be heated in air to a temperature of 800 °C and held at that temperature for a period of 10 minutes and shall then be allowed to cool.

2.7.2.3.3.6 Specimens that comprise or simulate radioactive material enclosed in a sealed capsule may be excepted from:

- (a) The tests prescribed in 2.7.2.3.3.5 (a) and (b) provided the mass of the special form radioactive material:
 - (i) is less than 200 g and they are alternatively subjected to the Class 4 impact test prescribed in ISO 2919:1999 "Radiation protection - Sealed radioactive sources - General requirements and classification"; or
 - (ii) is less than 500 g and they are alternatively subjected to the Class 5 impact test prescribed in ISO 2919:1999 "Radiation protection - Sealed radioactive sources - General requirements and classification"; and
- (b) The test prescribed in 2.7.2.3.3.5 (d) provided they are alternatively subjected to the Class 6 temperature test specified in ISO 2919:1999 "Radiation protection - Sealed radioactive sources - General requirements and classification".

2.7.2.3.3.7 For specimens which comprise or simulate indismissible solid material, a leaching assessment shall be performed as follows:

- (a) The specimen shall be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the 7 day test period the free volume of the unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6-8 and a maximum conductivity of 1 mS/m at 20 °C;
- (b) The water with specimen shall then be heated to a temperature of (50 ± 5) °C and maintained at this temperature for 4 hours;
- (c) The activity of the water shall then be determined;
- (d) The specimen shall then be kept for at least 7 days in still air at not less than 30 °C and relative humidity not less than 90%;

- (e) The specimen shall then be immersed in water of the same specification as in (a) above and the water with the specimen heated to (50 ± 5) °C and maintained at this temperature for 4 hours;
- (f) The activity of the water shall then be determined.

2.7.2.3.3.8 For specimens which comprise or simulate radioactive material enclosed in a sealed capsule, either a leaching assessment or a volumetric leakage assessment shall be performed as follows:

- (a) The leaching assessment shall consist of the following steps:
 - (i) the specimen shall be immersed in water at ambient temperature. The water shall have an initial pH of 6-8 with a maximum conductivity of 1 mS/m at 20 °C;
 - (ii) the water and specimen shall be heated to a temperature of (50 ± 5) °C and maintained at this temperature for 4 hours;
 - (iii) the activity of the water shall then be determined;
 - (iv) the specimen shall then be kept for at least 7 days in still air at not less than 30 °C and relative humidity of not less than 90%;
 - (v) the process in (i), (ii) and (iii) shall be repeated;
- (b) The alternative volumetric leakage assessment shall comprise any of the tests prescribed in ISO 9978:1992 "Radiation Protection - Sealed radioactive sources - Leakage test methods", which are acceptable to the competent authority.

2.7.2.3.4 *Low dispersible material*

2.7.2.3.4.1 The design for low dispersible radioactive material shall require multilateral approval. Low dispersible radioactive material shall be such that the total amount of this radioactive material in a package shall meet the following requirements:

- (a) The radiation level at 3 m from the unshielded radioactive material does not exceed 10 mSv/h;

- (b) If subjected to the tests specified in 6.4.20.3 and 6.4.20.4, the airborne release in gaseous and particulate forms of up to 100 µm aerodynamic equivalent diameter would not exceed 100 A₂. A separate specimen may be used for each test; and
- (c) If subjected to the test specified in 2.7.2.3.1.4 the activity in the water would not exceed 100 A₂. In the application of this test, the damaging effects of the tests specified in (b) above shall be taken into account.

2.7.2.3.4.2 Low dispersible material shall be tested as follows:

A specimen that comprises or simulates low dispersible radioactive material shall be subjected to the enhanced thermal test specified in 6.4.20.3 and the impact test specified in 6.4.20.4. A different specimen may be used for each of the tests. Following each test, the specimen shall be subjected to the leach test specified in 2.7.2.3.1.4. After each test it shall be determined if the applicable requirements of 2.7.2.3.4.1 have been met.

2.7.2.3.4.3 Demonstration of compliance with the performance standards in 2.7.2.3.4.1 and 2.7.2.3.4.2 shall be in accordance with 6.4.12.1 and 6.4.12.2.

2.7.2.3.5 *Fissile material*

Packages containing fissile radionuclides shall be classified under the relevant entry of table 2.7.2.1.1 for fissile material unless the following conditions are met:

- (a) A mass limit per consignment such that:

$$\frac{\text{mass of uranium – 235 (g)}}{X} + \frac{\text{mass of other fissile material (g)}}{Y} < 1$$

where X and Y are the mass limits defined in Table 2.7.2.3.5, provided that the smallest external dimension of each package is not less than 10 cm and that either:

- (i) each individual package contains not more than 15 g of fissile material; for unpackaged material, this quantity limitation shall apply to the consignment being carried in or on the conveyance; or
- (ii) the fissile material is a homogeneous hydrogenous solution or mixture where the ratio of fissile nuclides to hydrogen is less than 5% by mass; or

- (iii) there are not more than 5 g of fissile material in any 10 litre volume of material.

Neither beryllium nor deuterium shall be present in quantities exceeding 1% of the applicable consignment mass limits provided in Table 2.7.2.3.5, except for deuterium in natural concentration in hydrogen.

- (b) Uranium enriched in uranium-235 to a maximum of 1% by mass, and with a total plutonium and uranium-233 content not exceeding 1% of the mass of uranium-235, provided that the fissile material is distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it shall not form a lattice arrangement;
- (c) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2% by mass, with a total plutonium and uranium-233 content not exceeding 0.002% of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2;
- (d) Packages containing, individually, a total plutonium mass not more than 1 kg, of which not more than 20% by mass may consist of plutonium-239, plutonium-241 or any combination of those radionuclides.

Table 2.7.2.3.5: Consignment mass limits for exceptions from the requirements for packages containing fissile material

Fissile material	Fissile material mass (g) mixed with substances having an average hydrogen density less than or equal to water	Fissile material mass (g) mixed with substances having an average hydrogen density greater than water
Uranium-235 (X)	400	290
Other fissile material (Y)	250	180

2.7.2.4 Classification of packages or unpacked material

The quantity of radioactive material in a package shall not exceed the relevant limits for the package type as specified below.

2.7.2.4.1 Classification as excepted package

2.7.2.4.1.1 Packages may be classified as excepted packages if:

- (a) they are empty packagings having contained radioactive material;
- (b) they contain instruments or articles in limited quantities;
- (c) they contain articles manufactured of natural uranium, depleted uranium or natural thorium; or
- (d) they contain radioactive material in limited quantities.

2.7.2.4.1.2 A package containing radioactive material may be classified as an excepted package provided that the radiation level at any point on its external surface does not exceed 5 $\mu\text{Sv/h}$.

Table 2.7.2.4.1.2: Activity limits for excepted packages

Physical state of contents	Instruments or article		Materials Package limits ^a
	Item limits ^a	Package limits ^a	
(1)	(2)	(3)	(4)
Solids			
special form	$10^{-2} A_1$	A_1	$10^{-3} A_1$
other form	$10^{-2} A_2$	A_2	$10^{-3} A_2$
Liquids	$10^{-3} A_2$	$10^{-1} A_2$	$10^{-4} A_2$
Gases			
tritium	$2 \times 10^{-2} A_2$	$2 \times 10^{-1} A_2$	$2 \times 10^{-2} A_2$
special form	$10^{-3} A_1$	$10^{-2} A_1$	$10^{-3} A_1$
other forms	$10^{-3} A_2$	$10^{-2} A_2$	$10^{-3} A_2$

^a For mixtures of radionuclides, see 2.7.2.2.4 to 2.7.2.2.6.

2.7.2.4.1.3 Radioactive material which is enclosed in or is included as a component part of an instrument or other manufactured article may be classified under UN 2911, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - INSTRUMENTS or ARTICLES provided that:

- (a) The radiation level at 10 cm from any point on the external surface of any unpackaged instrument or article is not greater than 0.1 mSv/h; and
- (b) Each instrument or manufactured article bears the marking "RADIOACTIVE" except:
 - (i) radioluminescent time-pieces or devices;
 - (ii) consumer products that either have received regulatory approval according to 1.5.1.4 (d) or do not individually

exceed the activity limit for an exempt consignment in Table 2.7.2.2.1 (column 5), provided such products are transported in a package that bears the marking "RADIOACTIVE" on an internal surface in such a manner that warning of the presence of radioactive material is visible on opening the package; and

- (c) The active material is completely enclosed by non-active components (a device performing the sole function of containing radioactive material shall not be considered to be an instrument or manufactured article); and
- d) The limits specified in columns 2 and 3 of Table 2.7.2.4.1.2 are met for each individual item and each package, respectively.

2.7.2.4.1.4 Radioactive material with an activity not exceeding the limit specified in column 4 of Table 2.7.2.4.1.2, may be classified under UN 2910, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - LIMITED QUANTITY OF MATERIAL provided that:

- (a) The package retains its radioactive contents under routine conditions of transport; and
- (b) The package bears the marking "RADIOACTIVE" on an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package.

2.7.2.4.1.5 An empty packaging which had previously contained radioactive material with an activity not exceeding the limit specified in column 4 of Table 2.7.2.4.1.2 may be classified under UN 2908, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - EMPTY PACKAGING, provided that:

- (a) It is in a well-maintained condition and securely closed;
- (b) The outer surface of any uranium or thorium in its structure is covered with an inactive sheath made of metal or some other substantial material;
- (c) The level of internal non-fixed contamination, when averaged over any 300 cm², does not exceed:
 - (i) 400 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters; and
 - (ii) 40 Bq/cm² for all other alpha emitters; and

- (d) Any labels which may have been displayed on it in conformity with 5.2.2.1.11.1 are no longer visible.

2.7.2.4.1.6 Articles manufactured of natural uranium, depleted uranium or natural thorium and articles in which the sole radioactive material is unirradiated natural uranium, unirradiated depleted uranium or unirradiated natural thorium may be classified under UN 2909, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM, provided that the outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or some other substantial material.

2.7.2.4.2 *Classification as Low specific activity (LSA) material*

Radioactive material may only be classified as LSA material if the conditions of 2.7.2.3.1 and 4.1.9.2 are met.

2.7.2.4.3 *Classification as Surface contaminated object (SCO)*

Radioactive material may be classified as SCO if the conditions of 2.7.2.3.2.1 and 4.1.9.2 are met.

2.7.2.4.4 *Classification as Type A package*

Packages containing radioactive material may be classified as Type A packages provided that the following conditions are met:

Type A packages shall not contain activities greater than the following:

- (a) For special form radioactive material - A_1 ; or
- (b) For all other radioactive material - A_2 .

For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:

$$\sum_i \frac{B(i)}{A_1(i)} + \sum_j \frac{C(j)}{A_2(j)} \leq 1$$

where $B(i)$ is the activity of radionuclide i as special form radioactive material;

$A_1(i)$ is the A_1 value for radionuclide i ;

C (j) is the activity of radionuclide j as other than special form radioactive material; and

A₂ (j) is the A₂ value for radionuclide j.

2.7.2.4.5 *Classification of Uranium hexafluoride*

Uranium hexafluoride shall only be assigned to UN Nos 2977, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE, or 2978, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, non-fissile or fissile-excepted.

2.7.2.4.5.1 Packages containing uranium hexafluoride shall not contain:

- (a) a mass of uranium hexafluoride different from that authorized for the package design;
- (b) a mass of uranium hexafluoride greater than a value that would lead to an ullage smaller than 5 % at the maximum temperature of the package as specified for the plant systems where the package shall be used; or
- (c) uranium hexafluoride other than in solid form or at an internal pressure above atmospheric pressure when presented for transport.

2.7.2.4.6 *Classification as Type B(U), Type B(M) or Type C packages*

2.7.2.4.6.1 Packages not otherwise classified in 2.7.2.4 (2.7.2.4.1 to 2.7.2.4.5) shall be classified in accordance with the competent authority approval certificate for the package issued by the country of origin of design.

2.7.2.4.6.2 A package may only be classified as a Type B(U) if it does not contain:

- (a) Activities greater than those authorized for the package design;
- (b) Radionuclides different from those authorized for the package design; or
- (c) Contents in a form, or a physical or chemical state different from those authorized for the package design;

as specified in the certificate of approval.

2.7.2.4.6.3 A package may only be classified as a Type B(M) if it does not contain:

- (a) Activities greater than those authorized for the package design;
- (b) Radionuclides different from those authorized for the package design; or
- (c) Contents in a form, or a physical or chemical state different from those authorized for the package design;

as specified in the certificate of approval.

2.7.2.4.6.4 A package may only be classified as a Type C if it does not contain:

- (a) Activities greater than those authorized for the package design;
- (b) Radionuclides different from those authorized for the package design; or
- (c) Contents in a form, or physical or chemical state different from those authorized for the package design;

as specified in the certificate of approval.

2.7.2.5 *Special arrangements*

Radioactive material shall be classified as transported under special arrangement when it is intended to be transported in accordance with 1.5.4."

PART 3

Dangerous Goods List

For UN Nos. 2913, 3321, 3322, 3324, 3325 and 3326, insert "336" in column (6).

For UN Nos. 2916, 2917, 3328 and 3329 insert "337" in column (6).

Chapter 3.3

3.3.1 Add new special provisions to read as follows:

- "336 A single package of non-combustible solid LSA-II or LSA-III material, if carried by air, shall not contain an activity greater than 3000 A₂.
- 337 Type B(U) and Type B(M) packages, if transported by air, shall not contain activities greater than the following:
- (a) For low dispersible radioactive material - as authorized for the package design as specified in the certificate of approval;
 - (b) For special form radioactive material - 3000 A₁ or 100 000 A₂, whichever is the lower; or
 - (c) For all other radioactive material - 3000 A₂".

PART 4**Chapter 4.1**

4.1.9.1.1 Add at the end: "The types of packages for radioactive materials covered by these Regulations, are:

- (a) Excepted package;
- (b) Industrial package Type 1 (Type IP-1 package);
- (c) Industrial package Type 2 (Type IP-2 package);
- (d) Industrial package Type 3 (Type IP-3 package);
- (e) Type A package;
- (f) Type B(U) package;
- (g) Type B(M) package;
- (h) Type C package.

Packages containing fissile material or uranium hexafluoride are subject to additional requirements."

Insert new paragraphs 4.1.9.1.6 to 4.1.9.1.11 to read as follows:

"4.1.9.1.6 Before the first shipment of any package, the following requirements shall be fulfilled:

- (a) If the design pressure of the containment system exceeds 35 kPa (gauge), it shall be ensured that the containment system of each package conforms to the approved design requirements relating to the capability of that system to maintain its integrity under that pressure;
- (b) For each Type B(U), Type B(M) and Type C package and for each package containing fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design;
- (c) For packages containing fissile material, where, in order to comply with the requirements of 6.4.11.1, neutron poisons are specifically included as components of the package, checks shall be performed to confirm the presence and distribution of those neutron poisons.

4.1.9.1.7 Before each shipment of any package, the following requirements shall be fulfilled:

- (a) For any package it shall be ensured that all the requirements specified in the relevant provisions of these Regulations have been satisfied;
- (b) It shall be ensured that lifting attachments which do not meet the requirements of 6.4.2.2 have been removed or otherwise rendered incapable of being used for lifting the package, in accordance with 6.4.2.3;
- (c) For each package requiring competent authority approval, it shall be ensured that all the requirements specified in the approval certificates have been satisfied;
- (d) Each Type B(U), Type B(M) and Type C package shall be held until equilibrium conditions have been approached closely enough to demonstrate compliance with the requirements for temperature and pressure unless an exemption from these requirements has received unilateral approval;

- (e) For each Type B(U), Type B(M) and Type C package, it shall be ensured by inspection and/or appropriate tests that all closures, valves, and other openings of the containment system through which the radioactive contents might escape are properly closed and, where appropriate, sealed in the manner for which the demonstrations of compliance with the requirements of 6.4.8.8 and 6.4.10.3 were made;
- (f) For each special form radioactive material, it shall be ensured that all the requirements specified in the approval certificate and the relevant provisions of these Regulations have been satisfied;
- (g) For packages containing fissile material the measurement specified in 6.4.11.4 (b) and the tests to demonstrate closure of each package as specified in 6.4.11.7 shall be performed where applicable;
- (h) For each low dispersible radioactive material, it shall be ensured that all the requirements specified in the approval certificate and the relevant provisions of these Regulations have been satisfied.

4.1.9.1.8 The consignor shall also have a copy of any instructions with regard to the proper closing of the package and any preparation for shipment before making any shipment under the terms of the certificates.

4.1.9.1.9 Except for consignments under exclusive use, the transport index of any package or overpack shall not exceed 10, nor shall the criticality safety index of any package or overpack exceed 50.

4.1.9.1.10 Except for packages or overpacks transported under exclusive use by rail or by road under the conditions specified in 7.2.3.1.2 (a), or under exclusive use and special arrangement by vessel or by air under the conditions specified in 7.2.3.2.1 or 7.2.3.3.3 respectively, the maximum radiation level at any point on any external surface of a package or overpack shall not exceed 2 mSv/h.

4.1.9.1.11 The maximum radiation level at any point on any external surface of a package or overpack under exclusive use shall not exceed 10 mSv/h."

Insert a new sub-section 4.1.9.3 to read as follows:

"4.1.9.3 *Packages containing fissile material*

Unless [excepted by 6.4.11.2][not classified as fissile in accordance with 2.7.2.3.5]², packages containing fissile material shall not contain:

- (a) A mass of fissile material different from that authorized for the package design;
- (b) Any radionuclide or fissile material different from those authorized for the package design; or
- (c) Contents in a form or physical or chemical state, or in a spatial arrangement, different from those authorized for the package design;

as specified in their certificates of approval where appropriate."

PART 5

Chapter 5.1

5.1.2.1 Add at the end: ", except as required in 5.2.2.1.12."

5.1.3.2 Replace "Tanks and intermediate bulk containers" with "Packagings, including IBCs, and tanks".

5.1.5.1 Delete. Renumber subsequent paragraphs 5.1.5.2 to 5.1.5.3 accordingly.

Consequential amendments:

Section 5.1.5 Amend all references to renumbered paragraphs, as appropriate.

6.4.23.14 (h) Replace "5.1.5.2.2" with "5.1.5.1.2".

6.4.22.2, 6.4.22.3 and 6.4.23.2 (c) Replace "5.1.5.3.1" with "5.1.5.2.1".

5.1.5.2.2 (current 5.1.5.3.2) Delete the second sentence.

Insert a new sub-section 5.1.5.4 to read as follows:

"5.1.5.4 *Determination of transport index (TI) and criticality safety index (CSI)*

5.1.5.4.1 The transport index (TI) for a package, overpack or freight container, or for unpackaged LSA-I or SCO-I, shall be the number derived in accordance with the following procedure:

² *Second option proposed by the secretariat.*

- (a) Determine the maximum radiation level in units of millisieverts per hour (mSv/h) at a distance of 1 m from the external surfaces of the package, overpack, freight container, or unpackaged LSA-I and SCO-I. The value determined shall be multiplied by 100 and the resulting number is the transport index. For uranium and thorium ores and their concentrates, the maximum radiation level at any point 1 m from the external surface of the load may be taken as:
- 0.4 mSv/h for ores and physical concentrates of uranium and thorium;
 0.3 mSv/h for chemical concentrates of thorium;
 0.02 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride;
- (b) For tanks, freight containers and unpackaged LSA-I and SCO-I, the value determined in step (a) above shall be multiplied by the appropriate factor from Table 5.1.5.4.1;
- (c) The value obtained in steps (a) and (b) above shall be rounded up to the first decimal place (e.g. 1.13 becomes 1.2), except that a value of 0.05 or less may be considered as zero.

Table 5.1.5.4.1: Multiplication factors for tanks, freight containers and unpackaged LSA-I and SCO-I

Size of load ^a	Multiplication factor
size of load $\leq 1 \text{ m}^2$	1
$1 \text{ m}^2 < \text{size of load} \leq 5 \text{ m}^2$	2
$5 \text{ m}^2 < \text{size of load} \leq 20 \text{ m}^2$	3
$20 \text{ m}^2 < \text{size of load}$	10

^a *Largest cross-sectional area of the load being measured.*

5.1.5.4.2 The transport index for each overpack, freight container or conveyance shall be determined as either the sum of the TIs of all the packages contained, or by direct measurement of radiation level, except in the case of non-rigid overpacks for which the transport index shall be determined only as the sum of the TIs of all the packages.

5.1.5.4.3 The criticality safety index for each overpack or freight container shall be determined as the sum of the CSIs of all the packages contained. The same procedure shall be followed for determining the total sum of the CSIs in a consignment or aboard a conveyance.

5.1.5.4.4 Packages and overpacks shall be assigned to either category I-WHITE, II-YELLOW or III-YELLOW in accordance with the conditions specified in Table 5.1.5.4.4 and with the following requirements:

- (a) For a package or overpack, both the transport index and the surface radiation level conditions shall be taken into account in determining which is the appropriate category. Where the transport index satisfies the condition for one category but the surface radiation level satisfies the condition for a different category, the package or overpack shall be assigned to the higher category. For this purpose, category I-WHITE shall be regarded as the lowest category;
- (b) The transport index shall be determined following the procedures specified in 5.1.5.4.1 and 5.1.5.4.2;
- (c) If the surface radiation level is greater than 2 mSv/h, the package or overpack shall be transported under exclusive use and under the provisions of 7.2.3.1.3, 7.2.3.2.1, or 7.2.3.3.3, as appropriate;
- (d) A package transported under a special arrangement shall be assigned to category III-YELLOW [except under the provisions of 2.7.2.4.6][except when otherwise specified in the competent authority approval certificate of the country of origin of design (see 2.7.2.4.6)]³;
- (e) An overpack which contains packages transported under special arrangement shall be assigned to category III-YELLOW [except under the provisions of 2.7.2.4.6][except when otherwise specified in the competent authority approval certificate of the country of origin of design (see 2.7.2.4.6)]³.

³ Note by the secretariat: to be checked.

Table 5.1.5.4.4: Categories of packages and overpacks

Conditions		
Transport index	Maximum radiation level at any point on external surface	Category
0 ^a	Not more than 0.005 mSv/h	I-WHITE
More than 0 but not more than 1 ^a	More than 0.005 mSv/h but not more than 0.5 mSv/h	II-YELLOW
More than 1 but not more than 10	More than 0.5 mSv/h but not more than 2 mSv/h	III-YELLOW
More than 10	More than 2 mSv/h but not more than 10 mSv/h	III-YELLOW ^b

^a *If the measured TI is not greater than 0.05, the value quoted may be zero in accordance with 5.1.5.4.1(c).*

^b *Shall also be transported under exclusive use."*

Chapter 5.2

5.2.1.5.2 Amend to read as follows:

"5.2.1.5.2 In the case of excepted packages marking the proper shipping name is not required."

5.2.2.1.12.1 In the first sentence, replace "Except as provided for large freight containers and tanks in accordance with 5.3.1.1.5.1" with "Except when enlarged labels are used in accordance with 5.3.1.1.5.1".

5.2.2.1.12.2 (d) Replace "See 2.7.6.1.1 and 2.7.6.1.2" with "The number determined in accordance with 5.1.5.4.1 and 5.1.5.4.2".

PART 6

Chapter 6.4

6.4.5.4.1 (b) Amend to read as follows:

"(b) They are designed to satisfy the requirements prescribed for packing group I or II in Chapter 6.1 of these Regulations; and"

6.4.5.4.2 Amend (b) to read as follows:

"(b) They are designed to satisfy the requirements prescribed in Chapter 6.7 of these Regulations and are capable of withstanding a test pressure of 265 kPa; and"

6.4.5.4.3 Replace "that they conform to standards at least equivalent to those prescribed in 6.4.5.4.2." with "that:

- (a) They satisfy the requirements of 6.4.5.1;
- (b) They are designed to satisfy the requirements prescribed in regional or national regulations for the transport of dangerous goods and are capable of withstanding a test pressure of 265 kPa; and
- (c) They are designed so that any additional shielding which is provided shall be capable of withstanding the static and dynamic stresses resulting from handling and routine conditions of transport and of preventing an increase of more than 20% in the maximum radiation level at any external surface of the tanks."

6.4.5.4.4 In the first sentence, insert "of a permanent enclosed character" after "Freight containers".

[6.4.5.4.5 (b) Amend the text before (i) and (ii) to read as follows:

"(b) They are designed to satisfy the requirements prescribed in Chapter 6.5 of these Regulations for packing group I or II, and if they were subjected to the tests prescribed in that Chapter, but with the drop test conducted in the most damaging orientation, they would prevent:"]⁴

[6.4.11.2 In the first sentence, replace "of this paragraph" with "of 2.7.2.3.5". Delete subparagraphs (a) to (d) and Table 6.4.11.2.]⁵

Insert a new 6.4.11.3 to read as follows:

"6.4.11.3 The criticality safety index (CSI) for packages containing fissile material shall be obtained by dividing the number 50 by the smaller of the two values of N derived in 6.4.11.11 and 6.4.11.12 (i.e. $CSI = 50/N$). The value of the criticality safety index may be zero, provided that an unlimited number of packages is subcritical (i.e. N is effectively equal to infinity in both cases)."

6.4.23.14 (o) Insert "6.4.8.4," before "6.4.8.5".

6.4.23.15 Add at the end "under 6.4.22.2, 6.4.22.3, 6.4.22.4, 6.4.24.2 and 6.4.24.3".

⁴ Note by the secretariat: to be checked - See annex 3 of ST/SG/AC.10/C.3/2006/53.

⁵ Additional amendment proposed by the secretariat.