



**WORKING PAPER**

**DANGEROUS GOODS PANEL (DGP)  
MEETING OF THE WORKING GROUP OF THE WHOLE**

**Montréal, 15 to 19 April 2013**

- Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2015-2016 Edition**  
**2.2 : Part 2 — Classification**

**DRAFT AMENDMENTS TO THE TECHNICAL INSTRUCTIONS TO ALIGN WITH THE UN  
RECOMMENDATIONS — PART 2**

(Presented by the Secretary)

**SUMMARY**

This working paper contains draft amendments to Part 2 of the Technical Instructions to reflect the decisions taken by the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals at its sixth session (Geneva, 14 December 2012). It also reflects amendments agreed by DGP-WG12 (Montreal, 15 to 19 October 2012).

The DGP-WG is invited to agree to the draft amendments in this working paper.

## Part 2

# CLASSIFICATION OF DANGEROUS GOODS

## INTRODUCTORY CHAPTER

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### 2. CLASSES, DIVISIONS, PACKING GROUPS — DEFINITIONS

2.4 For packing purposes, dangerous goods other than those of Classes 1, 2 and 7, Divisions 5.2 and 6.2 and self-reactive substances of Division 4.1 are assigned to three packing groups in accordance with the degree of danger they present:

Packing Group I: Substances presenting high danger

Packing Group II: Substances presenting medium danger

Packing Group III: Substances presenting low danger

The packing group to which a substance is assigned is indicated in the Dangerous Goods List in Part 3, Chapter 2, Table 3-1.

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UN Model Regulations, paragraph 2.0.1.3, ST/SG/AC.10/40/Add.1

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Articles are not assigned to packing groups. For packing purposes, any requirement for a specific packaging performance level is set out in the applicable packing instruction.

### 4. PRECEDENCE OF HAZARD CHARACTERISTICS

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UN Model Regulations, paragraph 2.0.3.2, ST/SG/AC.10/40/Add.1

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4.2 Apart from radioactive material in excepted packages (where the other hazardous properties take precedence), radioactive material having other hazardous properties must always be classified in Class 7 and the subsidiary risk must also be identified. For radioactive material in excepted packages, except for UN 3507, Uranium hexafluoride, radioactive material, excepted package, Special Provision A130 applies.

4.3 An article which, apart from its other hazards, also meets the criterion for a magnetized material, must be identified in accordance with the provisions of this section and in addition as a magnetized material.

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## Chapter 2

### CLASS 2 — GASES

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UN Model Regulations, paragraph 2.2.1.2, ST/SG/AC.10/40/Add.1

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2.1.2 The transport condition of a gas is described according to its physical state as:

- a) compressed gas — a gas which when packaged under pressure for transport is entirely gaseous at  $-50^{\circ}\text{C}$ ; this category includes all gases with a critical temperature less than or equal to  $-50^{\circ}\text{C}$ ;

- b) liquefied gas — a gas which when packaged under pressure for transport is partially liquid at temperatures above – 50°C. A distinction is made between:

*High pressure liquefied gas:* a gas with a critical temperature between –50°C and +65°C, and

*Low pressure liquefied gas:* a gas with a critical temperature above +65°C;

- c) refrigerated liquefied gas — a gas which when packaged for transport is made partially liquid because of its low temperature; or
- d) dissolved gas — a gas which when packaged under pressure for transport is dissolved in a liquid phase solvent.
- e) adsorbed gas — a gas which when packaged for transport is adsorbed onto a solid porous material resulting in an internal receptacle pressure of less than 101.3 kPa at 20°C and less than 300 kPa at 50°C.

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## Chapter 3

### CLASS 3 — FLAMMABLE LIQUIDS

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#### 3.2 ASSIGNMENT OF PACKING GROUPS

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UN Model Regulations, paragraphs 2.3.2.2 and 2.3.2.3, ST/SG/AC.10/40/Add.1

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#### ~~3.2.2~~ Criteria for inclusion in Packing Group III

3.2.2 Viscous flammable liquids such as paints, enamels, lacquers, varnishes, adhesives and polishes ~~with~~ having a flash point of less than 23°C may be assigned to Packing Group III in conformity with the procedures prescribed in Part III, subsection 32.3 of the UN *Manual of Tests and Criteria* provided that:

- ~~a~~b) less than 3 per cent of the clear solvent layer separates in the solvent separation test;
- ~~b~~c) the mixture or any separated solvent does not meet the criteria for Division 6.1 or Class 8;
- ~~e~~a) the viscosity expressed as the flowtime in seconds and flash point are in accordance with Table 2-5;
- d) ~~when assigned to Packing Group III, the flammable liquids must not exceed a~~ the net quantity per package ~~of~~ does not exceed 30 L for passenger aircraft or 100 L for cargo aircraft.

3.2.3 Substances classified as flammable liquids due to their being transported or offered for transport at elevated temperatures are included in Packing Group III.

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## Chapter 5

### CLASS 5 — OXIDIZING SUBSTANCES; ORGANIC PEROXIDES

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#### 5.2 OXIDIZING SUBSTANCES (DIVISION 5.1)

##### 5.2.1 Classification in Division 5.1

5.2.1.1 Oxidizing substances are classified in Division 5.1 in accordance with the test methods, procedures and criteria in 5.2.2, 5.2.3 and the UN *Manual of Tests and Criteria*, Part III, section 34. In the event of divergence between test results and known experience, the appropriate authority of the State of Origin must be consulted to establish the appropriate classification and packing group.

*Note.— Where substances of this division are listed in the Dangerous Goods List in 3;2, reclassification of those substances in accordance with these criteria need only be undertaken when this is necessary for safety.*

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UN Model Regulations, paragraph 2.5.2.2.1.1, ST/SG/AC.10/40/Add.1

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### 5.2.2 Oxidizing solids

#### 5.2.2.1 Criteria for classification in Division 5.1

5.2.2.1.1 Tests are performed to measure the potential for a solid substance to increase the burning rate or burning intensity of a combustible substance when the two are thoroughly mixed. The procedure is given in the UN *Manual of Tests and Criteria*, Part III, subsection 34.4.1 (test O.1) or alternatively, in subsection 34.4.3 (test O.3). Tests are conducted on the substance to be evaluated mixed with dry fibrous cellulose in mixing ratios of 1:1 and 4:1, by mass, of sample to cellulose. The burning characteristics of the mixtures are compared:

- a) in the test O.1, with the standard 3:7 mixture, by mass, of potassium bromate to cellulose. If the burning time is equal to or less than this standard mixture, the burning times should be compared with those from the Packing Group I or II reference standards, 3:2 and 2:3 ratios, by mass, of potassium bromate to cellulose, respectively: or
- b) in the test O.3, with the standard 1:2 mixture, by mass, of calcium peroxide to cellulose. If the burning rate is equal to or greater than this standard mixture, the burning rates must be compared with those from the Packing Group I or II reference standards 3:1 and 1:1 ratios, by mass, of calcium peroxide to cellulose, respectively.

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UN Model Regulations, paragraph 2.5.2.2.1.2, ST/SG/AC.10/40/Add.1

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5.2.2.1.2 The classification test results are assessed on the basis of:

- a) the comparison of the mean burning time (for the test O.1) or burning rate (for the test O.3) with those of the reference mixtures; and
- b) whether the mixture of substance and cellulose ignites and burns.

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UN Model Regulations, paragraph 2.5.2.2.1.3, ST/SG/AC.10/40/Add.1

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5.2.2.1.3 A solid substance is classified in Division 5.1 if the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits:

- a) in the test O.1, a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose: or
- b) in the test O.3, a mean burning rate equal to or greater than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose.

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UN Model Regulations, paragraph 2.5.2.2.2, ST/SG/AC.10/40/Add.1

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#### 5.2.2.2 Assignment of packing groups

Solid oxidizing substances are assigned to a packing group according to the test procedure in the UN *Manual of Tests and Criteria*, Part III, section 34.4.1 (test O.1) or alternatively, in subsection 34.4.3 (test O.3), in accordance with the following criteria:

a) Test O.1:

- i) Packing Group I: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose;
- ii) Packing Group II: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose and the criteria for Packing Group I are not met;
- iii) Packing Group III: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose and the criteria for Packing Groups I and II are not met;

div) Not Division 5.1: any substance which, in both the 4:1 and 1:1 sample-to-cellulose ratio (by mass) tested, does not ignite and burn, or exhibits mean burning times greater than that of a 3:7 mixture (by mass) of potassium bromate and cellulose.

b) Test O.3:

i) Packing Group I: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate greater than the mean burning rate of a 3:1 mixture (by mass) of calcium peroxide and cellulose;

(ii) Packing Group II: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate equal to or greater than the mean burning rate of a 1:1 mixture (by mass) of calcium peroxide and cellulose, and the criteria for Packing Group I are not met;

(iii) Packing Group III: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate equal to or greater than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose, and the criteria for Packing Groups I and II are not met;

(iv) Not Division 5.1: any substance which, in both the 4:1 and 1:1 sample-to-cellulose ratio (by mass) tested, does not ignite and burn, or exhibits a mean burning rate less than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose.

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## Chapter 6

### CLASS 6 — TOXIC AND INFECTIOUS SUBSTANCES

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#### 6.3 DIVISION 6.2 — INFECTIOUS SUBSTANCES

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##### 6.3.2 Classification of infectious substances

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###### 6.3.2.3 Exceptions

6.3.2.3.1 Substances which do not contain infectious substances or substances which are unlikely to cause disease in humans or animals are not subject to these Instructions unless they meet the criteria for inclusion in another class.

6.3.2.3.2 Substances containing micro-organisms which are non-pathogenic to humans or animals are not subject to these Instructions unless they meet the criteria for inclusion in another class.

6.3.2.3.3 Substances in a form that any present pathogens have been neutralized or inactivated such that they no longer pose a health risk are not subject to these Instructions unless they meet the criteria for inclusion in another class.

6.3.2.3.4 Environmental samples (including food and water samples) which are not considered to pose a significant risk of infection are not subject to these Instructions unless they meet the criteria for inclusion in another class.

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UN Model Regulations, paragraphs 2.6.3.2.3.5, 2.6.3.2.3.6 and 2.6.3.2.3.7, ST/SG/AC.10/40/Add.1

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6.3.2.3.5 Dried blood spots, collected by applying a drop of blood onto absorbent material, ~~or~~ are not subject to these Instructions.

~~6.3.2.3.6 Faecal occult blood screening tests and~~ samples are not are not subject to these Instructions.

~~6.3.2.3.7 Blood or blood components that have been collected for the purposes of transfusion or for the preparation of blood products to be used for transfusion or transplantation and any tissues or organs intended for use in transplantation as well as samples drawn in connection with such purposes~~ are not subject to these Instructions.

6.3.2.3.68 Patient specimens for which there is minimal likelihood that pathogens are present are not subject to these Instructions if the specimen is transported in a packaging which will prevent any leakage and which is marked with the words "Exempt human specimen" or "Exempt animal specimen", as appropriate. The packaging must meet the following conditions:

- a) The packaging must consist of three components:
  - i) a leakproof primary receptacle(s);
  - ii) a leakproof secondary packaging; and
  - iii) an outer packaging of adequate strength for its capacity, mass and intended use, and with at least one surface having minimum dimensions of 100 mm × 100 mm;
- b) For liquids, absorbent material in sufficient quantity to absorb the entire contents must be placed between the primary receptacle(s) and the secondary packaging so that, during transport, any release or leak of a liquid substance will not reach the outer packaging and will not compromise the integrity of the cushioning material;
- c) When multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact between them.

*Note.— In determining whether a patient specimen has a minimum likelihood that pathogens are present, an element of professional judgement is required to determine if a substance is exempt under this paragraph. That judgement should be based on the known medical history, symptoms and individual circumstances of the source, human or animal, and endemic local conditions. Examples of specimens which may be transported under this paragraph include blood or urine tests to*

*monitor cholesterol levels, blood glucose levels, hormone levels, or prostate specific antibodies (PSA); tests required to monitor organ function such as heart, liver or kidney function for humans or animals with non-infectious diseases, or therapeutic drug monitoring; tests conducted for insurance or employment purposes and are intended to determine the presence of drugs or alcohol; pregnancy tests; biopsies to detect cancer; and antibody detection in humans or animals in the absence of any concern for infection (e.g. evaluation of vaccine induced immunity, diagnosis of autoimmune disease, etc.).*

6.3.2.3.79 Except for:

- a) medical waste (UN 3291);
- b) medical devices or equipment contaminated with or containing infectious substances in Category A (UN 2814 or UN 2900); and
- c) medical devices or equipment contaminated with or containing other dangerous goods that meet the definition of another hazard class,

medical devices or equipment potentially contaminated with or containing infectious substances which are being transported for disinfection, cleaning, sterilization, repair, or equipment evaluation are not subject to the provisions of these Instructions if packed in packagings designed and constructed in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents. Packagings must be designed to meet the construction requirements listed in 6;3.

6.3.2.3.79.1 These packagings must meet the general packing requirements of 4;1.1.1, 4;1.1.3.1 and 4;1.1.4 (with the exception of 4;1.1.4.1). If the outer packaging is not liquid tight and the medical devices or equipment are contaminated with or contain liquid infectious substances, a means of containing the liquid in the event of leakage must be provided in the form of a leakproof liner, plastic bag or other equally effective means of containment. These packagings must be capable of retaining the medical devices and equipment when dropped from a height of 1.2 m.

6.3.2.3.79.2 Packages must be marked "Used medical device" or "Used medical equipment". When an overpack is used, it must be marked with the words "Used medical device" or "Used medical equipment" unless the markings are visible.

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## Chapter 7

### CLASS 7 — RADIOACTIVE MATERIAL

*Parts of this Chapter are affected by State Variations BE 4, CA 1, CA 3, CA 4, CH 4 DE 3, DK 1, DQ 1, IR 4, JP 26, KG 1; see Table A-1*

*Note.— For Class 7, the type of packaging may have a decisive effect on classification.*

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#### 7.1.3 Definitions of specific terms

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UN Model Regulations, paragraph 2.7.1.3, ST/SG/AC.10/40/Add.1

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*Fissile nuclides.* Uranium-233, uranium-235, plutonium-239 and plutonium-241. Fissile material is a material containing any of the fissile nuclides. Excluded from the definition of fissile material are the following:

- a) natural uranium or depleted uranium which is unirradiated; ~~and~~
- b) natural uranium or depleted uranium which has been irradiated in thermal reactors only; ~~and~~
- c) material with fissile nuclides less than a total of 0.25 g;
- d) any combination of a), b) and/or c).

These exclusions are only valid if there is no other material with fissile nuclides in the package or in the consignment if shipped unpackaged.

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UN Model Regulations, paragraph 1.2.1, ST/SG/AC.10/40/Add.1

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*Freight container in the case of radioactive material transport.* An article of transport equipment designed to facilitate the transport of packaged goods by one or more modes of transport without intermediate reloading, which is of a permanent enclosed character, rigid and strong enough for repeated use, and must be fitted with devices facilitating its handling, particularly in transfer between aircraft and from one mode of transport to another. A small freight container is that which has either an overall outer dimension less than 1.5 m, or an internal volume of not more than 3 m<sup>3</sup>. Any other freight container is considered to be a large freight container. For the transport of Class 7 material, a freight container may be used as a packaging.

In addition: Small freight container means a freight container that has an internal volume of not more than 3 m<sup>3</sup>. Large freight container means a freight container that has an internal volume of more than 3 m<sup>3</sup>.

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*Surface contaminated object (SCO).* A solid object which is not itself radioactive but which has radioactive material distributed on its ~~surfaces~~ surface.

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## 7.2 CLASSIFICATION

### 7.2.1 General provisions

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UN Model Regulations, paragraph 2.7.2.1.1, ST/SG/AC.10/40/Add.1

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7.2.1.1 Radioactive material must be assigned to one of the UN numbers specified in Table 2-11 ~~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 7.2.2 to 7.2.5 in accordance with 7.2.4.2 to 7.2.4.5, taking into account the material characteristics determined in 7.2.3.

UN Model Regulations, Table 2.7.2.1.1, ST/SG/AC.10/40/Add.1

**Table 2-11. Assignment of UN numbers**

UN number	<i>Proper shipping name and description<sup>a</sup></i>
<i>Excepted packages (1;6.1.5)</i>	
UN 2908	<b>Radioactive material, excepted package — empty packaging</b>
UN 2909	<b>Radioactive material, excepted package — articles manufactured from natural uranium or depleted uranium or natural thorium</b>
UN 2910	<b>Radioactive material, excepted package — limited quantity of material</b>
UN 2911	<b>Radioactive material, excepted package — instruments or articles</b>
<u>UN 3507</u>	<u><b>Uranium hexafluoride, radioactive material, excepted package, less than 0.1 kg per package, non-fissile or fissile-excepted<sup>b,c</sup></b></u>
<i>Low specific activity radioactive material (7.2.3.1)</i>	
UN 2912	<b>Radioactive material, low specific activity (LSA-I), non-fissile or fissile excepted<sup>b</sup></b>
UN 3321	<b>Radioactive material, low specific activity (LSA-II), non-fissile or fissile excepted<sup>b</sup></b>
UN 3322	<b>Radioactive material, low specific activity (LSA-III), non-fissile or fissile excepted<sup>b</sup></b>
UN 3324	<b>Radioactive material, low specific activity (LSA-II) fissile</b>
UN 3325	<b>Radioactive material, low specific activity (LSA-III) fissile</b>
<i>Surface contaminated objects (7.2.3.2)</i>	
UN 2913	<b>Radioactive material, surface contaminated objects (SCO-I or SCO-II), non-fissile or fissile excepted<sup>b</sup></b>
UN 3326	<b>Radioactive material, surface contaminated objects (SCO-I or SCO-II), fissile</b>
<i>Type A packages (7.2.4.4)</i>	
UN 2915	<b>Radioactive material, Type A package, non-special form, non-fissile or fissile excepted<sup>b</sup></b>
UN 3327	<b>Radioactive material, Type A package, fissile, non-special form</b>
UN 3332	<b>Radioactive material, Type A package, special form, non-fissile or fissile excepted<sup>b</sup></b>
UN 3333	<b>Radioactive material, Type A package, special form, fissile</b>
<i>Type B(U) package (7.2.4.6)</i>	
UN 2916	<b>Radioactive material, Type B(U) package, non-fissile or fissile excepted<sup>b</sup></b>
UN 3328	<b>Radioactive material, Type B(U) package, fissile</b>
<i>Type B(M) package (7.2.4.6)</i>	
UN 2917	<b>Radioactive material, Type B(M) package, non-fissile or fissile excepted<sup>b</sup></b>
UN 3329	<b>Radioactive material, Type B(M) package, fissile</b>
<i>Type C package (7.2.4.6)</i>	
UN 3323	<b>Radioactive material, Type C package, non-fissile or fissile excepted<sup>b</sup></b>
UN 3330	<b>Radioactive material, Type C package, fissile</b>
<i>Special arrangement (7.2.5)</i>	
UN 2919	<b>Radioactive material, transported under special arrangement, non-fissile or fissile excepted<sup>b</sup></b>
UN 3331	<b>Radioactive material, transported under special arrangement, fissile</b>
<i>Uranium hexafluoride (7.2.4.5)</i>	
UN 2977	<b>Radioactive material, uranium hexafluoride, fissile</b>

UN number	<i>Proper shipping name and description<sup>a</sup></i>
UN 2978	<b>Radioactive material, uranium hexafluoride</b> , non-fissile or fissile excepted <sup>b</sup>
<u>UN 3507</u>	<u><b>Uranium hexafluoride, radioactive material, excepted package less than 0.1 kg per package, non-fissile or fissile-excepted<sup>b,c</sup></b></u>
<p><u>a</u> The proper shipping name is found in the column "proper shipping name and description" and is restricted to that part shown in bold letters. In the cases of UN Nos. 2909, 2911, 2913 and 3326, where alternative proper shipping names are separated by the word "or", only the relevant proper shipping name must be used</p> <p><u>b</u> The term "fissile-excepted" refers only to material excepted under 7.2.3.5.</p> <p><u>c</u> For UN No. 3507, see also Special Provision A194.</p>	

### 7.2.2 Determination of activity level

#### UN Model Regulations, paragraph 2.7.2.2.1, ST/SG/AC.10/40/Add.1

7.2.2.1 The following basic values for individual radionuclides are given in Table 2-12:

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

#### UN Model Regulations, paragraph 2.7.2.2.2, ST/SG/AC.10/40/Add.1

7.2.2.2 For individual radionuclides-:

- a which are not listed in Table 2-12, determination of the basic radionuclide values referred to in 7.2.2.1 must require multilateral approval. For these radionuclides, activity concentration limits for exempt material and activity limits for exempt consignments must be calculated in accordance with the principles established in the *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No.115, IAEA, Vienna (1996)*. It is permissible to use the  $A_2$  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 2-13 may be used without obtaining competent authority approval.
- b in instruments or articles in which the radioactive material is enclosed or is included as a component part of the instrument or other manufactured article and which meet 7.2.4.1.1.3 c), alternative basic radionuclide values to those in Table 2-12 for the activity limit for an exempt consignment are permitted and must require multilateral approval. Such alternative activity limits for an exempt consignment must be calculated in accordance with the principles set out in the *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No.115, IAEA, Vienna (1996)*.

7.2.2.3 In the calculations of  $A_1$  and  $A_2$  for a radionuclide not in Table 2-12, 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, must be considered as a single radionuclide; and the activity to be taken into account and the  $A_1$  or  $A_2$  value to be applied must be that 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 must be considered as mixtures of different nuclides.

#### UN Model Regulations, paragraph 2.7.2.2.4, ST/SG/AC.10/40/Add.1

7.2.2.4 For mixtures of radionuclides, ~~the determination of~~ the basic radionuclide values referred to in 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 A<sub>1</sub> or A<sub>2</sub> or the activity concentration limit for exempt material or the activity limit for an exempt consignment as appropriate for the radionuclide i; and

X<sub>m</sub> is the derived value of A<sub>1</sub> or A<sub>2</sub> or the activity concentration limit for exempt material or the activity limit for an exempt consignment in the case of a mixture.

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 7.2.2.4 and 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.

7.2.2.6 For individual radionuclides or for mixtures of radionuclides for which relevant data are not available, the values shown in Table 2-13 must be used.

UN Model Regulations, Table 2.7.2.2.1, ST/SG/AC.10/40/Add.1

**Table 2-12. Basic radionuclides values for individual radionuclides**

Radionuclide (atomic number)	Special form A <sub>1</sub> (TBq)	Other form A <sub>2</sub> (TBq)	Activity concentration <u>limit</u> for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Actinium (89)				
...				
Zr-97 (a)	4 × 10 <sup>-1</sup>	4 × 10 <sup>-1</sup>	1 × 10 <sup>1</sup> (b)	1 × 10 <sup>5</sup> (b)
(a) A <sub>1</sub> and/or A <sub>2</sub> values for these parent radionuclides include contributions from daughter radionuclides <u>from their progeny</u> with half-lives less than 10 days, as listed in the following:				
...				

UN Model Regulations, Table 2.7.2.2.2, ST/SG/AC.10/40/Add.1

**Table 2-13. Basic radionuclide values for unknown radionuclides or mixtures**

Radioactive contents	A <sub>1</sub> (Tbq)	A <sub>2</sub> (Tbq)	Activity concentration <u>limit</u> for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Only beta- or gamma-emitting nuclides are known to be present	0.1	0.02	1 × 10 <sup>1</sup>	1 × 10 <sup>4</sup>
Alpha-emitting nuclides but no neutron emitters are known to be present	0.2	9 × 10 <sup>-5</sup>	1 × 10 <sup>-1</sup>	1 × 10 <sup>3</sup>
Neutron-emitting nuclides are known to be present or no relevant data are available	0.001	9 × 10 <sup>-5</sup>	1 × 10 <sup>-1</sup>	1 × 10 <sup>3</sup>

### 7.2.3 Determination of other material characteristics

#### 7.2.3.1 Low specific activity (LSA) material

##### 7.2.3.1.1 (Reserved)

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#### UN Model Regulations, paragraph 2.7.3.1.2, ST/SG/AC.10/40/Add.1

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7.2.3.1.2 LSA material must 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, that are unirradiated and in solid or liquid form;
- iii) radioactive material for which the  $A_2$  value is unlimited, ~~excluding fissile material~~ **may be included only if not** excepted under 7.2.3.5; 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 7.2.2.1 to 7.2.2.6, ~~excluding fissile material not~~ **may be included only if** excepted under 7.2.3.5.

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<sub>2</sub>/g for solids and gases, and  $10^{-5}$  A<sub>2</sub>/g for liquids.

c) LSA-III — solids (e.g. consolidated wastes, activated materials), excluding powders **that** meeting the requirements of 7.2.3.1.3, 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, **and** 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<sub>2</sub>; and
- iii) the estimated average specific activity of the solid, excluding any shielding material, does not exceed  $2 \times 10^{-3}$  A<sub>2</sub>/g.

7.2.3.1.3 LSA-III material must be a solid of such a nature that if the entire contents of a package were subjected to the test specified in 7.2.3.1.4, the activity in the water would not exceed 0.1 A<sub>2</sub>.

7.2.3.1.4 LSA-III material must be tested as follows:

A solid material sample representing the entire contents of the package must be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test must be sufficient to ensure that at the end of the 7-day test period, the free volume of the unabsorbed and unreacted water remaining must be at least 10 per cent of the volume of the solid test sample itself. The water must 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 must be measured following the 7-day immersion of the test sample.

7.2.3.1.5 Demonstration of compliance with the performance standards in 7.2.3.1.4 must be in accordance with 6;7.11.1 and 6;7.11.2.

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#### UN Model Regulations, paragraph 2.7.2.3.2, ST/SG/AC.10/40/Add.1

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#### 7.2.3.2 Surface contaminated object (SCO)

7.2.3.2.1 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<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 4 Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters, or 0.4 Bq/cm<sup>2</sup> for all other alpha emitters; ~~and~~
  - ii) the fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 4 × 10<sup>4</sup> Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters, or 4 × 10<sup>3</sup> Bq/cm<sup>2</sup> for all other alpha emitters; ~~and~~
  - iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 4 × 10<sup>4</sup> Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters, or 4 × 10<sup>3</sup> Bq/cm<sup>2</sup> 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<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 400 Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters, or 40 Bq/cm<sup>2</sup> for all other alpha emitters; ~~and~~
  - ii) the fixed contamination on the accessible surface, averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 8 × 10<sup>5</sup> Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters, or 8 × 10<sup>4</sup> Bq/cm<sup>2</sup> for all other alpha emitters; ~~and~~
  - iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 8 × 10<sup>5</sup> Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters, or 8 × 10<sup>4</sup> Bq/cm<sup>2</sup> for all other alpha emitters.

### 7.2.3.3 *Special form radioactive material*

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

7.2.3.3.2 Special form radioactive material must be of such a nature or must be so designed that if it is subjected to the tests specified in 7.2.3.3.4 to 7.2.3.3.8, it must meet the following requirements:

- a) it would not break or shatter under the impact, percussion and bending tests specified in 7.2.3.3.5 a), b), c) or 7.2.3.3.6 a), as applicable;
- b) it would not melt or disperse in the applicable heat test specified in 7.2.3.3.5 d) or 7.2.3.3.6 b), as applicable; and
- c) the activity in the water from the leaching tests specified in 7.2.3.3.7 and 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.

7.2.3.3.3 Demonstration of compliance with the performance standards in 7.2.3.3.2 must be in accordance with 6;7.11.1 and 6;7.11.2.

7.2.3.3.4 Specimens that comprise or simulate special form radioactive material must be subjected to the impact test, the percussion test, the bending test, and the heat test specified in 7.2.3.3.5 or alternative tests as authorized in 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 must be performed on the specimen by a method no less sensitive than the methods given in 7.2.3.3.7 for indispersible solid material or 7.2.3.3.8 for encapsulated material.

7.2.3.3.5 The relevant test methods are:

- a) Impact test: The specimen must drop onto the target from a height of 9 m. The target must be as defined in 6;7.13;
- b) Percussion test: The specimen must 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 must 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, must cover an area greater than that covered by the specimen. A fresh surface of lead must be used for each impact. The bar must strike the specimen so as to cause maximum damage.
- c) Bending test: The test must 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 must 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 must 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 must 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 must be 25 mm in diameter with the edges rounded off to a radius of  $(3.0 \pm 0.3)$  mm.

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

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UN Model Regulations, paragraph 2.7.2.3.3.6, ST/SG/AC.10/40/Add.1

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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 7.2.3.3.5 a) and b) provided ~~the mass of the special form radioactive material is~~ that the specimens are alternatively subjected to the impact test prescribed in ISO 2919:2012: "Radiation Protection — Sealed Radioactive Sources — General requirements and classification":
- i) ~~less than 200 g and the specimens are alternatively subjected to the Class 4 impact test prescribed in ISO 2919:1999 "Radiation protection — Sealed radioactive sources — General requirements and classification"~~ if the mass of the special form radioactive material is less than 200 g; or
- ii) ~~less than 500 g and the specimens are alternatively subjected to the Class 5 impact test prescribed in ISO 2919:1999 "Radiation protection — Sealed radioactive sources — General requirements and classification"~~ if the mass of the special form radioactive material is more than 200 g but less than 500 g; and
- b) the test prescribed in 7.2.3.3.5 d) provided the specimens are alternatively subjected to the Class 6 temperature test specified in ISO ~~2919:1999~~ ISO 2919:2012 "Radiation protection — Sealed radioactive sources — General requirements and classification".

7.2.3.3.7 For specimens which comprise or simulate indispersible solid material, a leaching assessment must be performed as follows:

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

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UN Model Regulations, paragraph 2.7.2.3.3.8, ST/SG/AC.10/40/Add.1

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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 must be performed as follows:

- a) The leaching assessment must consist of the following steps:
- i) the specimen must be immersed in water at ambient temperature. The water must have an initial pH of 6-8 with a maximum conductivity of 1 mS/m at 20°C;
- ii) the water and specimen must be heated to a temperature of  $(50 \pm 5)$ °C and maintained at this temperature for 4 hours;
- iii) the activity of the water must then be determined;
- iv) the specimen must 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 per cent;
- v) the process in i), ii) and iii) must be repeated;

- b) The alternative volumetric leakage assessment must comprise any of the tests prescribed in ISO 9978:1992 "Radiation protection — Sealed radioactive sources — Leakage test methods", which are provided that they are acceptable to the competent authority.

7.2.3.4 *Low dispersible radioactive material*

7.2.3.4.1 The design for low dispersible radioactive material requires multilateral approval. Low dispersible radioactive material must be such that the total amount of this radioactive material in a package, taking into account the provisions of 6;7.7.14, must 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;7.19.3 and 6;7.19.4, the airborne release in gaseous and particulate forms of up to 100 µm aerodynamic equivalent diameter would not exceed 100 A<sub>2</sub>. A separate specimen may be used for each test; and
- c) If subjected to the test specified in 7.2.3.1.4, the activity in the water would not exceed 100 A<sub>2</sub>. In the application of this test, the damaging effects of the tests specified in b) above must be taken into account.

7.2.3.4.2 Low dispersible material must be tested as follows:

A specimen that comprises or simulates low dispersible radioactive material must be subjected to the enhanced thermal test specified in 6;7.19.3 and the impact test specified in 6;7.19.4. A different specimen may be used for each of the tests. Following each test, the specimen must be subjected to the leach test specified in 7.2.3.1.4. After each test, it must be determined if the applicable requirements of 7.2.3.4.1 have been met.

7.2.3.4.3 Demonstration of compliance with the performance standards in 7.2.3.4.1 and 7.2.3.4.2 must be in accordance with 6;7.11.1 and 6;7.11.2.

UN Model Regulations, paragraph 2.7.2.3.5, ST/SG/AC.10/40/Add.1

7.2.3.5 *Fissile material*

7.2.3.5.1 Fissile material and P packages containing fissile material must be classified under the relevant entry as Fissile in accordance with of Table 2-11, the description of which includes the words "FISSILE" or "fissile excepted". Classification as "fissile excepted" is allowed only if one of the conditions a) to d) of this paragraph is met. Only one type of exception is allowed per consignment (see also 6;7.6.2) unless excepted by one of the provisions of sub-paragraphs a) to f) below and transported subject to the requirements of 7.2.10.4.3. All provisions apply only to material in packages that meets the requirements of 6;7.6.2 unless unpackaged material is specifically allowed in the provision.

- ~~a) A mass limit per consignment, provided that the smallest external dimension of each package is not less than 10 cm, 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 2-14, provided that either:~~

- ~~i) each individual package contains not more than 15 g of fissile nuclides; for unpackaged material, this quantity limitation must apply to the consignment being carried in or on the conveyance;~~
- ~~ii) the fissile material is a homogeneous hydrogenous solution or mixture where the ratio of fissile nuclides to hydrogen is less than 5 per cent by mass; or~~
- ~~iii) there are not more than 5 g of fissile nuclides in any 10 L volume of material.~~

~~Beryllium must not be present in quantities exceeding 1 per cent of the applicable consignment mass limits provided in Table 2-14, except where the concentration of beryllium in the material does not exceed 1 gram beryllium in any 1 000 grams.~~

~~Deuterium must also not be present in quantities exceeding 1 per cent of the applicable consignment mass limits provided in Table 2-14, except where deuterium occurs up to natural concentration in hydrogen.~~

**Table 2-14. — Consignment mass limits for exceptions from the requirements for packages containing fissile material**

<i>Fissile material</i>	<i>Fissile material mass (g) mixed with substances having an average hydrogen density less than or equal to water</i>	<i>Fissile material mass (g) mixed with substances having an average hydrogen density greater than water</i>
Uranium $\square$ 235 (X)	400	290
Other fissile material (Y)	250	180

~~ba)~~ Uranium enriched in uranium-235 to a maximum of 1 per cent by mass, and with a total plutonium and uranium-233 content not exceeding 1 per cent of the mass of uranium-235, provided that the fissile nuclides are distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it must not form a lattice arrangement;

~~eb)~~ Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2 per cent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 per cent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2;

~~d)~~ Plutonium containing not more than 20 per cent of fissile nuclides by mass up to a maximum of 1 kg of plutonium per consignment. Shipments under this exception must be under exclusive use.

c) Uranium with a maximum uranium enrichment of 5 per cent by mass uranium-235 provided:

i) there is no more than 3.5 g of uranium-235 per package;

ii) the total plutonium and uranium-233 content does not exceed 1 per cent of the mass of uranium-235 per package;

iii) transport of the package is subject to the consignment limit provided in 7;2.10.4.3 c);

d) Fissile nuclides with a total mass not greater than 2 g per package provided the package is transported subject to the consignment limit provided in 7;2.10.4.3 d);

e) Fissile nuclides with a total mass not greater than 45 g either packaged or unpackaged subject to limits provided in 7;2.10.4.3 e);

f) A fissile material that meets the requirements of 7;2.10.4.3 b), 7.2.3.6 and 5;1.2.2.1.

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UN Model Regulations, paragraph 2.7.2.3.6, ST/SG/AC.10/40/Add.1

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7.2.3.6 A fissile material excepted from classification as **Fissile** under 7.2.3.5.1 f) must be subcritical without the need for accumulation control under the following conditions:

a) the conditions of 6;7.10.1 a);

b) the conditions consistent with the assessment provisions stated in 6;7.10.12 b) and 6;7.10.13 b) for packages; and

c) the conditions specified in 6;7.10.11 a).



#### 7.2.4 Classification of packages

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

##### 7.2.4.1.1 Classification as excepted packages

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UN Model Regulations, paragraph 2.7.2.4.1.1, ST/SG/AC.10/40/Add.1

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7.2.4.1.1.1 ~~A P~~packages may be classified as excepted packages if it meets one of the following conditions:

- a) ~~they are~~ it is an empty packaging having contained radioactive material;
- b) ~~they~~ it contains instruments or articles in limited quantities as not exceeding the activity limits specified in columns 2 and 3 of Table 2-14 2-14;
- c) ~~they~~ it contains articles manufactured of natural uranium, depleted uranium or natural thorium; or
- d) ~~they~~ it contains radioactive material in limited quantities as not exceeding the activity limits specified in column 4 of Table 2-14 2-14; or
- e) it contains less than 0.1 kg of uranium hexafluoride not exceeding the activity limits specified in column 4 of Table 2-14.

7.2.4.1.1.2 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 µSv/h.

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UN Model Regulations, paragraph 2.7.2.4.1.3, ST/SG/AC.10/40/Add.1

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7.2.4.1.1.3 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** ~~only if~~ 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 article bears the marking "RADIOACTIVE" ~~except~~ on its external surface except for the following:
  - i) radioluminescent time-pieces or devices;
  - ii) consumer products that either have received regulatory approval ~~according to~~ in accordance with 1;6.1.4 b) or do not individually exceed the activity limit for an exempt consignment in Table 2-12 (column 5), provided such products are transported in a package that 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; and
  - iii) other instruments or articles too small to bear the marking "RADIOACTIVE", provided that they are transported in a package that bears the marking "RADIOACTIVE" on its internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package;
- c) the active material is completely enclosed by non-active components (a device performing the sole function of containing radioactive material must not be considered to be an instrument or manufactured article); and
- d) the limits specified in columns 2 and 3 of Table ~~2-14~~ 2-14 are met for each individual item and each package, respectively.

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UN Model Regulations, paragraph 2.7.2.4.1.4, ST/SG/AC.10/40/Add.1

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7.2.4.1.1.4 Radioactive material in forms other than as specified in 7.2.4.1.1.3 and with an activity not exceeding the limits specified in column 4 of Table ~~2-14~~ 2-14 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 either:
  - i) an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; or
  - ii) the outside of the package, where it is impractical to mark an internal surface.

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UN Model Regulations, new paragraph 2.7.2.4.1.5, ST/SG/AC.10/40/Add.1

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7.2.4.1.1.5 Uranium hexafluoride not exceeding the limits specified in column 4 of Table 2-14 may be classified under UN 3507 **Radioactive material, excepted package — uranium hexafluoride, less than 0.1 kg per package, non-fissile or fissile-excepted** provided that:

- a) the mass of uranium hexafluoride in the package is less than 0.1 kg; and
- b) the conditions of 7.2.4.5.1 and 7.2.4.1.1.4 a) and b) are met.

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UN Model Regulations, paragraph 2.7.2.4.1.7, ST/SG/AC.10/40/Add.1

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Move the following paragraph accordingly.

~~7.2.4.1.1.5.7~~ An empty packaging which had previously contained radioactive material may be classified under UN 2908 — **Radioactive material, excepted package — empty packaging** ~~only if~~ 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 cm<sup>2</sup>, does not exceed:
  - (i) 400 Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters; and
  - (ii) 40 Bq/cm<sup>2</sup> for all other alpha emitters; and
- d) any labels which may have been displayed on it in conformity with 5.3.2.6 are no longer visible.

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UN Model Regulations, paragraph 2.7.2.4.1.6, ST/SG/AC.10/40/Add.1

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7.2.4.1.1.6 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** ~~only if~~ provided that the outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or some other substantial material.

**Table 2-15 2-14. Activity limits for excepted packages**

<i>Physical state of contents</i>	<i>Instruments or article</i>		<i>Materials</i>
	<i>Item limits*</i>	<i>Package limits*</i>	<i>Package limits*</i>
<b>Solids</b>			
Special form	$10^{-2} A_1$	$A_1$	$10^{-3} A_1$
Other form	$10^{-2} A_2$	$A_2$	$10^{-3} A_2$
<b>Liquids</b>	$10^{-3} A_2$	$10^{-1} A_2$	$10^{-4} A_2$
<b>Gases</b>			
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	$10^{-3} A_2$	$10^{-2} A_2$	$10^{-3} A_2$

\* For mixtures of radionuclides, see 7.2.2.4 to 7.2.2.6.

7.2.4.2 *Classification as low specific activity (LSA) material*

7.2.4.2.1 Radioactive material may only be classified as LSA material if the definition of LSA in 7.1.3 and the conditions of 7.2.3.1, 4;9.2.1 and 7;2.9.2 are met.

7.2.4.3 *Classification as surface contaminated object (SCO)*

7.2.4.3.1 Radioactive material may be classified as SCO if the definition of SCO in 7.1.3 and the conditions of 7.2.3.2, 4;9.2.1 and 7;2.9.2 are met.

7.2.4.4 *Classification of Type A packages*

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

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UN Model Regulations, new paragraph 2.7.2.4.4, ST/SG/AC.10/40/Add.1

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7.2.4.4.1.1 Type A packages must not contain activities greater than **either of** the following:

- a) for special form radioactive material —  $A_1$ ;
- b) for all other radioactive material —  $A_2$ .

7.2.4.4.1.2 For mixtures of radionuclides whose identities and respective activities are known, the following condition must 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<sub>1</sub>(i) is the A<sub>1</sub> value for radionuclide i;

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

A<sub>2</sub>(j) is the A<sub>2</sub> value for radionuclide j.

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 UN Model Regulations, new paragraph 2.7.2.4.5, ST/SG/AC.10/40/Add.1
 

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7.2.4.5 *Classification of uranium hexafluoride*

7.2.4.5.1 Uranium hexafluoride must only be assigned to:

- ~~a) UN 2977 — Radioactive material, uranium hexafluoride, fissile; or~~
- ~~b) UN 2978 — Radioactive material, uranium hexafluoride, non-fissile or fissile excepted; or~~
- ~~c) UN 3507 — Uranium hexafluoride, radioactive material, excepted package, less than 0.1 kg per package, non-fissile or fissile-excepted~~

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 UN Model Regulations, new paragraph 2.7.2.4.5.2, ST/SG/AC.10/40/Add.1
 

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7.2.4.5.2 ~~The contents of a P~~ packages containing uranium hexafluoride must ~~not contain~~ comply with the following requirements:

- a) ~~for UN Nos. 2977 and 2978, a the~~ mass of uranium hexafluoride must not be different from that ~~authorized~~ allowed for the package design, and for UN 3507, the mass of uranium hexafluoride must be less than 0.1 kg;
- b) ~~a the~~ mass of uranium hexafluoride must not be greater than a value that would lead to an ullage smaller than 5 per cent at the maximum temperature of the package as specified for the plant systems where the package will be used; or
- c) ~~the~~ uranium hexafluoride ~~other than~~ must be in solid form ~~or at an~~ and the internal pressure must not be above atmospheric pressure when presented for transport.

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


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 UN Model Regulations, 2.7.2.4.6.1, ST/SG/AC.10/40/Add.1
 

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7.2.4.6.1 Packages not otherwise classified in 7.2.4 (7.2.4.1.1 to 7.2.4.5) must be classified in accordance with the competent authority certificate of approval ~~certificate~~ for the package issued by the country of origin of design.

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 UN Model Regulations, 2.7.2.4.6.2, ST/SG/AC.10/40/Add.1
 

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7.2.4.6.2 ~~A package may only be classified as a~~ The contents of a Type B(U), Type B(M) or Type C package 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;~~

must be as specified in their certificates the certificate of approval.

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 UN Model Regulations, paragraphs 2.7.2.4.6.3 and 2.7.2.4.6.4, ST/SG/AC.10/40/Add.1
 

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7.2.4.6.3 ~~(Deleted)~~ ~~A package may only be classified as a Type B(M) package 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 their certificates of approval.~~7.2.4.6.4 ~~(Deleted)~~ ~~A package may only be classified as a Type C package 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 their certificates of approval.~~

#### **7.2.5 Special arrangements**

Radioactive material must be classified as transported under special arrangement when it is intended to be transported in accordance with 1;6.4.

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## Chapter 8

### CLASS 8 — CORROSIVE SUBSTANCES

#### 8.1 DEFINITION OF CLASS 8

Class 8 substances (corrosive substances) are substances which, by chemical action, will cause severe damage when in contact with living tissue or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.

#### 8.2 ASSIGNMENT OF PACKING GROUPS

8.2.1 Substances and preparations of Class 8 are divided among the three packing groups according to their degree of hazard in transport as follows:

- a) Packing Group I: Very dangerous substances and preparations;
- b) Packing Group II : Substances and preparations presenting medium danger;
- c) Packing Group III: Substances and preparations presenting minor danger.

8.2.2 Allocation of substances in Class 8 to the packing groups referred to in the introduction to Part 3, Chapter 1 has been on the basis of experience, taking into account such additional factors as inhalation risk and reactivity with water, including the formation of hazardous decomposition products. New substances, including mixtures, can be assigned to packing groups on the basis of the length of time of contact necessary to produce full thickness destruction of human skin. Liquids, and solids which may become liquid during transport, which are judged not to cause full thickness destruction of human skin must still be considered for their potential to cause corrosion to certain metal surfaces in accordance with the criteria in 8.2.5 c) ii).

8.2.3 A substance or preparation meeting the criteria of Class 8 having an inhalation toxicity of dusts and mists ( $LC_{50}$ ) in the range of Packing Group I, but toxicity through oral ingestion or dermal contact only in the range of Packing Group III or less, must be allocated to Class 8.

8.2.4 In assigning the packing group to a substance in accordance with 8.2.2, account must be taken of human experience in instances of accidental exposure. In the absence of human experience, the packing group must be based on data obtained from experiments in accordance with OECD Guideline for the Testing of Chemicals No. 404, *Acute Dermal Irritation/Corrosion*, 2002 or No. 435, *In Vitro Membrane Barrier Test Method for Skin Corrosion*, 2006. A substance which is determined not to be corrosive in accordance with OECD Guideline for the Testing of Chemicals No. 430, *In Vitro Skin Corrosion: Transcutaneous Electrical Resistance Test (TER)*, 2004 or No. 431, *In Vitro Skin Corrosion: Human Skin Model Test*, 2004 may be considered not to be corrosive to skin for the purposes of these Instructions without further testing.

8.2.5 Packing groups are assigned to corrosive substances in accordance with the following criteria:

- a) *Packing Group I* is assigned to substances that cause full thickness destruction of intact skin tissue within an observation period of up to 60 minutes starting after an exposure time of 3 minutes or less.
- b) *Packing Group II* is assigned to substances that cause full thickness destruction of intact skin tissue within an observation period of up to 14 days starting after an exposure time of more than 3 minutes but not more than 60 minutes.
- c) *Packing Group III* is assigned to substances that:
  - i) cause full thickness destruction of intact skin tissue within an observation period of up to 14 days starting after an exposure time of more than 60 minutes but not more than 4 hours;
  - ii) are judged not to cause full thickness destruction of intact skin tissue but which exhibit a corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm a year at a test temperature of 55°C when tested on both materials. For the purposes of testing steel, type S235JR+CR (1.0037 resp. St 37-2), S275J2G3+CR (1.0144 resp. St 44-3), ISO 3574, Unified Numbering System (UNS) G10200 or SAE 1020, and for testing aluminium, non-clad types 7075-T6 or AZ5GU-T6, must be used. An acceptable test is prescribed in the UN *Manual of Tests and Criteria*, Part III, Section 37.

Note.— Where an initial test on either steel or aluminium indicates the substance being tested is corrosive, the follow up test on the other metal is not required.

**Table 2-162-15. Summary of criteria for assigning packing groups to corrosive substances**

<i>Packing group</i>	<i>Exposure time</i>	<i>Observation period</i>	<i>Effect</i>
I	≤ 3 min	≤ 60 min	Full thickness destruction of intact skin
II	> 3 min ≤ 1 h	≤ 14 d	Full thickness destruction of intact skin
III	> 1 h ≤ 4 h	≤ 14 d	Full thickness destruction of intact skin
III	—	—	Corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm a year at a test temperature of 55°C when tested on both materials

## Chapter 9

### CLASS 9 — MISCELLANEOUS DANGEROUS SUBSTANCES AND ARTICLES, INCLUDING ENVIRONMENTALLY HAZARDOUS SUBSTANCES

*Parts of this Chapter are affected by State Variations DE 5, NL 4; see Table A-1*

#### 9.1 DEFINITION

9.1.1 *Class 9 substances and articles (miscellaneous dangerous substances and articles)* are substances and articles which, during air transport, present a danger not covered by other classes.

9.1.2 *Genetically modified micro-organisms (GMMOs) and genetically modified organisms (GMOs)* are micro-organisms and organisms in which genetic material has been purposely altered through genetic engineering in a way that does not occur naturally.

#### 9.2 ASSIGNMENT TO CLASS 9

9.2.1 Class 9 includes, inter alia:

- a) Environmentally hazardous substances (aquatic environment) are those that meet the criteria in 2.9.3 of the UN Model Regulations or that meet criteria in international regulations or national regulations established by the appropriate national authority in the State of Origin, transit or destination of the consignment.

Substances or mixtures dangerous to the aquatic environment not otherwise classified under these Instructions must be assigned to Packing Group III and designated:

UN 3077 Environmentally hazardous substance, solid, n.o.s.; or  
UN 3082 Environmentally hazardous substance, liquid, n.o.s.

- b) Elevated temperature substances (i.e. substances that are transported or offered for transport at temperatures equal to or exceeding 100°C in a liquid state or at temperatures equal to or exceeding 240°C in a solid state (these substances may only be carried under 1;1.1)).
- c) GMMOs or GMOs which do not meet the definition of toxic substances (see 6.2) or infectious substances (see 6.3) must be assigned to UN 3245. GMMOs or GMOs are not subject to these Instructions when authorized for use by the appropriate national authorities of the States of Origin, transit and destination. Genetically modified live animals must be transported under terms and conditions of the appropriate national authorities of the States of Origin and destination.
- d) Magnetized material: Any material which, when packed for air transport, has a maximum magnetic field strength sufficient to cause a compass deflection of more than 2 degrees at a distance of 2.1 m from any point on the surface of the assembled package. The magnetic field strength at the compass producing a 2 degree deflection is taken to be 0.418 A/m (0.00525 Gauss).

The magnetic field strength must be measured with a magnetic compass sensitive enough to read a 2 degree variation, preferably in 1 degree increments or finer, or using a Gauss meter having a sensitivity sufficient to measure magnetic fields greater than 0.0005 Gauss within a tolerance of plus or minus 5 per cent, or by an equivalent means.

Compass measurements must be taken in an area free from magnetic interference other than the Earth's magnetic field. When using a compass, the material and the compass must be aligned in an east-west direction. Gauss meter measurements must be in accordance with the manufacturer's instructions. Measurements are taken while the packaged material is rotated through 360 degrees in its horizontal plane while maintaining a constant distance (2.1 m or 4.6 m as referred to in Packing Instruction 953) between the measuring device and any point on the outside surface of the package. Shielding may be used to reduce the package's magnetic strength.

*Note.— Masses of ferro-magnetic metals such as automobiles, automobile parts, metal fencing, piping and metal construction material, even if not meeting the definition of magnetized material may affect aircraft compasses, as may packages or items which individually do not meet the definition of magnetized material but cumulatively may have a magnetic field strength of a magnetized material.*



- e) Aviation regulated solid or liquid: Any material which has narcotic, noxious or other properties such that, in the event of spillage or leakage on an aircraft, extreme annoyance or discomfort could be caused to crew members so as to prevent the correct performance of assigned duties.

Some examples of articles in Class 9 are:

- Engines, internal combustion;
- Life-saving appliances, self-inflating;
- Battery-powered equipment or vehicle.

Some examples of substances in Class 9 are:

- Blue, brown or white asbestos;
- Carbon dioxide, solid (dry ice);
- Zinc dithionite.

### 9.3 LITHIUM BATTERIES

9.3.1 Cells and batteries, cells and batteries contained in equipment, or cells and batteries packed with equipment, containing lithium in any form must be assigned to UN Nos. 3090, 3091, 3480 or 3481 as appropriate. They may be transported under these entries if they meet the following provisions:

- a) each cell or battery is of the type proved to meet the requirements of each test of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;

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UN Model Regulations, paragraph 2.9.4, ST/SG/AC.10/40/Add.1

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Cells and batteries manufactured according to a type meeting the requirements of subsection 38.3 of the UN Manual of Tests and Criteria, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing may continue to be transported, unless otherwise provided in these Instructions.

Cell and battery types only meeting the requirements of the Manual of Tests and Criteria, Revision 3, are no longer valid. However, cells and batteries manufactured in conformity with such types before 1 July 2003 may continue to be transported if all other applicable requirements are fulfilled.

*Note 1.— Batteries must be of a design type proved to meet the testing requirements of the UN Manual of Tests and Criteria, Part III, subsection 38.3, irrespective of whether the cells of which they are composed are of a tested design type.*

~~*Note 2.— Batteries and cells manufactured before 1 January 2014 conforming to a design type tested according to the requirements of the fifth revised edition of the UN Manual of Tests and Criteria, Part III, subsection 38.3 may continue to be transported.*~~

- b) each cell and battery incorporates a safety venting device or is designed to preclude a violent rupture under conditions normally incident to transport;
- c) each cell and battery is equipped with an effective means of preventing external short circuits;
- d) each battery containing cells or a series of cells connected in parallel is equipped with effective means as necessary to prevent dangerous reverse current flow (e.g. diodes, fuses, etc.);
- e) cells and batteries must be manufactured under a quality management programme that includes:
  - 1) a description of the organizational structure and responsibilities of personnel with regard to design and product quality;
  - 2) the relevant inspection and test, quality control, quality assurance, and process operation instructions that will be used;
  - 3) process controls that should include relevant activities to prevent and detect internal short circuit failure during manufacture of cells;
  - 4) quality records, such as inspection reports, test data, calibration data and certificates. Test data must be kept and made available to the appropriate national authority upon request;
  - 5) management reviews to ensure the effective operation of the quality management programme;
  - 6) a process for control of documents and their revision;

- 7) a means for control of cells or batteries that are not conforming to the type tested in accordance with Part III, subsection 38.3 of the UN *Manual of Tests and Criteria*;
- 8) training programmes and qualification procedures for relevant personnel; and
- 9) procedures to ensure that there is no damage to the final product.

*Note.— In-house quality management programmes may be accepted. Third-party certification is not required, but the procedures listed in 1) to 9) above must be properly recorded and traceable. A copy of the quality management programme must be made available to the appropriate national authority upon request.*

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