

## 2.2.51 Class 5.1 Oxidizing substances

### 2.2.51.1 Criteria

2.2.51.1.1 The heading of Class 5.1 covers substances which, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material, and articles containing such substances.

2.2.51.1.2 The substances of Class 5.1 and articles containing such substances are subdivided as follows:

O Oxidizing substances without subsidiary risk or articles containing such substances:

- O1 Liquid;
- O2 Solid;
- O3 Articles;

OF Oxidizing substances, solid, flammable;

OS Oxidizing substances, solid, self-heating;

OW Oxidizing substances, solid which, in contact with water, emit flammable gases;

OT Oxidizing substances, toxic:

- OT1 Liquid;
- OT2 Solid;

OC Oxidizing substances, corrosive:

- OC1 Liquid;
- OC2 Solid;

OTC Oxidizing substances, toxic, corrosive.

2.2.51.1.3 Substances and articles classified in Class 5.1 are listed in Table A of Chapter 3.2. The assignment of substances and articles not mentioned by name in Table A of Chapter 3.2 to the relevant entry of 2.2.51.3 in accordance with the provisions of Chapter 2.1 can be based on the tests, methods and criteria in paragraphs 2.2.51.1.6-2.2.51.1.9 below and the Manual of Tests and Criteria, Part III, Section 34.4. In the event of divergence between test results and known experience, judgement based on known experience shall take precedence over test results.

2.2.51.1.4 If substances of Class 5.1, as a result of admixtures, come into different categories of risk from those to which the substances mentioned by name in Table A of Chapter 3.2 belong, these mixtures or solutions shall be assigned to the entries to which they belong on the basis of their actual degree of danger.

***NOTE:** For the classification of solutions and mixtures (such as preparations and wastes), see also Section 2.1.3.*

2.2.51.1.5 On the basis of the test procedures in the Manual of Tests and Criteria, Part III, Section 34.4 and the criteria set out in 2.2.51.1.6 to 2.2.51.1.9 it may also be determined whether the nature of a substance mentioned by name in Table A of Chapter 3.2 is such that the substance is not subject to the provisions for this class.

### ***Oxidizing solids***

#### *Classification*

2.2.51.1.6 When oxidizing solid substances not mentioned by name in Table A of Chapter 3.2 are assigned to one of the entries listed in 2.2.51.3 on the basis of the test procedure in accordance with the Manual of Tests and Criteria, Part III, sub-section 34.4.1, the following criteria shall apply:

A solid substance shall be assigned to Class 5.1 if, in the 4:1 or the 1:1 sample-to-cellulose ratio (by mass) tested, it ignites or burns or exhibits mean burning times equal to or less than that of a 3:7 mixture (by mass) of potassium bromate and cellulose.

#### *Assignment of packing groups*

2.2.51.1.7 Oxidizing solids classified under the various entries in Table A of Chapter 3.2 shall be assigned to packing groups I, II or III on the basis of test procedures of the Manual of Tests and Criteria, Part III, sub-section 34.4.1, in accordance with the following criteria:

- (a) 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;
- (b) 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;
- (c) 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.

### ***Oxidizing liquids***

#### *Classification*

2.2.51.1.8 When oxidizing liquid substances not mentioned by name in Table A of Chapter 3.2 are assigned to one of the entries listed in sub-section 2.2.51.3 on the basis of the test procedure in accordance with the Manual of Tests and Criteria, Part III, sub-section 34.4.2, the following criteria shall apply:

A liquid substance shall be assigned to Class 5.1 if, in the 1:1 mixture, by mass, of substance and cellulose tested, it exhibits a pressure rise of 2070 kPa gauge or more and a mean pressure rise time equal to or less than the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose.

#### *Assignment of packing groups*

2.2.51.1.9 Oxidizing liquids classified under the various entries in Table A of Chapter 3.2 shall be assigned to packing groups I, II or III on the basis of test procedures of the Manual of Tests and Criteria, Part III, section 34.4.2, in accordance with the following criteria:

- (a) Packing group I: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, spontaneously ignites; or the mean pressure rise time of a 1:1 mixture, by mass, of substance and cellulose is less than that of a 1:1 mixture, by mass, of 50% perchloric acid and cellulose;
- (b) Packing group II: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40% aqueous sodium chlorate solution and cellulose; and the criteria for packing group I are not met;
- (c) Packing group III: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose; and the criteria for packing groups I and II are not met.

## **2.2.51.2** *Substances not accepted for carriage*

2.2.51.2.1 The chemically unstable substances of Class 5.1 shall not be accepted for carriage unless the necessary steps have been taken to prevent their dangerous decomposition or polymerization during carriage. To this end it shall in particular be ensured that receptacles and tanks do not contain any material liable to promote these reactions.

2.2.51.2.2 The following substances and mixtures shall not be accepted for carriage:

- oxidizing solids, self-heating, assigned to UN No. 3100, oxidizing solids, water-reactive, assigned to UN No. 3121 and oxidizing solids, flammable, assigned to UN No. 3137, unless they meet the requirements for Class 1 (see also 2.1.3.7);
- hydrogen peroxide, not stabilized or hydrogen peroxide, aqueous solutions, not stabilized containing more than 60 % hydrogen peroxide;
- tetranitromethane not free from combustible impurities;
- perchloric acid solutions containing more than 72 % (mass) acid, or mixtures of perchloric acid with any liquid other than water;
- chloric acid solution containing more than 10 % chloric acid or mixtures of chloric acid with any liquid other than water;
- halogenated fluor compounds other than UN Nos. 1745 BROMINE PENTAFLUORIDE; 1746 BROMINE TRIFLUORIDE and 2495 IODINE PENTAFLUORIDE of Class 5.1 as well as UN Nos. 1749 CHLORINE TRIFLUORIDE and 2548 CHLORINE PENTAFLUORIDE of Class 2;
- ammonium chlorate and its aqueous solutions and mixtures of a chlorate with an ammonium salt;
- ammonium chlorite and its aqueous solutions and mixtures of a chlorite with an ammonium salt;
- mixtures of a hypochlorite with an ammonium salt;
- ammonium bromate and its aqueous solutions and mixtures of a bromate with an ammonium salt;

- ammonium permanganate and its aqueous solutions and mixtures of a permanganate with an ammonium salt;
- ammonium nitrate containing more than 0.2 % combustible substances (including any organic substance calculated as carbon) unless it is a constituent of a substance or article of Class 1;
- fertilizers having an ammonium nitrate content (in determining the ammonium nitrate content, all nitrate ions for which a molecular equivalent of ammonium ions is present in the mixture shall be calculated as ammonium nitrate) or a content in combustible substances exceeding the values specified in special provision 307 except under the conditions applicable to Class 1;
- ammonium nitrite and its aqueous solutions and mixtures of an inorganic nitrite with an ammonium salt;
- mixtures of potassium nitrate, sodium nitrite and an ammonium salt.

2.2.51.3 *List of collective entries*

<b>Oxidizing substances</b>	<b>liquid</b>	<b>O1</b>	3210 CHLORATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. 3211 PERCHLORATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. 3213 BROMATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. 3214 PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. 3216 PERSULPHATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. 3218 NITRATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. 3219 NITRITES, INORGANIC, AQUEOUS SOLUTION, N.O.S. 3139 OXIDIZING LIQUID, N.O.S.
			1450 BROMATES, INORGANIC, N.O.S 1461 CHLORATES, INORGANIC, N.O.S. 1462 CHLORITES, INORGANIC, N.O.S. 1477 NITRATES, INORGANIC, N.O.S 1481 PERCHLORATES, INORGANIC, N.O.S. 1482 PERMANGANATES, INORGANIC, N.O.S. 1483 PEROXIDES, INORGANIC, N.O.S 2627 NITRITES, INORGANIC, N.O.S. 3212 HYPOCHLORITES, INORGANIC, N.O.S. 3215 PERSULPHATES, INORGANIC, N.O.S. 1479 OXIDIZING SOLID, N.O.S.
<b>Without subsidiary risk</b>	<b>solid</b>	<b>O2</b>	
<b>O</b>			
	<b>articles</b>	<b>O3</b>	3356 OXYGEN GENERATOR, CHEMICAL
<b>Solid, flammable</b>		<b>OF</b>	3137 OXIDIZING SOLID, FLAMMABLE, N.O.S. (not allowed, see 2.2.51.2)
<b>Solid, self-heating</b>		<b>OS</b>	3100 OXIDIZING SOLID, SELF-HEATING, N.O.S. (not allowed, see 2.2.51.2)
<b>Solid, water reactive</b>		<b>OW</b>	3121 OXIDIZING SOLID, WATER REACTIVE, N.O.S. (not allowed, see 2.2.51.2)
<b>Toxic</b>	<b>liquid</b>	<b>OT1</b>	3099 OXIDIZING LIQUID, TOXIC, N.O.S.
	<b>OT</b>		
	<b>solid</b>	<b>OT2</b>	3087 OXIDIZING SOLID, TOXIC, N.O.S.
<b>Corrosive</b>	<b>liquid</b>	<b>OC1</b>	3098 OXIDIZING LIQUID, CORROSIVE, N.O.S.
	<b>OC</b>		
	<b>solid</b>	<b>OC2</b>	3085 OXIDIZING SOLID, CORROSIVE, N.O.S.
<b>Toxic, corrosive</b>		<b>OTC</b>	(No collective entry with this classification code available; if need be, classification under a collective entry with a classification code to be determined according to the table of precedence of hazard in 2.1.3.9.)

## 2.2.52 Class 5.2 Organic peroxides

### 2.2.52.1 Criteria

2.2.52.1.1 The heading of Class 5.2 covers organic peroxides and formulations of organic peroxides.

2.2.52.1.2 The substances of Class 5.2 are subdivided as follows:

- P1 Organic peroxides, not requiring temperature control;
- P2 Organic peroxides, requiring temperature control.

#### *Definition*

2.2.52.1.3 *Organic peroxides* are organic substances which contain the bivalent -O-O- structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals.

#### *Properties*

2.2.52.1.4 Organic peroxides are liable to exothermic decomposition at normal or elevated temperatures. The decomposition can be initiated by heat, contact with impurities (e.g. acids, heavy-metal compounds, amines), friction or impact. The rate of decomposition increases with temperature and varies with the organic peroxide formulation. Decomposition may result in the evolution of harmful, or flammable, gases or vapours. For certain organic peroxides the temperature shall be controlled during carriage. Some organic peroxides may decompose explosively, particularly if confined. This characteristic may be modified by the addition of diluents or by the use of appropriate packagings. Many organic peroxides burn vigorously. Contact of organic peroxides with the eyes is to be avoided. Some organic peroxides will cause serious injury to the cornea, even after brief contact, or will be corrosive to the skin.

**NOTE:** Test methods for determining the flammability of organic peroxides are set out in the *Manual of Tests and Criteria, Part III, sub-section 32.4*. Because organic peroxides may react vigorously when heated, it is recommended to determine their flash-point using small sample sizes such as described in *ISO 3679:1983*.

#### *Classification*

2.2.52.1.5 Any organic peroxide shall be considered for classification in Class 5.2 unless the organic peroxide formulation contains:

- (a) Not more than 1.0 % available oxygen from the organic peroxides when containing not more than 1.0 % hydrogen peroxide;
- (b) Not more than 0.5 % available oxygen from the organic peroxides when containing more than 1.0 % but not more than 7.0 % hydrogen peroxide.

**NOTE:** The available oxygen content (%) of an organic peroxide formulation is given by the formula

$$16 \times \sum (n_i \times c_i / m_i)$$

where:

- $n_i$  = number of peroxygen groups per molecule of organic peroxide  $i$ ;
- $c_i$  = concentration (mass %) of organic peroxide  $i$ ; and
- $m_i$  = molecular mass of organic peroxide  $i$ .

2.2.52.1.6 Organic peroxides are classified into seven types according to the degree of danger they present. The types of organic peroxide range from type A, which is not accepted for carriage in the packaging in which it is tested, to type G, which is not subject to the provisions of Class 5.2. The classification of types B to F is directly related to the maximum quantity allowed in one packaging. The principles to be applied to the classification of substances not listed in 2.2.52.4 are set out in the Manual of Tests and Criteria, Part II.

2.2.52.1.7 Organic peroxides which have already been classified and are already permitted for carriage in packagings are listed in 2.2.52.4, those already permitted for carriage in IBCs are listed in 4.1.4.2, packing instruction IBC520 and those already permitted for carriage in tanks in accordance with Chapters 4.2 and 4.3 are listed in 4.2.5.2, portable tank instruction T23. Each permitted substance listed is assigned to a generic entry of Table A of Chapter 3.2 (UN Nos. 3101 to 3120) and appropriate subsidiary risks and remarks providing relevant transport information are given.

These generic entries specify:

- the type (B to F) of organic peroxide (see 2.2.52.1.6 above);
- physical state (liquid/solid); and
- temperature control (when required), see 2.2.52.1.15 to 2.2.52.1.18.

Mixtures of these formulations may be classified as the same type of organic peroxide as that of the most dangerous component and be carried under the conditions of carriage given for this type. However, as two stable components can form a thermally less stable mixture, the self-accelerating decomposition temperature (SADT) of the mixture shall be determined and, if necessary, the control and emergency temperatures derived from the SADT in accordance with 2.2.52.1.16.

2.2.52.1.8 Classification of organic peroxides, formulations or mixtures of organic peroxides not listed in 2.2.52.4, 4.1.4.2 packing instruction IBC520 or 4.2.5.2, portable tank instruction T23, and assignment to a collective entry shall be made by the competent authority of the country of origin. The statement of approval shall contain the classification and the relevant conditions of carriage. If the country of origin is not a Contracting Party to ADR, the classification and conditions of carriage shall be recognized by the competent authority of the first country Contracting Party to ADR reached by the consignment.

2.2.52.1.9 Samples of organic peroxides or formulations of organic peroxides not listed in 2.2.52.4, for which a complete set of test results is not available and which are to be carried for further testing or evaluation, shall be assigned to one of the appropriate entries for organic peroxides type C provided the following conditions are met:

- the available data indicate that the sample would be no more dangerous than organic peroxides type B;
- the sample is packaged in accordance with packing method OP2 and the quantity per transport unit is limited to 10 kg;
- the available data indicate that the control temperature, if any, is sufficiently low to prevent any dangerous decomposition and sufficiently high to prevent any dangerous phase separation.

### *Desensitization of organic peroxides*

2.2.52.1.10 In order to ensure safety during carriage, organic peroxides are in many cases desensitized by organic liquids or solids, inorganic solids or water. Where a percentage of a substance is stipulated, this refers to the percentage by mass, rounded to the nearest whole number. In general, desensitization shall be such that, in case of spillage, the organic peroxide will not concentrate to a dangerous extent.

2.2.52.1.11 Unless otherwise stated for the individual organic peroxide formulation, the following definition(s) shall apply to diluents used for desensitization:

- diluents type A are organic liquids which are compatible with the organic peroxide and which have a boiling point of not less than 150 °C. Type A diluents may be used for desensitizing all organic peroxides;
- diluents type B are organic liquids which are compatible with the organic peroxide and which have a boiling point of less than 150 °C but not less than 60 °C and a flash-point of not less than 5 °C.

Type B diluents may be used for desensitization of all organic peroxides provided that the boiling point of the liquid is at least 60 °C higher than the SADT in a 50 kg package.

2.1.52.1.12 Diluents, other than type A or type B, may be added to organic peroxide formulations as listed in 2.2.52.4 provided that they are compatible. However, replacement of all or part of a type A or type B diluent by another diluent with differing properties requires that the organic peroxide formulation be re-assessed in accordance with the normal acceptance procedure for Class 5.2.

2.2.52.1.13 Water may only be used for the desensitization of organic peroxides which are listed in 2.2.52.4 or in the competent authority decision according to 2.2.52.1.8 as being "with water" or "as a stable dispersion in water". Samples of organic peroxides or formulations of organic peroxides not listed in 2.2.52.4 may also be desensitized with water provided the requirements of 2.2.52.1.9 are met.

2.2.52.1.14 Organic and inorganic solids may be used for desensitization of organic peroxides provided that they are compatible. Compatible liquids and solids are those which have no detrimental influence on the thermal stability and hazard type of the organic peroxide formulation.

### *Temperature control requirements*

2.2.52.1.15 Certain organic peroxides may only be carried under temperature-controlled conditions. The control temperature is the maximum temperature at which the organic peroxide can be safely carried. It is assumed that the temperature of the immediate surroundings of a package only exceeds 55 °C during carriage for a relatively short time in a 24 hour period. In the event of loss of temperature control, it may be necessary to implement emergency procedures. The emergency temperature is the temperature at which such procedures shall be implemented.

2.2.52.1.16 The control and emergency temperatures are derived from the SADT which is defined as the lowest temperature at which self-accelerating decomposition may occur with a substance in the packaging as used during carriage (see Table 1). The SADT shall be determined in order to decide whether a substance shall be subjected to temperature control during carriage. Provisions for the determination of the SADT are given in the Manual of Tests and Criteria, Part II, Sections 20 and 28.4.



**Table 1: Derivation of control and emergency temperatures**

Type of receptacle	SADT <sup>a</sup>	Control temperature	Emergency temperature
Single packagings and IBCs	20 °C or less	20 °C below SADT	10 °C below SADT
	over 20 °C to 35 °C	15 °C below SADT	10 °C below SADT
	over 35 °C	10 °C below SADT	5 °C below SADT
Tanks	not greater than 50 °C	10 °C below SADT	5 °C below SADT

<sup>a</sup> *SADT of the substance as packaged for carriage*

2.2.52.1.17 The following organic peroxides shall be subject to temperature control during carriage:

- organic peroxides types B and C with an SADT ≤ 50 °C;
- organic peroxides type D showing a medium effect when heated under confinement with an SADT ≤ 50 °C or showing a low or no effect when heated under confinement with an SADT ≤ 45 °C; and
- organic peroxides types E and F with an SADT ≤ 45 °C.

**NOTE:** *Provisions for the determination of the effects of heating under confinement are given in the Manual of Tests and Criteria, Part II, Section 20 and Sub-section 28.4.*

2.2.52.1.18 Where applicable, control and emergency temperatures are listed in 2.2.52.4. The actual temperature during carriage may be lower than the control temperature but shall be selected so as to avoid dangerous separation of phases.

#### **2.2.52.2 Substances not accepted for carriage**

Organic peroxides, type A, shall not be accepted for carriage under the provisions of Class 5.2 (see Manual of Tests and Criteria, Part II, paragraph 20.4.3 (a)).

**2.2.52.3** *List of collective entries*

<b>Organic peroxides</b>		ORGANIC PEROXIDE TYPE A, LIQUID	} Not accepted for carriage, see 2.2.52.2	
		ORGANIC PEROXIDE TYPE A, SOLID		
		3101 ORGANIC PEROXIDE TYPE B, LIQUID		
		3102 ORGANIC PEROXIDE TYPE B, SOLID		
		3103 ORGANIC PEROXIDE TYPE C, LIQUID		
		3104 ORGANIC PEROXIDE TYPE C, SOLID		
	<b>Not requiring temperature control</b>	<b>P1</b>	3105 ORGANIC PEROXIDE TYPE D, LIQUID	
			3106 ORGANIC PEROXIDE TYPE D, SOLID	
			3107 ORGANIC PEROXIDE TYPE E, LIQUID	
			3108 ORGANIC PEROXIDE TYPE E, SOLID	
			3109 ORGANIC PEROXIDE TYPE F, LIQUID	
		3110 ORGANIC PEROXIDE TYPE F, SOLID		
		ORGANIC PEROXIDE TYPE G, LIQUID	} Not subject to the provisions applicable to Class 5.2, see 2.2.52.1.6	
		ORGANIC PEROXIDE TYPE G, SOLID		
<b>Requiring temperature control</b>	<b>P2</b>	3111 ORGANIC PEROXIDE TYPE B, LIQUID, TEMPERATURE CONTROLLED		
		3112 ORGANIC PEROXIDE TYPE B, SOLID, TEMPERATURE CONTROLLED		
		3113 ORGANIC PEROXIDE TYPE C, LIQUID, TEMPERATURE CONTROLLED		
		3114 ORGANIC PEROXIDE TYPE C, SOLID, TEMPERATURE CONTROLLED		
		3115 ORGANIC PEROXIDE TYPE D, LIQUID, TEMPERATURE CONTROLLED		
		3116 ORGANIC PEROXIDE TYPE D, SOLID, TEMPERATURE CONTROLLED		
		3117 ORGANIC PEROXIDE TYPE E, LIQUID, TEMPERATURE CONTROLLED		
		3118 ORGANIC PEROXIDE TYPE E, SOLID, TEMPERATURE CONTROLLED		
		3119 ORGANIC PEROXIDE TYPE F, LIQUID, TEMPERATURE CONTROLLED		
		3120 ORGANIC PEROXIDE TYPE F, SOLID, TEMPERATURE CONTROLLED		

**2.2.52.4** *List of currently assigned organic peroxides in packagings*

In the column "Packing Method", codes "OP1" to "OP8" refer to packing methods in 4.1.4.1, packing instruction P520 (see also 4.1.7.1). Organic peroxides to be carried shall fulfil the classification and the control and emergency temperatures (derived from the SADT) as listed. For substances permitted in IBCs, see 4.1.4.2, packing instruction IBC520 and, for those permitted in tanks according to Chapters 4.2 and 4.3, see 4.2.5.2, portable tank instruction T23.

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
ACETYL ACETONE PEROXIDE	≤ 42	≥ 48			≥ 8	OP7			3105	2)
"	≤ 32 as a paste					OP7			3106	20)
ACETYL CYCLOHEXANESULPHONYL PEROXIDE	≤ 82				≥ 12	OP4	-10	0	3112	3)
"	≤ 32		≥ 68			OP7	-10	0	3115	
tert-AMYL HYDROPEROXIDE	≤ 88	≥ 6			≥ 6	OP8			3107	
tert-AMYL PEROXYACETATE	≤ 62	≥ 38				OP7			3105	
tert-AMYL PEROXYBENZOATE	≤ 100					OP5			3103	
tert-AMYL PEROXY-2-ETHYLHEXANOATE	≤ 100					OP7	+20	+25	3115	
tert-AMYL PEROXY-2-ETHYLHEXYL CARBONATE	≤ 100					OP7			3105	
tert-AMYL PEROXY ISOPROPYL CARBONATE	≤ 77	≥ 23				OP5			3103	
tert-AMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7	0	+10	3115	
tert-AMYL PEROXYPIVALATE	≤ 77		≥ 23			OP5	+10	+15	3113	
tert-AMYLPEROXY-3,5,5-TRIMETHYLHEXANOATE	≤ 100					OP5			3101	3)
tert-BUTYL CUMYL PEROXIDE	> 42 - 100					OP8			3107	
"	≤ 52			≥ 48		OP8			3108	
n-BUTYL-4,4-DI-(tert-BUTYLPEROXY)VALERATE	> 52 - 100					OP5			3103	
"	≤ 52			≥ 48		OP8			3108	
tert-BUTYL HYDROPEROXIDE	>79 - 90				≥ 10	OP5			3103	13)
"	≤ 80	≥ 20				OP7			3105	4) 13)
"	≤ 79				> 14	OP8			3107	13) 23)
"	≤ 72				≥ 28	OP8			3109	13)
tert-BUTYL HYDROPEROXIDE + DI-tert-BUTYLPEROXIDE	< 82 + >9				≥ 7	OP5			3103	13)
tert-BUTYL MONOPEROXYMALEATE	> 52 - 100					OP5			3102	3)
"	≤ 52	≥ 48				OP6			3103	
"	≤ 52			≥ 48		OP8			3108	
"	≤ 52 as a paste					OP8			3108	
tert-BUTYL PEROXYACETATE	> 52 - 77	≥ 23				OP5			3101	3)
"	> 32 - 52	≥ 48				OP6			3103	
"	≤ 32		≥ 68			OP8			3109	
tert-BUTYL PEROXYBENZOATE	> 77 - 100					OP5			3103	
"	> 52 - 77	≥ 23				OP7			3105	
"	≤ 52			≥ 48		OP7			3106	

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
tert-BUTYL PEROXYBUTYL FUMARATE	≤ 52	≥ 48				OP7			3105	
tert-BUTYL PEROXYCROTONATE	≤ 77	≥ 23				OP7			3105	
tert-BUTYL PEROXYDIETHYLACETATE	≤ 100					OP5	+20	+25	3113	
tert-BUTYL PEROXY-2-ETHYLHEXANOATE	> 52 – 100					OP6	+20	+25	3113	
"	> 32 - 52		≥ 48			OP8	+30	+35	3117	
"	≤ 52			≥ 48		OP8	+20	+25	3118	
"	≤ 32		≥ 68			OP8	+40	+45	3119	
tert-BUTYL PEROXY-2-ETHYLHEXANOATE + 2,2-DI-(tert-BUTYLPEROXY)BUTANE	≤ 12 + ≤ 14	≥ 14		≥ 60		OP7			3106	
"	≤ 31 + ≤ 36		≥ 33			OP7	+35	+40	3115	
tert-BUTYL PEROXY-2-ETHYLHEXYLCARBONATE	≤ 100					OP7			3105	
tert-BUTYL PEROXYISOBUTYRATE	> 52 - 77		≥ 23			OP5	+15	+20	3111	3)
"	≤ 52		≥ 48			OP7	+15	+20	3115	
tert-BUTYLPEROXY ISOPROPYLCARBONATE	≤ 77	≥ 23				OP5			3103	
1-(2-tert-BUTYLPEROXY ISOPROPYL)-3-ISOPROPENYLBENZENE	≤ 77	≥ 23				OP7			3105	
"	≤ 42			≥ 58		OP8			3108	
tert-BUTYL PEROXY-2-METHYLBENZOATE	≤ 100					OP5			3103	
tert-BUTYL PEROXYNEODECANOATE	> 77 - 100					OP7	-5	+5	3115	
"	≤ 77	≥ 23				OP7	0	+10	3115	
"	≤ 52 as a stable dispersion in water					OP8	0	+10	3119	
"	≤ 42 as a stable dispersion in water (frozen)					OP8	0	+10	3118	
"	≤ 32	≥ 68				OP8	0	+10	3119	
tert-BUTYL PEROXYNEOHEPTANOATE	≤ 77	≥ 23				OP7	0	+10	3115	
"	≤ 42 as a stable dispersion in water					OP8	0	+10	3117	
tert-BUTYL PEROXYPIVALATE	> 67 - 77	≥ 23				OP5	0	+10	3113	
"	> 27 - 67		≥ 33			OP7	0	+10	3115	
"	≤ 27		≥ 73			OP8	+30	+35	3119	
tert-BUTYLPEROXY STEARYLCARBONATE	≤ 100					OP7			3106	
tert-BUTYL PEROXY-3,5,5-TRIMETHYLHEXANOATE	> 32 - 100					OP7			3105	
"	≤ 32		≥ 68			OP8			3109	

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
3-CHLOROPEROXYBENZOIC ACID	> 57 - 86			≥ 14		OP1			3102	3)
"	≤ 57			≥ 3	≥ 40	OP7			3106	
"	≤ 77			≥ 6	≥ 17	OP7			3106	
CUMYL HYDROPEROXIDE	> 90 - 98	≤ 10				OP8			3107	13)
"	≤ 90	≥ 10				OP8			3109	13) 18)
CUMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7	-10	0	3115	
"	≤ 52 as a stable dispersion in water					OP8	-10	0	3119	
CUMYL PEROXYNEOHEPTANOATE	≤ 77	≥ 23				OP7	-10	0	3115	
CUMYL PEROXYPIVALATE	≤ 77		≥ 23			OP7	-5	+5	3115	
CYCLOHEXANONE PEROXIDE(S)	≤ 91				≥ 9	OP6			3104	13)
"	≤ 72	≥ 28				OP7			3105	5)
"	≤ 72 as a paste					OP7			3106	5) 20)
"	≤ 32			≥ 68					Exempt	29)
DIACETONE ALCOHOL PEROXIDES	≤ 57		≥ 26		≥ 8	OP7	+40	+45	3115	6)
DIACETYL PEROXIDE	≤ 27		≥ 73			OP7	+20	+25	3115	7) 13)
DI-tert-AMYL PEROXIDE	≤ 100					OP8			3107	
1,1-DI-(tert-AMYLPEROXY)CYCLOHEXANE	≤ 82	≥ 18				OP6			3103	
DIBENZOYL PEROXIDE	> 51 - 100			≤ 48		OP2			3102	3)
"	> 77 - 94				≥ 6	OP4			3102	3)
"	≤ 77				≥ 23	OP6			3104	
"	≤ 62			≥ 28	≥ 10	OP7			3106	
"	> 52 – 62 as a paste					OP7			3106	20)
"	> 35 - 52			≥ 48		OP7			3106	
"	> 36 - 42	≥ 18			≤ 40	OP8			3107	
"	≤ 56.5 as a paste				≥ 15	OP8			3108	
"	≤ 52 as a paste					OP8			3108	20)
"	≤ 42 as a stable dispersion in water					OP8			3109	
"	≤ 35			≥ 65					Exempt	29)
DI-(4-tert-BUTYLCYCLOHEXYL) PEROXYDICARBONATE	≤ 100					OP6	+30	+35	3114	
"	≤ 42 as a stable dispersion in water					OP8	+30	+35	3119	

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
DI-tert-BUTYL PEROXIDE	> 52 - 100					OP8			3107	
"	≤ 52		≥ 48			OP8			3109	25)
DI-tert-BUTYL PEROXYAZELATE	≤ 52	≥ 48				OP7			3105	
2,2-DI-(tert-BUTYLPEROXY)BUTANE	≤ 52	≥ 48				OP6			3103	
1,1-DI-(tert-BUTYLPEROXY) CYCLOHEXANE	> 80 - 100					OP5			3101	3)
"	> 52 - 80	≥ 20				OP5			3103	
"	> 42 - 52	≥ 48				OP7			3105	
"	≤ 42	≥ 13		≥ 45		OP7			3106	
"	≤ 42	≥ 58				OP8			3109	
"	≤ 27	≥ 25				OP8			3107	21)
"	≤ 13	≥ 13	≥ 74			OP8			3109	
DI-n-BUTYL PEROXYDICARBONATE	> 27 - 52		≥ 48			OP7	-15	-5	3115	
"	≤ 27		≥ 73			OP8	-10	0	3117	
"	≤ 42 as a stable dispersion in water (frozen)					OP8	-15	-5	3118	
DI-sec-BUTYL PEROXYDICARBONATE	> 52 - 100					OP4	-20	-10	3113	
"	≤ 52		≥ 48			OP7	-15	-5	3115	
1,6-Di-(tert-BUTYLPEROXY-CARBONYLOXY) HEXANE	≤ 72	≥ 28				OP5			3103	
DI-(2-tert-BUTYLPEROXYISOPROPYL)BENZENE(S)	> 42 - 100			≤ 57		OP7			3106	
"	≤ 42			≥ 58					Exempt	29)
DI-(tert-BUTYLPEROXY) PHTHALATE	> 42 - 52	≥ 48				OP7			3105	
"	≤ 52 as a paste					OP7			3106	20)
"	≤ 42	≥ 58				OP8			3107	
2,2-DI-(tert-BUTYLPEROXY)PROPANE	≤ 52	≥ 48				OP7			3105	
"	≤ 42	≥ 13		≥ 45		OP7			3106	
1,1-DI-(tert-BUTYLPEROXY)-3,3,5-TRIMETHYLCYCLOHEXANE	> 90 - 100					OP5			3101	3)
"	> 57 - 90	≥ 10				OP5			3103	
"	≤ 77		≥ 23			OP5			3103	
"	≤ 57			≥ 43		OP8			3110	
"	≤ 57	≥ 43				OP8			3107	
"	≤ 32	≥ 26	≥ 42			OP8			3107	

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
DICETYL PEROXYDICARBONATE	≤ 100					OP7	+30	+35	3116	
"	≤ 42 as a stable dispersion in water					OP8	+30	+35	3119	
DI-4-CHLOROBENZOYL PEROXIDE	≤ 77				≥ 23	OP5			3102	3)
"	≤ 52 as a paste					OP7			3106	20)
"	≤ 32			≥ 68					Exempt	29)
DICUMYL PEROXIDE	> 52 - 100			≤ 57		OP8			3110	12)
"	≤ 52			≥ 48					Exempt	29)
DICYCLOHEXYL PEROXYDICARBONATE	> 91 - 100					OP3	+10	+15	3112	3)
"	≤ 91				≥ 9	OP5	+10	+15	3114	
"	≤ 42 as a stable dispersion in water					OP8	+15	+20	3119	
DIDECANOYL PEROXIDE	≤ 100					OP6	+30	+35	3114	
2,2-DI-(4,4-DI (tert-BUTYLPEROXY) CYCLOHEXYL) PROPANE	≤ 42			≥ 58		OP7			3106	
"	≤ 22		≥ 78			OP8			3107	
DI-2,4-DICHLOROBENZOYL PEROXIDE	≤ 77				≥ 23	OP5			3102	3)
"	≤ 52 as a paste with silicon oil					OP7			3106	
DI-(2-ETHOXYETHYL) PEROXYDICARBONATE	≤ 52		≥ 48			OP7	-10	0	3115	
1-(2-ETHYLHEXANOYLPEROXY)-1,3-DIMETHYLBUTYL PEROXYPIVALATE	≤ 52	≥ 45	≥ 10			OP7	-20	-10	3115	
DI-(2-ETHYLHEXYL) PEROXYDICARBONATE	> 77 - 100					OP5	-20	-10	3113	
"	≤ 77		≥ 23			OP7	-15	-5	3115	
"	≤ 62 as a stable dispersion in water					OP8	-15	-5	3117	
"	≤ 52 as a stable dispersion in water					OP8	-15	-5	3119	
"	≤ 52 as a stable dispersion in water (frozen)					OP8	-15	-5	3120	
2,2-DIHYDROPEROXYPROPANE	≤ 27			≥ 73		OP5			3102	3)
DI-(1-HYDROXYCYCLOHEXYL) PEROXIDE	≤ 100					OP7			3106	
DIISOBUTYRYL PEROXIDE	> 32 - 52		≥ 48			OP5	-20	-10	3111	3)
"	≤ 32		≥ 68			OP7	-20	-10	3115	

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
DIISOPROPYLBENZENE DIHYDROPEROXIDE	≤ 82	≥ 5			≥ 5	OP7			3106	24)
DIISOPROPYL PEROXYDICARBONATE	> 52-100					OP2	-15	-5	3112	3)
"	≤ 52		≥ 48			OP7	-20	-10	3115	
"	≤ 28	≥ 72				OP7	-15	-5	3115	
DILAUROYL PEROXIDE	≤ 100					OP7			3106	
"	≤ 42 as a stable dispersion in water					OP8			3109	
DI-(3-METHOXYBUTYL) PEROXYDICARBONATE	≤ 52		≥ 48			OP7	-5	+5	3115	
DI-(2-METHYLBENZOYL) PEROXIDE	≤ 87				≥ 13	OP5	+30	+35	3112	3)
DI-(3-METHYLBENZOYL) PEROXIDE + BENZOYL (3-METHYLBENZOYL) PEROXIDE + DIBENZOYL PEROXIDE	≤ 20 + ≤ 18 + ≤ 4		≥ 58			OP7	+35	+40	3115	
DI-(4-METHYLBENZOYL) PEROXIDE	≤ 52 as a paste with silicon oil					OP7			3106	
2,5-DIMETHYL-2,5-DI-(BENZOYLPEROXY)HEXANE	> 82-100					OP5			3102	3)
"	≤ 82			≥ 18		OP7			3106	
"	≤ 82				≥ 18	OP5			3104	
2,5-DIMETHYL-2,5-DI-(tert-BUTYLPEROXY)HEXANE	> 52 – 100					OP7			3105	
"	≤ 47 as a paste					OP8			3108	
"	≤ 52	≥ 48				OP8			3109	
"	≤ 77			≥ 23		OP8			3108	
2,5-DIMETHYL-2,5-DI-(tert-BUTYLPEROXY)HEXYNE-3	> 86-100					OP5			3101	3)
"	>52-86	≥ 14				OP5			3103	26)
"	≤ 52			≥ 48		OP7			3106	
2,5-DIMETHYL-2,5-DI-(2-ETHYLHEXANOYLPEROXY)HEXANE	≤ 100					OP5	+20	+25	3113	
2,5-DIMETHYL-2,5-DIHYDROPEROXYHEXANE	≤ 82				≥ 18	OP6			3104	
2,5-DIMETHYL-2,5-DI-(3,5,5-TRIMETHYLHEXANOYLPEROXY)HEXANE	≤ 77	≥ 23				OP7			3105	
1,1-DIMETHYL-3-HYDROXYBUTYL PEROXYNEOHEPTANOATE	≤ 52	≥ 48				OP8	0	+10	3117	
DIMYRISTYL PEROXYDICARBONATE	≤ 100					OP7	+20	+25	3116	
"	≤ 42 as a stable dispersion in water					OP8	+20	+25	3119	



ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
DI-(2-NEODECANOYLPEROXYISOPROPYL) BENZENE	≤ 52	≥ 48				OP7	-10	0	3115	
DI-n-NONANOYL PEROXIDE	≤ 100					OP7	0	+10	3116	
DI-n-OCTANOYL PEROXIDE	≤ 100					OP5	+10	+15	3114	
DI-(2-PHENOXYETHYL) PEROXYDICARBONATE	>85-100					OP5			3102	3)
"	≤ 85				≥ 15	OP7			3106	
DIPROPIONYL PEROXIDE	≤ 27		≥ 73			OP8	+15	+20	3117	
DI-n-PROPYL PEROXYDICARBONATE	≤ 100					OP3	-25	-15	3113	
"	≤ 77		≥ 23			OP5	-20	-10	3113	
DISUCCINIC ACID PEROXIDE	> 72-100					OP4			3102	3) 17)
"	≤ 72				≥ 28	OP7	+10	+15	3116	
DI-(3,5,5-TRIMETHYLHEXANOYL) PEROXIDE	> 38-82	≥ 18				OP7	0	+10	3115	
"	≤ 52 as a stable dispersion in water					OP8	+10	+15	3119	
"	≤ 38	≥ 62				OP8	+20	+25	3119	
ETHYL 3,3-DI-(tert-AMYLPEROXY)BUTYRATE	≤ 67	≥ 33				OP7			3105	
ETHYL 3,3-DI-(tert-BUTYLPEROXY)BUTYRATE	> 77 - 100					OP5			3103	
"	≤ 77	≥ 23				OP7			3105	
"	≤ 52			≥ 48		OP7			3106	
tert-HEXYL PEROXYNEODECANOATE	≤ 71	≥ 29				OP7	0	+10	3115	
tert-HEXYL PEROXYPIVALATE	≤ 72		≥ 28			OP7	+10	+15	3115	
ISOPROPYL sec-BUTYL PEROXYDICARBONATE +DI-sec-BUTYL PEROXYDICARBONATE +DI-ISOPROPYL PEROXYDICARBONATE	≤ 32 + ≤ 15 – 18 ≤ 12 – 15	≥ 38				OP7	-20	-10	3115	
"	≤ 52 + ≤ 28 + ≤ 22					OP5	-20	-10	3111	3)
ISOPROPYLCUMYL HYDROPEROXIDE	≤ 72	≥ 28				OP8			3109	13)
p-MENTHYL HYDROPEROXIDE	> 72 - 100					OP7			3105	13)
"	≤ 72	≥ 28				OP8			3109	27)
METHYLCYCLOHEXANONE PEROXIDE(S)	≤ 67		≥ 33			OP7	+35	+40	3115	
METHYL ETHYL KETONE PEROXIDE(S)	see remark 8)	≥ 48				OP5			3101	3) 8) 13)
"	see remark 9)	≥ 55				OP7			3105	9)
"	see remark 10)	≥ 60				OP8			3107	10)
METHYL ISOBUTYL KETONE PEROXIDE(S)	≤ 62	≥ 19				OP7			3105	22)

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%)	Inert solid (%)	Water	Packing Method	Control temperature (°C)	Emergency temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
ORGANIC PEROXIDE, LIQUID, SAMPLE						OP2			3103	11)
ORGANIC PEROXIDE, LIQUID, SAMPLE, TEMPERATURE CONTROLLED						OP2			3113	11)
ORGANIC PEROXIDE, SOLID, SAMPLE						OP2			3104	11)
ORGANIC PEROXIDE, SOLID, SAMPLE, TEMPERATURE CONTROLLED						OP2			3114	11)
PEROXYACETIC ACID, TYPE D, stabilized	≤ 43					OP7			3105	13) 14) 19)
PEROXYACETIC ACID, TYPE E, stabilized	≤ 43					OP8			3107	13) 15) 19)
PEROXYACETIC ACID, TYPE F, stabilized	≤ 43					OP8			3109	13) 16) 19)
PEROXYLAURIC ACID	≤ 100					OP8	+35	+40	3118	
PINANYL HYDROPEROXIDE	> 56 – 100					OP7			3105	13)
"	≤ 56	≥ 44				OP8			3109	
POLYETHER POLY-tert-BUTYLPEROXY-CARBONATE	≤ 52		≥ 48			OP8			3107	
1,1,3,3-TETRAMETHYLBUTYL HYDROPEROXIDE	≤ 100					OP7			3105	
1,1,3,3-TETRAMETHYLBUTYL PEROXY-2 ETHYLHEXANOATE	≤ 100					OP7	+15	+20	3115	
1,1,3,3- TETRAMETHYLBUTYL PEROXYNEODECANOATE	≤ 72		≥ 28			OP7	-5	+5	3115	
"	≤ 52 as a stable dispersion in water					OP8	-5	+5	3119	
1,1,3,3-TETRAMETHYLBUTYL PEROXYPIVALATE	≤ 77	≥ 23				OP7	0	+10	3115	
3,6,9-TRIETHYL-3,6,9-TRIMETHYL-1,4,7 TRIPEROXONANE	≤ 42	≥ 58				OP7			3105	28)

**Remarks (refer to the last column of the Table in 2.2.52.4):**

- 1) Diluent type B may always be replaced by diluent type A. The boiling point of diluent type B shall be at least 60°C higher than the SADT of the organic peroxide.
- 2) Available oxygen  $\leq 4.7\%$ .
- 3) "EXPLOSIVE" subsidiary risk label required (Model No.1, see 5.2.2.2.2).
- 4) Diluent may be replaced by di-tert-butyl peroxide.
- 5) Available oxygen  $\leq 9\%$ .
- 6) With  $\leq 9\%$  hydrogen peroxide; available oxygen  $\leq 10\%$ .
- 7) Only non-metallic packagings allowed.
- 8) Available oxygen  $> 10\%$  and  $\leq 10.7\%$ , with or without water.
- 9) Available oxygen  $\leq 10\%$ , with or without water.
- 10) Available oxygen  $\leq 8.2\%$ , with or without water.
- 11) See 2.2.52.1.9.
- 12) Up to 2000 kg per receptacle assigned to ORGANIC PEROXIDE TYPE F on the basis of large scale trials.
- 13) "CORROSIVE" subsidiary risk label required (Model No.8, see 5.2.2.2.2).
- 14) Peroxyacetic acid formulations which fulfil the criteria of the Manual of Tests and Criteria, paragraph 20.4.3 (d).
- 15) Peroxyacetic acid formulations which fulfil the criteria of the Manual of Tests and Criteria, paragraph 20.4.3 (e).
- 16) Peroxyacetic acid formulations which fulfil the criteria of the Manual of Tests and Criteria, paragraph 20.4.3 (f).
- 17) Addition of water to this organic peroxide will decrease its thermal stability.
- 18) No "CORROSIVE" subsidiary risk label (Model No.8, see 5.2.2.2.2) required for concentrations below 80%.
- 19) Mixtures with hydrogen peroxide, water and acid(s).
- 20) With diluent type A, with or without water.
- 21) With  $\geq 25\%$  diluent type A by mass, and in addition ethylbenzene.
- 22) With  $\geq 19\%$ , diluent type A by mass, and in addition methyl isobutyl ketone.
- 23) With  $< 6\%$  di-tert-butyl peroxide.
- 24) With  $\leq 8\%$  1-isopropylhydroperoxy-4-isopropylhydroxybenzene.
- 25) Diluent type B with boiling point  $> 110\text{ }^{\circ}\text{C}$ .
- 26) With  $< 0.5\%$  hydroperoxides content.
- 27) For concentrations more than 56%, "CORROSIVE" subsidiary risk label required (Model No.8, see 5.2.2.2.2).
- 28) Available active oxygen  $\leq 7.6\%$  in diluent type A having a 95% boil-off point in the range of 200 - 260 °C.
- 29) Not subject to the requirements of ADR for Class 5.2.

**2.2.61 Class 6.1 Toxic substances**

**2.2.61.1 Criteria**

2.2.61.1.1 The heading of Class 6.1 covers substances of which it is known by experience or regarding which it is presumed from experiments on animals that in relatively small quantities they are able by a single action or by action of short duration to cause damage to human health, or death, by inhalation, by cutaneous absorption or by ingestion.

2.2.61.1.2 Substances of Class 6.1 are subdivided as follows:

T Toxic substances without subsidiary risk:

- T1 Organic, liquid;
- T2 Organic, solid;
- T3 Organometallic substances;
- T4 Inorganic, liquid;
- T5 Inorganic, solid;
- T6 Liquid, used as pesticides;
- T7 Solid, used as pesticides;
- T8 Samples;
- T9 Other toxic substances;

TF Toxic substances, flammable:

- TF1 Liquid;
- TF2 Liquid, used as pesticides;
- TF3 Solid;

TS Toxic substances, self-heating, solid;

TW Toxic substances, which, in contact with water, emit flammable gases:

- TW1 Liquid;
- TW2 Solid;

TO Toxic substances, oxidizing:

- TO1 Liquid;
- TO2 Solid;

TC Toxic substances, corrosive:

- TC1 Organic, liquid;
- TC2 Organic, solid;
- TC3 Inorganic, liquid;
- TC4 Inorganic, solid;

TFC Toxic substances, flammable, corrosive.

## Definitions

### 2.2.61.1.3 For the purposes of ADR:

*LD<sub>50</sub> (median lethal dose) for acute oral toxicity* is the statistically derived single dose of a substance that can be expected to cause death within 14 days in 50 per cent of young adult albino rats when administered by the oral route. The LD<sub>50</sub> value is expressed in terms of mass of test substance per mass of test animal (mg/kg);

*LD<sub>50</sub> for acute dermal toxicity* is that dose of the substance which, administered by continuous contact for 24 hours with the bare skin of albino rabbits, is most likely to cause death within 14 days in one half of the animals tested. The number of animals tested shall be sufficient to give a statistically significant result and be in conformity with good pharmacological practice. The result is expressed in milligrams per kg body mass;

*LC<sub>50</sub> for acute toxicity on inhalation* is that concentration of vapour, mist or dust which, administered by continuous inhalation to both male and female young adult albino rats for one hour, is most likely to cause death within 14 days in one half of the animals tested. A solid substance shall be tested if at least 10% (by mass) of its total mass is likely to be dust in a respirable range, e.g. the aerodynamic diameter of that particle-fraction is 10 µm or less. A liquid substance shall be tested if a mist is likely to be generated in a leakage of the transport containment. Both for solid and liquid substances more than 90% (by mass) of a specimen prepared for inhalation toxicity shall be in the respirable range as defined above. The result is expressed in milligrams per litre of air for dusts and mists or in millilitres per cubic metre of air (parts per million) for vapours.

### *Classification and assignment of packing groups*

### 2.2.61.1.4 Substances of Class 6.1 shall be classified in three packing groups according to the degree of danger they present for carriage, as follows:

Packing group I:	highly toxic substances
Packing group II:	toxic substances
Packing group III:	slightly toxic substances.

### 2.2.61.1.5 Substances, mixtures, solutions and articles classified in Class 6.1 are listed in Table A of Chapter 3.2. The assignment of substances, mixtures and solutions not mentioned by name in Table A of Chapter 3.2 to the relevant entry of sub-section 2.2.61.3 and to the relevant packing group in accordance with the provisions of Chapter 2.1, shall be made according to the following criteria in 2.2.61.1.6 to 2.2.61.1.11.

### 2.2.61.1.6 To assess the degree of toxicity, account shall be taken of human experience of instances of accidental poisoning, as well as special properties possessed by any individual substances: liquid state, high volatility, any special likelihood of cutaneous absorption, and special biological effects.

2.2.61.1.7 In the absence of observations on humans, the degree of toxicity shall be assessed using the available data from animal experiments in accordance with the table below:

	Packing group	Oral toxicity LD <sub>50</sub> (mg/kg)	Dermal toxicity LD <sub>50</sub> (mg/kg)	Toxicity on inhalation of dusts and mists LC <sub>50</sub> (mg/l)
Highly toxic	I	≤ 5	≤ 40	≤ 0.5
Toxic	II	> 5-50	> 40 - 200	> 0.5-2
Slightly toxic	III <sup>a</sup>	solids: > 50-200 liquids: > 50-500	> 200 - 1000	> 2-10

<sup>a</sup> *Tear gas substances shall be included in packing group II even if data concerning their toxicity correspond to packing group III criteria.*

2.2.61.1.7.1 Where a substance exhibits different degrees of toxicity for two or more kinds of exposure, it shall be classified under the highest such degree of toxicity.

2.2.61.1.7.2 Substances meeting the criteria of Class 8 and with an inhalation toxicity of dusts and mists (LC<sub>50</sub>) leading to packing group I shall only be accepted for an allocation to Class 6.1 if the toxicity through oral ingestion or dermal contact is at least in the range of packing groups I or II. Otherwise an assignment to Class 8 shall be made if appropriate (see 2.2.8.1.5).

2.2.61.1.7.3 The criteria for inhalation toxicity of dusts and mists are based on LC<sub>50</sub> data relating to 1-hour exposure, and where such information is available it shall be used. However, where only LC<sub>50</sub> data relating to 4-hour exposure are available, such figures can be multiplied by four and the product substituted in the above criteria, i.e. LC<sub>50</sub> value multiplied by four (4 hour) is considered the equivalent of LC<sub>50</sub> (1 hour).

*Inhalation toxicity of vapours*

2.2.61.1.8 Liquids giving off toxic vapours shall be classified into the following groups where "V" is the saturated vapour concentration (in ml/m<sup>3</sup> of air) (volatility) at 20 °C and standard atmospheric pressure:

	Packing group	
Highly toxic	I	Where $V \geq 10 LC_{50}$ and $LC_{50} \leq 1\ 000\ \text{ml/m}^3$
Toxic	II	Where $V \geq LC_{50}$ and $LC_{50} \leq 3\ 000\ \text{ml/m}^3$ and the criteria for packing group I are not met
Slightly toxic	III <sup>a</sup>	Where $V \geq 1/5 LC_{50}$ and $LC_{50} \leq 5\ 000\ \text{ml/m}^3$ and the criteria for packing groups I and II are not met

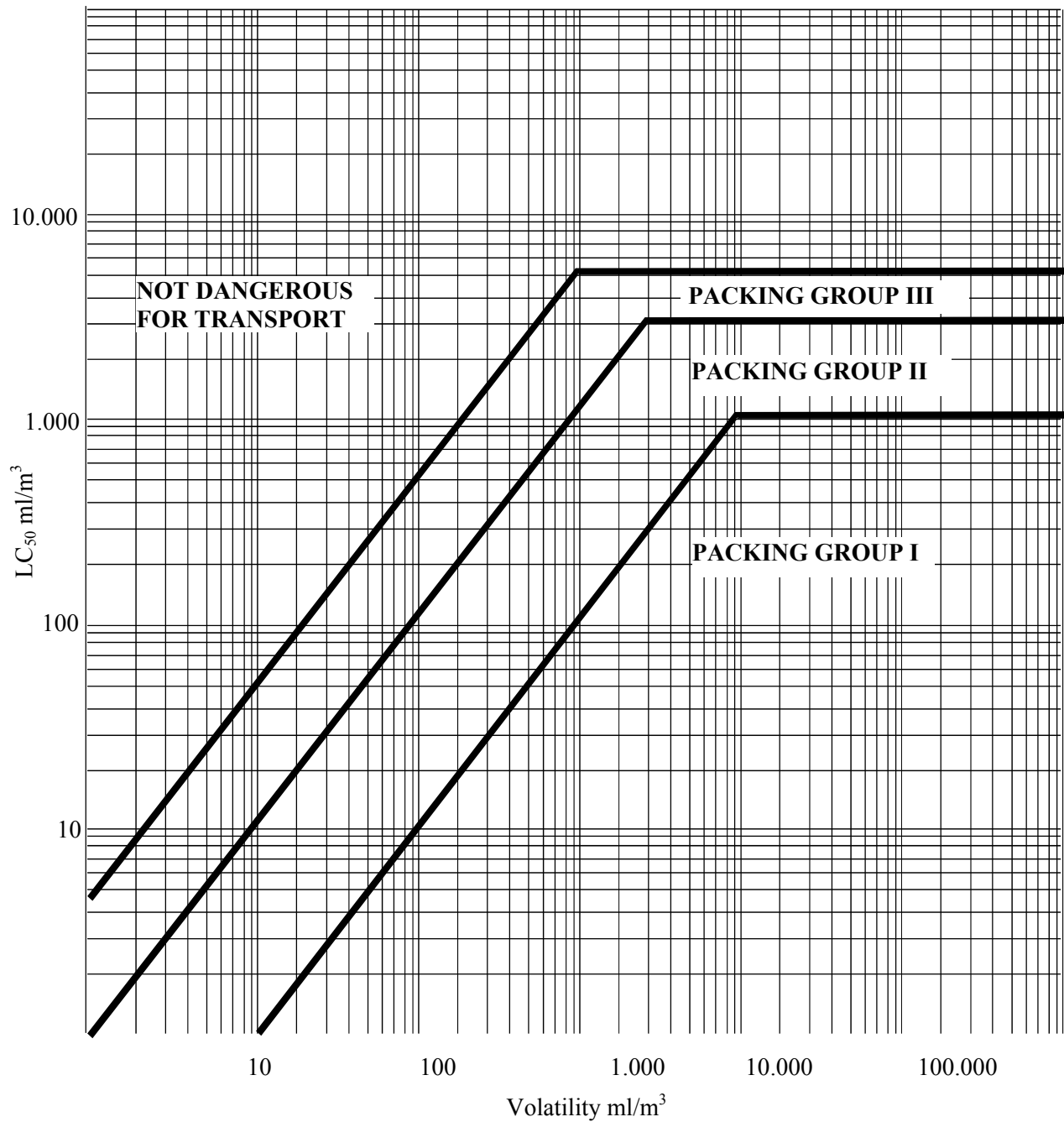
<sup>a</sup> *Tear gas substances shall be included in packing group II even if data concerning their toxicity correspond to packing group III criteria.*

These criteria for inhalation toxicity of vapours are based on LC<sub>50</sub> data relating to 1-hour exposure, and where such information is available, it shall be used.

However, where only LC<sub>50</sub> data relating to 4-hour exposure to the vapours are available, such figures can be multiplied by two and the product substituted in the above criteria, i.e. LC<sub>50</sub> (4 hour) × 2 is considered the equivalent of LC<sub>50</sub> (1 hour).

In this figure, the criteria are expressed in graphical form, as an aid to easy classification. However, due to approximations inherent in the use of graphs, substances falling on or near group borderlines shall be checked using numerical criteria.

### GROUP BORDERLINES INHALATION TOXICITY OF VAPOURS



*Mixtures of liquids*

2.2.61.1.9 Mixtures of liquids which are toxic on inhalation shall be assigned to packing groups according to the following criteria:

2.2.61.1.9.1 If  $LC_{50}$  is known for each of the toxic substances constituting the mixture, the packing group may be determined as follows:

(a) calculation of the  $LC_{50}$  of the mixture:

$$LC_{50} (\text{mixture}) = \frac{1}{\sum_{i=1}^n \frac{f_i}{LC_{50i}}}$$

where  $f_i$  = molar fraction of constituent  $i$  of the mixture;

$LC_{50i}$  = average lethal concentration of constituent  $i$  in  $\text{ml/m}^3$ .

(b) calculation of volatility of each mixture constituent:

$$V_i = P_i \times \frac{10^6}{101.3} (\text{ml/m}^3)$$

where  $P_i$  = partial pressure of constituent  $i$  in kPa at 20 °C and at standard atmospheric pressure.

(c) calculation of the ratio of volatility to  $LC_{50}$ :

$$R = \sum_{i=1}^n \frac{V_i}{LC_{50i}}$$

(d) the values calculated for  $LC_{50}$  (mixture) and  $R$  are then used to determine the packing group of the mixture:

Packing group I  $R \geq 10$  and  $LC_{50}$  (mixture)  $\leq 1\,000 \text{ ml/m}^3$ ;

Packing group II  $R \geq 1$  and  $LC_{50}$  (mixture)  $\leq 3\,000 \text{ ml/m}^3$ , if the mixture does not meet the criteria for packing group I;

Packing group III  $R \geq 1/5$  and  $LC_{50}$  (mixture)  $\leq 5\,000 \text{ ml/m}^3$ , if the mixture does not meet the criteria of packing groups I or II.

2.2.61.1.9.2 In the absence of  $LC_{50}$  data on the toxic constituent substances, the mixture may be assigned to a group based on the following simplified threshold toxicity tests. When these threshold tests are used, the most restrictive group shall be determined and used for carrying the mixture.



- 2.2.61.1.9.3 A mixture is assigned to packing group I only if it meets both of the following criteria:
- A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 1000 ml/m<sup>3</sup> vaporized mixture in air. Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days. If five or more of the animals die within the 14-day observation period, the mixture is presumed to have an LC<sub>50</sub> equal to or less than 1000 ml/m<sup>3</sup>;
  - A sample of vapour in equilibrium with the liquid mixture is diluted with 9 equal volumes of air to form a test atmosphere. Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days. If five or more of the animals die within the 14-day observation period, the mixture is presumed to have a volatility equal to or greater than 10 times the mixture LC<sub>50</sub>.
- 2.2.61.1.9.4 A mixture is assigned to packing group II only if it meets both of the following criteria, and does not meet the criteria for packing group I:
- A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 3000 ml/m<sup>3</sup> vaporized mixture in air. Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days. If five or more of the animals die within the 14-day observation period, the mixture is presumed to have an LC<sub>50</sub> equal to or less than 3000 ml/m<sup>3</sup>;
  - A sample of the vapour in equilibrium with the liquid mixture is used to form a test atmosphere. Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days. If five or more of the animals die within the 14-day observation period, the mixture is presumed to have a volatility equal to or greater than the mixture LC<sub>50</sub>.
- 2.2.61.1.9.5 A mixture is assigned to packing group III only if it meets both of the following criteria, and does not meet the criteria for packing groups I or II:
- A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 5000 ml/m<sup>3</sup> vaporized mixture in air. Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days. If five or more of the animals die within the 14-day observation period, the mixture is presumed to have an LC<sub>50</sub> equal to or less than 5000 ml/m<sup>3</sup>;
  - The vapour concentration (volatility) of the liquid mixture is measured and if the vapour concentration is equal to or greater than 1000 ml/m<sup>3</sup>, the mixture is presumed to have a volatility equal to or greater than 1/5 the mixture LC<sub>50</sub>.

*Methods for determining oral and dermal toxicity of mixtures*

- 2.2.61.1.10 When classifying and assigning the appropriate packing group to mixtures in Class 6.1 in accordance with the oral and dermal toxicity criteria (see 2.2.61.1.3), it is necessary to determine the acute LD<sub>50</sub> of the mixture.
- 2.2.61.1.10.1 If a mixture contains only one active substance, and the LD<sub>50</sub> of that constituent is known, in the absence of reliable acute oral and dermal toxicity data on the actual mixture to be carried, the oral or dermal LD<sub>50</sub> may be obtained by the following method:

$$\text{LD}_{50} \text{ value of preparation} = \frac{\text{LD}_{50} \text{ value of active substance} \times 100}{\text{percentage of active substance by mass}}$$

2.2.61.1.10.2 If a mixture contains more than one active constituent, there are three possible approaches that may be used to determine the oral or dermal LD<sub>50</sub> of the mixture. The preferred method is to obtain reliable acute oral and dermal toxicity data on the actual mixture to be carried. If reliable, accurate data is not available, then either of the following methods may be performed:

- (a) Classify the formulation according to the most hazardous constituent of the mixture as if that constituent were present in the same concentration as the total concentration of all active constituents; or
- (b) Apply the formula:

$$\frac{C_A}{T_A} + \frac{C_B}{T_B} + \dots + \frac{C_Z}{T_Z} = \frac{100}{T_M}$$

where:

C = the percentage concentration of constituent A, B, ..., Z in the mixture;

T = the oral LD<sub>50</sub> values of constituent A, B, ... Z;

T<sub>M</sub> = the oral LD<sub>50</sub> value of the mixture.

***NOTE:** This formula can also be used for dermal toxicities provided that this information is available on the same species for all constituents. The use of this formula does not take into account any potentiation or protective phenomena.*

#### *Classification of pesticides*

2.2.61.1.11 All active pesticide substances and their preparations for which the LC<sub>50</sub> and/or LD<sub>50</sub> values are known and which are classified in Class 6.1 shall be classified under appropriate packing groups in accordance with the criteria given in 2.2.61.1.6 to 2.2.61.1.9. Substances and preparations which are characterized by subsidiary risks shall be classified according to the precedence of hazard Table in 2.1.3.10 with the assignment of appropriate packing groups.

2.2.61.1.11.1 If the oral or dermal LD<sub>50</sub> value for a pesticide preparation is not known, but the LD<sub>50</sub> value of its active substance(s) is known, the LD<sub>50</sub> value for the preparation may be obtained by applying the procedures in 2.2.61.1.10.

***NOTE:** LD<sub>50</sub> toxicity data for a number of common pesticides may be obtained from the most current edition of the document "The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification" available from the International Programme on Chemical Safety, World Health Organisation (WHO), 1211 Geneva 27, Switzerland. While that document may be used as a source of LD<sub>50</sub> data for pesticides, its classification system shall not be used for purposes of transport classification of, or assignment of packing groups to, pesticides, which shall be in accordance with the requirements of ADR.*

2.2.61.1.11.2 The proper shipping name used in the carriage of the pesticide shall be selected on the basis of the active ingredient, of the physical state of the pesticide and any subsidiary risks it may exhibit (see 3.1.2).

2.2.61.1.12 If substances of Class 6.1, as a result of admixtures, come into categories of risk different from those to which the substances mentioned by name in Table A of Chapter 3.2 belong, these mixtures or solutions shall be assigned to the entries to which they belong on the basis of their actual degree of danger.

**NOTE:** For the classification of solutions and mixtures (such as preparations and wastes), see also 2.1.3.

2.2.61.1.13 On the basis of the criteria of 2.2.61.1.6 to 2.2.61.1.11, it may also be determined whether the nature of a solution or mixture mentioned by name or containing a substance mentioned by name is such that the solution or mixture is not subject to the requirements for this Class.

2.2.61.1.14 Substances, solutions and mixtures, with the exception of substances and preparations used as pesticides, which do not meet the criteria of Directives 67/548/EEC<sup>2</sup> or 88/379/EEC<sup>3</sup> as amended and which are not therefore classified as highly toxic, toxic or harmful according to these directives, as amended, may be considered as substances not belonging to Class 6.1.

### **2.2.61.2 Substances not accepted for carriage**

2.2.61.2.1 Chemically unstable substances of Class 6.1 shall not be accepted for carriage unless the necessary steps have been taken to prevent their dangerous decomposition or polymerization during carriage. To this end, it shall in particular be ensured that receptacles and tanks do not contain any substance(s) likely to cause such a reaction.

2.2.61.2.2 The following substances and mixtures shall not be accepted for carriage:

- Hydrogen cyanide, anhydrous or in solution, which do not meet the descriptions of UN Nos. 1051, 1613, 1614 and 3294;
- metal carbonyls, having a flash-point below 23 °C, other than UN Nos. 1259 NICKEL CARBONYL and 1994 IRON PENTACARBONYL;
- 2,3,7,8-TETRACHLORODIBENZO-P-DIOXINE (TCDD) in concentrations considered highly toxic in accordance with the criteria in 2.2.61.1.7;
- UN No. 2249 DICHLORODIMETHYL ETHER, SYMMETRICAL;
- preparations of phosphides without additives inhibiting the emission of toxic flammable gases.

---

<sup>2</sup> Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances (Official Journal of the European Communities No. L 196 of 16.08.1967, page 1).

<sup>3</sup> Council Directive 88/379/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous preparations (Official Journal of the European Communities No. L 187 of 16.07.1988, page 14).

## 2.2.61.3 List of collective entries

### Toxic substances without subsidiary risk(s)

Organic	liquid <sup>a</sup>	T1	1583 CHLOROPICRIN MIXTURE, N.O.S. 1602 DYE, LIQUID, TOXIC, N.O.S., or 1602 DYE INTERMEDIATE, LIQUID, TOXIC, N.O.S. 1693 TEAR GAS SUBSTANCE, LIQUID, N.O.S. 1851 MEDICINE, LIQUID, TOXIC, N.O.S. 2206 ISOCYANATES, TOXIC, N.O.S. or 2206 ISOCYANATE SOLUTION, TOXIC, N.O.S. 3140 ALKALOIDS, LIQUID, N.O.S. or 3140 ALKALOID SALTS, LIQUID, N.O.S. 3142 DISINFECTANT, LIQUID, TOXIC, N.O.S. 3144 NICOTINE COMPOUND, LIQUID, N.O.S. or 3144 NICOTINE PREPARATION, LIQUID, N.O.S. 3172 TOXINS, EXTRACTED FROM LIVING SOURCES, LIQUID, N.O.S. 3276 NITRILES, TOXIC, LIQUID, N.O.S. 3278 ORGANOPHOSPHORUS COMPOUND, TOXIC, LIQUID, N.O.S. 3381 TOXIC BY INHALATION LIQUID, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 500 LC <sub>50</sub> 3382 TOXIC BY INHALATION LIQUID, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 10 LC <sub>50</sub> 2810 TOXIC LIQUID, ORGANIC, N.O.S.
	solid <sup>a, b</sup>	T2	1544 ALKALOIDS, SOLID, N.O.S. or 1544 ALKALOID SALTS, SOLID, N.O.S. 1601 DISINFECTANT, SOLID, TOXIC, N.O.S. 1655 NICOTINE COMPOUND, SOLID, N.O.S., or 1655 NICOTINE PREPARATION, SOLID, N.O.S. 3448 TEAR GAS SUBSTANCE, SOLID, N.O.S. 3143 DYE, SOLID, TOXIC, N.O.S. or 3143 DYE INTERMEDIATE, SOLID, TOXIC, N.O.S. 3462 TOXINS, EXTRACTED FROM LIVING SOURCES, SOLID, N.O.S. 3249 MEDICINE, SOLID, TOXIC, N.O.S. 3464 ORGANOPHOSPHORUS COMPOUND, TOXIC, SOLID, N.O.S. 3439 NITRILES, TOXIC, SOLID, N.O.S. 2811 TOXIC SOLID, ORGANIC, N.O.S.
Organometallic <sup>c, d</sup>		T3	2026 PHENYLMERCURIC COMPOUND, N.O.S. 2788 ORGANOTIN COMPOUND, LIQUID, N.O.S. 3146 ORGANOTIN COMPOUND, SOLID, N.O.S. 3280 ORGANOARSENIC COMPOUND, LIQUID, N.O.S. 3465 ORGANOARSENIC COMPOUND, SOLID, N.O.S. 3281 METAL CARBONYLS, LIQUID, N.O.S. 3466 METAL CARBONYLS, SOLID, N.O.S. 3282 ORGANOMETALLIC COMPOUND, TOXIC, LIQUID, N.O.S. 3467 ORGANOMETALLIC COMPOUND, TOXIC, SOLID, N.O.S.

(cont'd on next page)

<sup>a</sup> Substances and preparations containing alkaloids or nicotine used as pesticides shall be classified under UN No. 2588 PESTICIDES, SOLID, TOXIC, N.O.S., UN No. 2902 PESTICIDES, LIQUID, TOXIC, N.O.S. or UN No. 2903 PESTICIDES, LIQUID, TOXIC, FLAMMABLE, N.O.S.

<sup>b</sup> Active substances and triturations or mixtures of substances intended for laboratories and experiments and for the manufacture of pharmaceutical products with other substances shall be classified according to their toxicity (see 2.2.61.1.7 to 2.2.61.1.11).

<sup>c</sup> Self-heating substances, slightly toxic and spontaneously combustible organometallic compounds, are substances of Class 4.2.

<sup>d</sup> Water-reactive substances, slightly toxic, and water-reactive organometallic compounds, are substances of Class 4.3.

2.2.61.3 *List of collective entries (cont'd)*

**Toxic substances without subsidiary risk(s) (cont'd)**

<b>Inorganic</b>	liquid <sup>e</sup> T4	<p>1556 ARSENIC COMPOUND, LIQUID, N.O.S., inorganic including: Arsenates, n.o.s., Arsenites, n.o.s.; and Arsenic sulphides, n.o.s.</p> <p>1935 CYANIDE SOLUTION, N.O.S.</p> <p>2024 MERCURY COMPOUND, LIQUID, N.O.S.</p> <p>3141 ANTIMONY COMPOUND, INORGANIC, LIQUID, N.O.S.</p> <p>3440 SELENIUM COMPOUND, LIQUID, N.O.S.</p> <p>3381 TOXIC BY INHALATION LIQUID, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m<sup>3</sup> and saturated vapour concentration greater than or equal to 500 LC<sub>50</sub></p> <p>3382 TOXIC BY INHALATION LIQUID, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m<sup>3</sup> and saturated vapour concentration greater than or equal to 10 LC<sub>50</sub></p> <p>3287 TOXIC LIQUID, INORGANIC, N.O.S.</p>
	solids <sup>f,g</sup> T5	<p>1549 ANTIMONY COMPOUND, INORGANIC, SOLID, N.O.S</p> <p>1557 ARSENIC COMPOUND, SOLID, N.O.S., including: Arsenates, n.o.s.; Arsenites, n.o.s.; and Arsenic sulphides, n.o.s.</p> <p>1564 BARIUM COMPOUND, N.O.S.</p> <p>1566 BERYLLIUM COMPOUND, N.O.S.</p> <p>1588 CYANIDES, INORGANIC, SOLID, N.O.S.</p> <p>1707 THALLIUM COMPOUND, N.O.S.</p> <p>2025 MERCURY COMPOUND, SOLID, N.O.S.</p> <p>2291 LEAD COMPOUND, SOLUBLE, N.O.S.</p> <p>2570 CADMIUM COMPOUND</p> <p>2630 SELENATES or</p> <p>2630 SELENITES</p> <p>2856 FLUOROSILICATES, N.O.S.</p> <p>3283 SELENIUM COMPOUND, SOLID, N.O.S.</p> <p>3284 TELLURIUM COMPOUND, N.O.S.</p> <p>3285 VANADIUM COMPOUND, N.O.S.</p> <p>3288 TOXIC SOLID, INORGANIC, N.O.S.</p>
	liquid <sup>h</sup> T6	<p>2992 CARBAMATE PESTICIDE, LIQUID, TOXIC</p> <p>2994 ARSENICAL PESTICIDE, LIQUID, TOXIC</p> <p>2996 ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC</p> <p>2998 TRIAZINE PESTICIDE, LIQUID, TOXIC</p> <p>3006 THIOCARBAMATE PESTICIDE, LIQUID, TOXIC</p> <p>3010 COPPER BASED PESTICIDE, LIQUID, TOXIC</p> <p>3012 MERCURY BASED PESTICIDE, LIQUID, TOXIC</p> <p>3014 SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC</p> <p>3016 BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC</p> <p>3018 ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC</p> <p>3020 ORGANOTIN PESTICIDE, LIQUID, TOXIC</p> <p>3026 COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC</p> <p>3348 PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC</p> <p>3352 PYRETHROID PESTICIDE, LIQUID, TOXIC</p> <p>2902 PESTICIDE, LIQUID, TOXIC, N.O.S.</p>
<b>Pesticides</b>		
<i>(cont'd on next page)</i>		

<sup>e</sup> Mercury fulminate, wetted with not less than 20% water, or mixture of alcohol and water by mass is a substance of Class 1, UN No. 0135.

<sup>f</sup> Ferricyanides, ferrocyanides, alkaline thiocyanates and ammonium thiocyanates are not subject to the provisions of ADR.

<sup>g</sup> Lead salts and lead pigments which, when mixed in a ratio of 1:1,000 with 0.07M hydrochloric acid and stirred for one hour at a temperature of 23 °C ± 2 °C, exhibit a solubility of 5% or less, are not subject to the provisions of ADR.

<sup>h</sup> Articles impregnated with this pesticide, such as fibreboard plates, paper strips, cotton-wool balls, sheets of plastics material, in hermetically closed wrappings, are not subject to the provisions of ADR.

### 2.2.61.3 List of collective entries (cont'd)

#### Toxic substances without subsidiary risk(s) (cont'd)

Pesticides (cont'd)		
Solid <sup>h</sup>	T7	2757 CARBAMATE PESTICIDE, SOLID, TOXIC
		2759 ARSENICAL PESTICIDE, SOLID, TOXIC
		2761 ORGANOCHLORINE PESTICIDE, SOLID, TOXIC
		2763 TRIAZINE PESTICIDE, SOLID, TOXIC
		2771 THIOCARBAMATE PESTICIDE, SOLID, TOXIC
		2775 COPPER BASED PESTICIDE, SOLID, TOXIC
		2777 MERCURY BASED PESTICIDE, SOLID, TOXIC
		2779 SUBSTITUTED NITROPHENOL PESTICIDE, SOLID, TOXIC
		2781 BIPYRIDILIUM PESTICIDE, SOLID, TOXIC
		2783 ORGANOPHOSPHORUS PESTICIDE, SOLID, TOXIC
		2786 ORGANOTIN PESTICIDE, SOLID, TOXIC
		3027 COUMARIN DERIVATIVE PESTICIDE, SOLID, TOXIC
		3048 ALUMINIUM PHOSPHIDE PESTICIDE
		3345 PHENOXYACETIC ACID DERIVATIVE PESTICIDE, SOLID, TOXIC
		3349 PYRETHROID PESTICIDE, SOLID, TOXIC
2588 PESTICIDE, SOLID, TOXIC, N.O.S.		
Samples		
	T8	3315 CHEMICAL SAMPLE, TOXIC
Other toxic substances <sup>i</sup>		
	T9	3243 SOLIDS CONTAINING TOXIC LIQUID, N.O.S.

#### Toxic substances with subsidiary risk(s)

Liquid <sup>j,k</sup>	TF1	3071 MERCAPTANS, LIQUID, TOXIC, FLAMMABLE, N.O.S. or
		3071 MERCAPTAN MIXTURE, LIQUID, TOXIC, FLAMMABLE, N.O.S.
		3080 ISOCYANATES, TOXIC, FLAMMABLE, N.O.S. or
		3080 ISOCYANATE SOLUTION, TOXIC, FLAMMABLE, N.O.S.
		3275 NITRILES, TOXIC, FLAMMABLE, N.O.S.
		3279 ORGANOPHOSPHORUS COMPOUND, TOXIC, FLAMMABLE, N.O.S.
		3383 TOXIC BY INHALATION LIQUID, FLAMMABLE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 500 LC <sub>50</sub>
		3384 TOXIC BY INHALATION LIQUID, FLAMMABLE, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 10 LC <sub>50</sub>
		2929 TOXIC LIQUID, FLAMMABLE, ORGANIC, N.O.S.
		2929 TOXIC LIQUID, FLAMMABLE, ORGANIC, N.O.S.
Flammable		
	TF	

(cont'd on next page)

<sup>h</sup> Articles impregnated with this pesticide, such as fibreboard plates, paper strips, cotton-wool balls, sheets of plastics material, in hermetically closed wrappings, are not subject to the provisions of ADR.

<sup>i</sup> Mixtures of solids which are not subject to the provisions of ADR and of toxic liquids may be carried under UN No. 3243 without first applying the classification criteria of Class 6.1, provided there is no free liquid visible at the time the substance is loaded or at the time the packaging, container or transport unit is closed. Each packaging shall correspond to a design type that has passed a leakproofness test at the packing group II level. This entry shall not be used for solids containing a packing group I liquid.

<sup>j</sup> Highly toxic or toxic, flammable liquids having a flash-point below 23 °C excluding substances which are highly toxic on inhalation, i.e. UN Nos. 1051, 1092, 1098, 1143, 1163, 1182, 1185, 1238, 1239, 1244, 1251, 1259, 1613, 1614, 1695, 1994, 2334, 2382, 2407, 2438, 2480, 2482, 2484, 2485, 2606, 2929, 3279 and 3294 are substances of Class 3.

<sup>k</sup> Flammable liquids, slightly toxic, with the exception of substances and preparations used as pesticides, having a flash-point between 23 °C and 61 °C inclusive, are substances of Class 3.

2.2.61.3 *List of collective entries (cont'd)*

*Toxic substances with subsidiary risk(s) (cont'd)*

Flammable TF (cont'd)	pesticides, liquid TF2 (flash-point not less than 23 °C)	2991 CARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		2993 ARSENICAL PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		2995 ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		2997 TRIAZINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3005 THIOCARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3009 COPPER BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3011 MERCURY BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3013 SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3015 BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3017 ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3019 ORGANOTIN PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3025 COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3347 PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		3351 PYRETHROID PESTICIDE, LIQUID, TOXIC, FLAMMABLE
		2903 PESTICIDE, LIQUID, TOXIC, FLAMMABLE, N.O.S.
	solid TF3	1700 TEAR GAS CANDLES
		2930 TOXIC SOLID, FLAMMABLE, ORGANIC, N.O.S.
Solid, self-heating <sup>c</sup> TS		3124 TOXIC SOLID, SELF-HEATING, N.O.S.
	liquid TW1	3385 TOXIC BY INHALATION LIQUID, WATER-REACTIVE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 500 LC <sub>50</sub>
		3386 TOXIC BY INHALATION LIQUID, WATER-REACTIVE, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 10 LC <sub>50</sub>
		3123 TOXIC LIQUID, WATER-REACTIVE, N.O.S.
Water-reactive <sup>d</sup> TW	solid <sup>n</sup> TW2	3125 TOXIC SOLID, WATER-REACTIVE, N.O.S.
	liquid TO1	3387 TOXIC BY INHALATION LIQUID, OXIDIZING, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 500 LC <sub>50</sub>
		3388 TOXIC BY INHALATION LIQUID, OXIDIZING, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 10 LC <sub>50</sub>
		3122 TOXIC LIQUID, OXIDIZING, N.O.S.
Oxidizing <sup>l</sup> TO	solid TO2	3086 TOXIC SOLID, OXIDIZING, N.O.S.
	liquid TC1	3277 CHLOROFORMATES, TOXIC, CORROSIVE, N.O.S.
		3361 CHLOROSILANES, TOXIC, CORROSIVE, N.O.S.
		3389 TOXIC BY INHALATION LIQUID, CORROSIVE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 500 LC <sub>50</sub>
		3390 TOXIC BY INHALATION LIQUID, CORROSIVE, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 10 LC <sub>50</sub>
		2927 TOXIC LIQUID, CORROSIVE, ORGANIC, N.O.S.
Corrosive <sup>m</sup> TC (cont'd on next page)	organic	

<sup>c</sup> Self-heating substances, slightly toxic and spontaneously combustible organometallic compounds, are substances of Class 4.2.

<sup>d</sup> Water-reactive substances, slightly toxic, and water-reactive organometallic compounds, are substances of Class 4.3.

<sup>l</sup> Oxidizing substances, slightly toxic, are substances of Class 5.1.

<sup>m</sup> Substances slightly toxic and slightly corrosive, are substances of Class 8.

<sup>n</sup> Metal phosphides assigned to UN Nos. 1360, 1397, 1432, 1714, 2011 and 2013 are substances of Class 4.3.

2.2.61.3 *List of collective entries (cont'd)*

*Toxic substances with subsidiary risk(s) (cont'd)*

<b>Corrosive<sup>m</sup> TC</b> <i>(cont'd)</i>	<b>organic</b> <i>(cont'd)</i>	<b>solid</b>	<b>TC2</b>	2928 TOXIC SOLID, CORROSIVE, ORGANIC, N.O.S.
		<b>liquid</b>	<b>TC3</b>	3389 TOXIC BY INHALATION LIQUID, CORROSIVE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 500 LC <sub>50</sub> 3390 TOXIC BY INHALATION LIQUID, CORROSIVE, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m <sup>3</sup> and saturated vapour concentration greater than or equal to 10 LC <sub>50</sub> 3289 TOXIC LIQUID, CORROSIVE, INORGANIC, N.O.S.
	<b>inorganic</b>			
	<b>solid</b>	<b>TC4</b>	3290 TOXIC SOLID, CORROSIVE, INORGANIC, N.O.S.	
<b>Flammable, corrosive</b>				2742 CHLOROFORMATES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S.
<b>TFC</b>				3362 CHLOROSILANES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S. (No other collective entry available; if need be, classification under a collective entry with a classification code to be determined according to the table of precedence of hazards in 2.1.3.10)

<sup>m</sup> *Substances slightly toxic and slightly corrosive, are substances of Class 8.*



**2.2.62 Class 6.2 Infectious substances**

**2.2.62.1 Criteria**

2.2.62.1.1 The heading of Class 6.2 covers infectious substances. For the purposes of ADR, infectious substances are substances which are known or are reasonably expected to contain pathogens. Pathogens are defined as micro-organisms (including bacteria, viruses, rickettsiae, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.

*NOTE 1: Genetically modified micro-organisms and organisms, biological products, diagnostic specimens and infected live animals shall be assigned to this Class if they meet the conditions for this Class.*

*NOTE 2: Toxins from plant, animal or bacterial sources which do not contain any infectious substances or organisms or which are not contained in them are substances of Class 6.1, UN Nos. 3172 or 3462.*

2.2.62.1.2 Substances of Class 6.2 are subdivided as follows:

- I1 Infectious substances affecting humans;
- I2 Infectious substances affecting animals only;
- I3 Clinical waste;
- I4 Diagnostic specimens.

*Definitions*

2.2.62.1.3 For the purposes of ADR,

*"Biological products"* are those products derived from living organisms which are manufactured and distributed in accordance with the requirements of appropriate national authorities, which may have special licensing requirements, and are used either for prevention, treatment, or diagnosis of disease in humans or animals, or for development, experimental or investigational purposes related thereto. They include, but are not limited to, finished or unfinished products such as vaccines;

*"Cultures (laboratory stocks)"* are the result of a process by which pathogens are amplified or propagated in order to generate high concentrations, thereby increasing the risk of infection when exposure to them occurs. This definition refers to cultures prepared for the intentional generation of pathogens and does not include cultures intended for diagnostic and clinical purposes;

*"Genetically modified micro-organisms and organisms"* are micro-organisms and organisms in which genetic material has been purposely altered through genetic engineering in a way that does not occur naturally;

*"Medical or clinical wastes"* are wastes derived from the medical treatment of animals or humans or from bio-research.

*Classification*

2.2.62.1.4 Infectious substances shall be classified in Class 6.2 and assigned to UN Nos. 2814, 2900 or 3373, as appropriate.

Infectious substances are divided into the following categories:

2.2.62.1.4.1 Category A: An infectious substance which is carried in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease to humans or animals. Indicative examples of substances that meet these criteria are given in the table in this paragraph.

***NOTE:** An exposure occurs when an infectious substance is released outside of the protective packaging, resulting in physical contact with humans or animals.*

- (a) Infectious substances meeting these criteria which cause disease in humans or both in humans and animals shall be assigned to UN No. 2814. Infectious substances which cause disease only in animals shall be assigned to UN No. 2900;
- (b) Assignment to UN No. 2814 or UN No. 2900 shall be based on the known medical history and symptoms of the source human or animal, endemic local conditions, or professional judgement concerning individual circumstances of the source human or animal.

***NOTE 1:** The proper shipping name for UN No. 2814 is "INFECTIOUS SUBSTANCE, AFFECTING HUMANS". The proper shipping name for UN No. 2900 is "INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only".*

***NOTE 2:** The following table is not exhaustive. Infectious substances, including new or emerging pathogens, which do not appear in the table but which meet the same criteria shall be assigned to Category A. In addition, if there is doubt as to whether or not a substance meets the criteria it shall be included in Category A.*

***NOTE 3:** In the following table, the micro-organisms written in italics are bacteria, mycoplasmas, rickettsia or fungi.*

**INDICATIVE EXAMPLES OF INFECTIOUS SUBSTANCES INCLUDED IN CATEGORY A  
IN ANY FORM UNLESS OTHERWISE INDICATED  
(2.2.62.1.4.1)**

UN Number and name	Micro-organism
<p><b>UN No. 2814</b> Infectious substances affecting humans</p>	<p><i>Bacillus anthracis (cultures only)</i>  <i>Brucella abortus (cultures only)</i>  <i>Brucella melitensis (cultures only)</i>  <i>Brucella suis (cultures only)</i>  <i>Burkholderia mallei - Pseudomonas mallei – Glanders (cultures only)</i>  <i>Burkholderia pseudomallei – Pseudomonas pseudomallei (cultures only)</i>  <i>Chlamydia psittaci</i> - avian strains (cultures only)  <i>Clostridium botulinum (cultures only)</i>  <i>Coccidioides immitis (cultures only)</i>  <i>Coxiella burnetii (cultures only)</i>  Crimean-Congo hemorrhagic fever virus  Dengue virus (cultures only)  Eastern equine encephalitis virus (cultures only)  <i>Escherichia coli</i>, verotoxigenic (cultures only)  Ebola virus  Flexal virus  <i>Francisella tularensis (cultures only)</i>  Guanarito virus  Hantaan virus  Hantaviruses causing hantavirus pulmonary syndrome  Hendra virus  Hepatitis B virus (cultures only)  Herpes B virus (cultures only)  Human immunodeficiency virus (cultures only)  Highly pathogenic avian influenza virus (cultures only)  Japanese Encephalitis virus (cultures only)  Junin virus  Kyasanur Forest disease virus  Lassa virus  Machupo virus  Marburg virus  Monkeypox virus  <i>Mycobacterium tuberculosis (cultures only)</i>  Nipah virus  Omsk hemorrhagic fever virus  Poliovirus (cultures only)  Rabies virus  <i>Rickettsia prowazekii (cultures only)</i>  <i>Rickettsia rickettsii (cultures only)</i>  Rift Valley fever virus  Russian spring-summer encephalitis virus (cultures only)  Sabia virus  <i>Shigella dysenteriae type 1 (cultures only)</i>  Tick-borne encephalitis virus (cultures only)</p>

<b>INDICATIVE EXAMPLES OF INFECTIOUS SUBSTANCES INCLUDED IN CATEGORY A IN ANY FORM UNLESS OTHERWISE INDICATED (2.2.62.1.4.1)</b>	
<b>UN Number and name</b>	<b>Micro-organism</b>
<b>UN No. 2814</b> Infectious substances affecting humans <b>(cont'd)</b>	Variola virus Venezuelan equine encephalitis virus West Nile virus (cultures only) Yellow fever virus (cultures only) <i>Yersinia pestis</i> (cultures only)
<b>UN No. 2900</b> Infectious substances affecting animals only	African horse sickness virus African swine fever virus Avian paramyxovirus Type 1 - Newcastle disease virus Bluetongue virus Classical swine fever virus Foot and mouth disease virus Lumpy skin disease virus <i>Mycoplasma mycoides</i> - Contagious bovine pleuropneumonia Peste des petits ruminants virus Rinderpest virus Sheep-pox virus Goatpox virus Swine vesicular disease virus Vesicular stomatitis virus

2.2.62.1.4.2 **Category B:** An infectious substance which does not meet the criteria for inclusion in Category A. Infectious substances in Category B shall be assigned to UN No. 3373 except that cultures, as defined in 2.2.62.1.3, shall be assigned to UN No. 2814 or UN No. 2900 as appropriate.

**NOTE:** *The proper shipping name of UN No. 3373 is "DIAGNOSTIC SPECIMENS" or "CLINICAL SPECIMENS."*

2.2.62.1.5 Substances which do not contain infectious substances or substances which are unlikely to cause disease in humans or animals are not subject to the provisions of ADR unless they meet the criteria for inclusion in another class.

2.2.62.1.6 Blood or blood components which 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 are not subject to the provisions of ADR.

2.2.62.1.7 Substances for which there is a low probability that infectious substances are present, or where the concentration is at a level naturally encountered, are not subject to the provisions of ADR. Examples are: foodstuffs, water samples, living persons and substances which have been treated so that the pathogens have been neutralized or deactivated.

2.2.62.1.8 A live animal which has been intentionally infected and is known or suspected to contain an infectious substance shall only be carried under terms and conditions approved by the competent authority<sup>4</sup>.

<sup>4</sup> *Such regulations are contained in, e.g. Directive 91/628/EEC (Official Journal of the European Communities No. L 340 of 11 December 1991, p. 17) and in the Recommendations of the Council of Europe (Ministerial Committee) on the carriage of certain animal species.*

2.2.62.1.9 *Biological products*

For the purposes of ADR, biological products are divided into the following groups:

- (a) those which are manufactured and packaged in accordance with the requirements of appropriate national authorities and carried for the purposes of final packaging or distribution, and use for personal health care by medical professionals or individuals. Substances in this group are not subject to the provisions of ADR;
- (b) those which do not fall under paragraph (a) and are known or reasonably believed to contain infectious substances and which meet the criteria for inclusion in Category A or Category B. Substances in this group shall be assigned to UN Nos. 2814, 2900 or 3373, as appropriate.

***NOTE:** Some licensed biological products may present a biohazard only in certain parts of the world. In that case, competent authorities may require these biological products to be in compliance with local requirements for infectious substances or may impose other restrictions.*

2.2.62.1.10 *Genetically modified micro-organisms and organisms*

Genetically modified micro-organisms not meeting the definition of infectious substance shall be classified according to section 2.2.9.

2.2.62.1.11 *Medical or clinical wastes*

2.2.62.1.11.1 Medical or clinical wastes containing Category A infectious substances or containing Category B infectious substances in cultures shall be assigned to UN No. 2814 or UN No. 2900 as appropriate. Medical or clinical wastes containing infectious substances in Category B, other than cultures, shall be assigned to UN No. 3291.

2.2.62.1.11.2 Medical or clinical wastes which are reasonably believed to have a low probability of containing infectious substances shall be assigned to UN No. 3291.

***NOTE:** The proper shipping name for UN No. 3291 is "CLINICAL WASTE, UNSPECIFIED, N.O.S." or "(BIO) MEDICAL WASTE, N.O.S". or "REGULATED MEDICAL WASTE, N.O.S".*

2.2.62.1.11.3 Decontaminated medical or clinical wastes which previously contained infectious substances are not subject to the provisions of ADR unless they meet the criteria for inclusion in another class.

2.2.62.1.11.4 Medical or clinical wastes assigned to UN No. 3291 are assigned to packing group II.

**2.2.62.2**      *Substances not accepted for carriage*

Live vertebrate or invertebrate animals shall not be used to carry an infectious agent unless the agent cannot be carried by other means or unless this carriage has been approved by the competent authority (see 2.2.62.1.8).

**2.2.62.3**      *List of collective entries*

<b>Effects on humans</b>	<b>I1</b>	2814    INFECTIOUS SUBSTANCE, AFFECTING HUMANS
<b>Effects on animals only</b>	<b>I2</b>	2900    INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only
<b>Clinical waste</b>	<b>I3</b>	3291    CLINICAL WASTE, UNSPECIFIED, N.O.S. or 3291    (BIO) MEDICAL WASTE, N.O.S. or 3291    REGULATED MEDICAL WASTE, N.O.S.
<b>Diagnostic specimens</b>	<b>I4</b>	3373    DIAGNOSTIC SPECIMENS or 3373    CLINICAL SPECIMENS