Technical Circular

No.: 065/2022 Date: 05th December 2022

Subject: Amendments (41-22) to IMDG Code.

1. The International Maritime Dangerous Goods (IMDG) Code is regularly reviewed to take into account new requirements for existing substances or new substances. IMO's Maritime Safety Committee adopted Resolution MSC.501 (105) specifying forthcoming amendments (41-22) to the IMDG Code.

2. The amendments (41-22) to IMDG Code will become mandatory from **1 January 2024**, however Administrations may choose to apply the amendments on a voluntary basis from **1 January 2023**.

3. The amendments (41-22) to IMDG Code is intended to align with the amendments to the UN Recommendations on the Transport of Dangerous Goods, 21st Revision Edition. In addition to the regular updates to classification, segregation, packing and marking of dangerous goods, these amendments include the following:

   a. Clarification on 5.1.2.1 with regard to the fact that Class 7 goods may need to be marked with different label in addition to 'OVERPACK';
   b. New definition for "pressure receptacle shell" in 1.2.1 of the IMDG Code;
   c. The addition of a telephone number to the Lithium battery mark;
   d. A new chapter regarding 'Portable tanks with shells made of fibre-reinforced plastics (FRP) materials;
   e. Deletion of 'special stowage' from note 1 in 7.2.7.1.4 as it is no longer applicable.

4. Further, based on the amendments (41-22) to the IMDG Code, a revised consolidated version of the EmS Guide was approved vide MSC.1/Circ.1588/Rev.2.

5. The purpose of this Guide is to provide guidance for dealing with fires and spillages (leakages) on board ships involving the dangerous goods listed in the IMDG Code. This Circular supersedes MSC.1/ Circ. 1588, Rev 1.

6. Owners and operators of ships intending to carry packaged dangerous goods cargoes are advised to be guided by above.

Enclosure:

1. IMO Resolution, MSC. 501 (105).

2. MSC.1/Circ.1588/Rev.2 – Revised Emergency Response Procedures for Ships carrying dangerous goods (EmS Guide).

ANNEX 8

RESOLUTION MSC.501(105)
(adopted on 28 April 2022)

AMENDMENTS TO THE INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG) CODE

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.122(75) by which it adopted the International Maritime Dangerous Goods Code (hereinafter referred to as "the IMDG Code"), which has become mandatory under chapter VII of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended (hereinafter referred to as "the Convention"),

NOTING ALSO article VIII(b) and regulation VII/1.1 of the Convention concerning the procedure for amending the IMDG Code,

HAVING CONSIDERED, at its 105th session, amendments to the IMDG Code, proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the IMDG Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2023 unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have notified their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2024 upon their acceptance in accordance with paragraph 2 above;

4 AGREES that Contracting Governments to the Convention may apply the aforementioned amendments in whole or in part on a voluntary basis from 1 January 2023;

5 REQUESTS the Secretary-General, for the purposes of article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

6 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG) CODE

Contents

Insert a new chapter 6.10 as follows:

"**Chapter 6.10 Provisions for the design, construction, inspection and testing of portable tanks with shells made of fibre-reinforced plastics (FRP) materials**

6.10.1 Application and general requirements

6.10.2 Provisions for the design, construction, inspection and testing of FRP portable tanks".

PART 1
GENERAL PROVISIONS, DEFINITIONS AND TRAINING

Chapter 1.2
Definitions, units of measurement and abbreviations

1.2.1 Definitions

In the definition for "Bundles of cylinders", replace the words "assemblies of cylinders" with the words "pressure receptacles comprising an assembly of cylinders or cylinder shells".

Add the following new note under the definition for "*Closure*":

"Note: For pressure receptacles, closures are, for example, valves, pressure relief devices, pressure gauges or level indicators."

Replace the definition for "*Cryogenic receptacles*" to read as follows:

"*Closed cryogenic receptacles* are thermally insulated pressure receptacles for refrigerated liquefied gases of a water capacity of not more than 1,000 L."

In the definition for "*Cylinders*", delete the word "transportable".

In the definition for "*GHS*", replace the word "eighth" by the word "ninth" and replace "ST/SG/AC.10/30/Rev.8" with "ST/SG/AC.10/30/Rev.9".

In the definition for "*Liquids*", in the footnote, replace "ECE/TRANS/275 (Sales No. E.18.VIII.1)" with "ECE/TRANS/300 (Sales No. E.21.VIII.1)".

In the definition for "*Manual of Tests and Criteria*", after "ST/SG/AC.10/11/Rev.7", insert the words "and Amend.1".

In the definition for "*Metal hydride storage system*", replace the word "receptacle" with the words "pressure receptacle shell".

In the definition for "*Pressure drums*", delete the word "transportable".

In the definition for "*Pressure receptacles*", after the words "*Pressure receptacles*", add the words "are transportable receptacles intended for holding substances under pressure including its closure(s) and other service equipment and it".

In the definition for "*Recycled plastics material*", at the end of the note, add the following new sentence:

> "These guidelines have been developed based on the experience of the manufacturing of drums and jerricans from recycled plastics material and as such may need to be adapted for other types of packagings, IBCs and large packagings made of recycled plastics material."

In the definition for "*Tube*", delete the word "transportable".

Replace the definition for "*Working pressure*" to read as follows:

> "*Working pressure*:
>
> .1 for a compressed gas, means the settled pressure at a reference temperature of 15°C in a full pressure receptacle;
>
> .2 for UN 1001 acetylene, dissolved, means the calculated settled pressure at a uniform reference temperature of 15°C in an acetylene cylinder containing the specified solvent content and the maximum acetylene content; and
>
> .3 for UN 3374 acetylene, solvent free, means the working pressure which was calculated for the equivalent cylinder for UN 1001 acetylene, dissolved."

Insert the following new definitions, in alphabetical order:

"*IAEA Regulations for the Safe Transport of Radioactive Material* means one of the editions of those Regulations, as follows:

> .1 for the 1985, 1985 (as amended 1990) editions: IAEA Safety Series No. 6;
>
> .2 for the 1996 edition: IAEA Safety Series No. ST-1;
>
> .3 for the 1996 (revised) edition: IAEA Safety Series No. TS-R-1 (ST-1, Revised);
>
> .4 for the 1996 (as amended 2003), 2005, 2009 editions: IAEA Safety Standards Series No. TS-R-1;
>
> .5 for the 2012 edition: IAEA Safety Standards Series No. SSR-6; and
>
> .6 for the 2018 edition: IAEA Safety Standards Series No. SSR-6 (Rev.1)."

"*Inner vessel,* for a closed cryogenic receptacle, means the pressure vessel intended to contain the refrigerated liquefied gas."

"*Pressure receptacle shell* means a cylinder, a tube, a pressure drum or a salvage pressure receptacle without its closures or other service equipment, but including any permanently attached device(s) (e.g. neck ring, foot ring, etc.).

Note: The terms "cylinder shell", "pressure drum shell" and "tube shell" are also used."

"*Service equipment* of a pressure receptacle means closure(s), manifold(s), piping, porous, absorbent or adsorbent material and any structural devices, e.g. for handling."

1.2.2 Units of measurement

1.2.2.1 In the table, after the entry for "Power", add the following new entry:

Electrical resistance	Ω (ohm)	–	$1\ \Omega = 1\ kg \cdot m^2 \cdot s^{-3} \cdot A^{-2}$

Chapter 1.4
Security provisions

1.4.3 Provisions for high consequence dangerous goods

1.4.3.2 Specific security provisions for high consequence dangerous goods

1.4.3.2.3 Delete both footnotes "*" and "†". After "Convention on Physical Protection of Nuclear Material", add "(INFCIRC/274/Rev.1, IAEA, Vienna (1980))". After "*Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities*", add "(INFCIRC/225/Rev.5, IAEA, Vienna (2011))".

Chapter 1.5
General provisions concerning radioactive material

1.5.1 Scope and application

1.5.1.1 Replace the second sentence to read "These provisions are based on the 2018 edition of the IAEA Regulations for the Safe Transport of Radioactive Material".

PART 2
CLASSIFICATION

Chapter 2.4
Class 4 – Flammable solids; substances liable to spontaneous combustion; substances which, in contact with water, emit flammable gases

2.4.2 Class 4.1 – Flammable solids, self-reactive substances, solid desensitized explosives and polymerizing substances

2.4.2.3 Class 4.1 Self-reactive substances

2.4.2.3.2 *Classification of self-reactive substances*

2.4.2.3.2.3 In the last sentence, after the words "The formulations" add the words "not listed in this provision but".

In the table, add the following new entry in proper order:

3230	(7-METHOXY-5-METHYL-BENZOTHIOPHEN-2-YL) BORONIC ACID	88-100	OP7			(11)

Under the table, add the following new table note:
"(11) The technical compound with the specified concentration limits may contain up to 12% water and up to 1% organic impurities."

Chapter 2.5
Class 5 – Oxidizing substances and organic peroxides

2.5.3 Class 5.2 – Organic peroxides

2.5.3.2 Classification of organic peroxides

2.5.3.2.4 List of currently assigned organic peroxides in packagings

In the last sentence, after the words "The formulations" add the words "not listed in this provision but".

In the table, add the following new entries in proper order:

3105	*tert*-BUTYLPEROXY ISOPROPYLCARBONATE	≤ 62		≥ 38			OP7			
3107	ACETYL ACETONE PEROXIDE	≤ 35	≥ 57			≥ 8	OP8			(32)
3117	*tert*-HEXYL PEROXYPIVALATE	≤ 52 as a stable dispersion in water					OP8	+15	+20	

In the list of "Remarks" add the following entry:

"(32) Active oxygen ≤ 4.15%"

Chapter 2.6
Class 6 – Toxic and infectious substances

2.6.0 Introductory notes

In note 3, at the end, add the words "or UN 3462".

Chapter 2.7
Class 7 – Radioactive material

2.7.2 Classification

2.7.2.3 Determination of other material characteristics

2.7.2.3.1 *Low specific activity (LSA)*

2.7.2.3.1.4 Delete the paragraph and add the words "2.7.2.3.1.4 Deleted."

2.7.2.3.1.5 Delete the paragraph and add the words "2.7.2.3.1.5 Deleted."

2.7.2.3.4 *Low dispersible material*

Replace the heading to read "***Low dispersible radioactive material***".

2.7.2.3.4.1.3 In the first sentence, replace "2.7.2.3.1.4" with "2.7.2.3.4.3".

2.7.2.3.4.3 Insert a new paragraph 2.7.2.3.4.3 to read as follows:

> "2.7.2.3.4.3 A solid material sample representing the entire contents of the package shall be immersed for seven days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the seven-day test period the free volume of the unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6-8 and a maximum conductivity of 1 mS/m at 20°C. The total activity of the free volume of water shall be measured following the seven-day immersion of the test sample."

and renumber the existing paragraph 2.7.2.3.4.3 to 2.7.2.3.4.4 and replace "2.7.2.3.4.1 and 2.7.2.3.4.2" with "2.7.2.3.4.1, 2.7.2.3.4.2 and 2.7.2.3.4.3".

Chapter 2.8
Class 8 – Corrosive substances

2.8.3 Packing group assignment for substances and mixtures

2.8.3.2 In the second sentence, replace the words "OECD Test Guidelines*†‡§" with the words "OECD Test Guidelines Nos. 404,* 435,† 431‡ or 430§". In the third sentence, replace the words "OECD Test Guidelines*†‡§" with the words "one of these or non-classified in accordance with OECD Test Guideline No. 439,[11]". In the fourth sentence, delete the words "*in vitro*". At the end, add the following new sentence: "If the test results indicate that the substance or mixture is corrosive, but the test method does not allow discrimination between packing groups, it shall be assigned to packing group I if no other test results indicate a different packing group."

Add a footnote [11] to read "[11] *OECD Guideline for the testing of chemicals No. 439 In Vitro Skin Irritation: Reconstructed Human Epidermis Test Method 2015*."

2.8.3.3.3.2 Replace the words "ISO 3574 or Unified Numbering System (UNS) G10200 or a similar type" with the words "ISO 3574, Unified Numbering System (UNS) G10200".

Chapter 2.9
Miscellaneous dangerous substances and articles (class 9) and environmentally hazardous substances

2.9.3 Environmentally hazardous substances (aquatic environment)

2.9.3.4 Mixtures classification categories and criteria

2.9.3.4.3 *Classification of mixtures when toxicity data are available for the complete mixture*

2.9.3.4.3.4 (a) *Classification for categories Chronic 1 and 2*

After (i), add a new note to read as follows:

"**Note:** In this situation, when ECx or NOEC of the tested mixture > 0.1 mg/L, there is no need to classify for long-term hazard under these provisions."

2.9.4 Lithium batteries

2.9.4.7 Amend the beginning of the sentence to read "Except for button cells installed in equipment (including circuit boards), manufacturers...".

PART 3
DANGEROUS GOODS LIST, SPECIAL PROVISIONS AND EXCEPTIONS

Chapter 3.1
General

3.1.4 Segregation groups

3.1.4.4 In the entry "**1 Acids (SGG1 or SGG1a)**", replace the heading to read "**1 Acids (SGG1)**", and delete all asterisks and the corresponding footnote "* identifies strong acids".

Chapter 3.2
Dangerous Goods List

Dangerous Goods List

UN No.	Amendment
1002	In column 6, add "397"
1012	In column 6, add "398"
1052	In column 16b, replace "SGG1a" with "SGG1"
1169 PG II	Delete the entry
1169 PG III	Delete the entry
1197 PG II	Replace column 2 to read "EXTRACTS, LIQUID, for flavour or aroma"
1197 PG III	Replace column 2 to read "EXTRACTS, LIQUID, for flavour or aroma"
1439	In column 16b, replace "SG75" with "SG35". In column 17, delete the word "strong".
1756	In column 17, delete the word "strong"
1757	In column 17, delete the word "strong"
1777	In column 16b, replace "SGG1a" with "SGG1"
1786	In column 16b, replace "SGG1a" with "SGG1"
1787 PG II	In column 16b, replace "SGG1a" with "SGG1"
1787 PG III	In column 16b, replace "SGG1a" with "SGG1"
1788 PG II	In column 16b, replace "SGG1a" with "SGG1"
1788 PG III	In column 16b, replace "SGG1a" with "SGG1"
1789 PG II	In column 16b, replace "SGG1a" with "SGG1"
1789 PG III	In column 16b, replace "SGG1a" with "SGG1"
1790 PG I	In column 16b, replace "SGG1a" with "SGG1"
1790 PG II	In column 16b, replace "SGG1a" with "SGG1"
1796 PG I	In column 16b, replace "SGG1a" with "SGG1"
1796 PG II	In column 16b, replace "SGG1a" with "SGG1"
1798	In column 16b, replace "SGG1a" with "SGG1"
1802	In column 16b, replace "SGG1a" with "SGG1"

UN No.	Amendment
1826 PG I	In column 16b, replace "SGG1a" with "SGG1"
1826 PG II	In column 16b, replace "SGG1a" with "SGG1"
1830	In column 16b, replace "SGG1a" with "SGG1"
1831	In column 16b, replace "SGG1a" with "SGG1"
1832	In column 16b, replace "SGG1a" with "SGG1"
1873	In column 16b, replace "SGG1a" with "SGG1"
1891	In column 3, replace "6.1" with "3". In column 4, add "6.1". In column 7a, replace "100 mL" with "1 L". In column 7b, replace "E4" with "E2". In column 15, replace "F-A" with "F-E" and replace "S-A" with "S-D". In column 17, before the words "Boiling point: 38°C.", add the words "Flashpoint -20°C c.c."
1906	In column 16b, replace "SGG1a" with "SGG1"
2031 PG I	In column 16b, replace "SGG1a" with "SGG1"
2031 PG II (*twice*)	In column 16b, replace "SGG1a" with "SGG1"
2032	In column 16b, replace "SGG1a" with "SGG1"
2240	In column 16b, replace "SGG1a" with "SGG1"
2308	In column 16b, replace "SGG1a" with "SGG1"
2426	In column 17, delete the word "strong"
2716	In column 17, delete the word "strong"
2796	In column 16b, replace "SGG1a" with "SGG1"
3208 PG II	In column 7b, replace "E0" with "E2"
3209 PG II	In column 7b, replace "E2" with "E0"
3527 PG II	In column 7b, replace "E0" with "See SP340"
3527 PG III	In column 7b, replace "E0" with "See SP340"
3538	In column 6, add "396"

(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16a)	(16b)	(17)
3550	COBALT DIHYDROXIDE POWDER, containing not less than 10% respirable particles	6.1	**P**	I	-	0	E5	P002	-	IBC07	B1 B40	-	T6	TP3 3	F-A, S-A	Category D SW2	-	Pink odourless powder. Toxic by dust inhalation.

Chapter 3.3
Special provisions applicable to certain substances, materials or articles

SP188 In .6, delete note 1 and renumber "**Note 2**" to "**Note**".

SP225 After .1, insert the following new note:

"**Note:** This entry applies to portable fire extinguishers, even if some components that are necessary for their proper functioning (e.g. hoses and nozzles) are temporarily detached, as long as the safety of the pressurized extinguishing agent containers is not compromised and the fire extinguishers continue to be identified as a portable fire extinguisher."

Add the following new special provisions:

"396 Large and robust articles may be transported with connected gas cylinders with the valves open regardless of 4.1.6.1.5 provided:

.1 the gas cylinders contain nitrogen of UN 1066 or compressed gas of UN 1956 or compressed air of UN 1002;

.2 the gas cylinders are connected with the article through pressure regulators and fixed piping in such a way that the pressure of the gas (gauge pressure) in the article does not exceed 35 kPa (0.35 bar);

.3 the gas cylinders are properly secured so that they cannot move in relation to the article and are fitted with strong and pressure resistant hoses and pipes;

.4 the gas cylinders, pressure regulators, piping and other components are protected from damage and impacts during transport by wooden crates or other suitable means;

.5 the transport document includes the following statement: "Transport in accordance with special provision 396."; and

.6 cargo transport units containing articles transported with cylinders with open valves containing a gas presenting a risk of asphyxiation are well ventilated and are marked in accordance with 5.5.3.6."

"397 Mixtures of nitrogen and oxygen containing not less than 19.5% and not more than 23.5% oxygen by volume may be transported under this entry when no other oxidizing gases are present. A division 5.1 subsidiary hazard label is not required for any concentrations within this limit."

"398 This entry applies to mixtures of butylenes, 1-butylene, *cis*-2-butylene and *trans*-2-butylene. For isobutylene, see UN 1055."

PART 4
PACKING AND TANK PROVISIONS

Chapter 4.1
Use of packagings, including intermediate bulk containers (IBCs) and large packagings

4.1.1 General provisions for the packing of dangerous goods in packagings, including IBCs and large packagings

4.1.1.15 Add a note at the end to read as follows:

"**Note:** For composite IBCs the period of use refers to the date of manufacture of the inner receptacle."

4.1.1.19 Use of salvage pressure receptacles

4.1.1.19.2 Delete the second sentence. In the fourth sentence, replace "1,000" with "3,000".

4.1.3 General provisions concerning packing instructions

4.1.3.3 Add a new last sentence to read as follows:

"Where packagings which need not meet the requirements of 4.1.1.3 (e.g. crates, pallets, etc.) are authorized in a packing instruction or the special provisions named in the Dangerous Goods List, these packages are not subject to the mass or volume limits generally applicable to packagings conforming to the requirements of chapter 6.1, unless otherwise indicated in the relevant packing instruction or special provision."

4.1.4 List of packing instructions

4.1.4.1 Packing instructions concerning the use of packagings (except IBCs and large packagings)

P003 Under special packing provision PP32, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P004 At the end, after (3), add a new note to read as follows:

"**Note:** The packagings authorized in (2) and (3) may exceed a net mass of 400 kg (see 4.1.3.3)."

P005 In the second row after the heading row, under the second paragraph, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P006 In paragraph (2), at the end, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P130 In special packing provision PP67, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P137 In special packing provision PP70, first sentence, replace "in accordance with 5.2.1.7.1" with "as illustrated in figures in 5.2.1.7.1".

P144 Under special packing provision PP77, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P200 In paragraph (5), in special packing provision "d", after "steel pressure receptacles", insert the words "or composite pressure receptacles with steel liners".

In special packing provision "z", at the end, add the following:

"Mixtures of fluorine and nitrogen with a fluorine concentration below 35% by volume may be filled in pressure receptacles up to a maximum allowable working pressure for which the partial pressure of fluorine does not exceed 31 bar (abs.).

$$\textit{working pressure}\ (\text{bar}) < \frac{31}{x_f} - 1$$

in which x_f = fluorine concentration in % by volume/100.

Mixtures of fluorine and inert gases with a fluorine concentration below 35% by volume may be filled in pressure receptacles up to a maximum allowable working pressure for which the partial pressure of fluorine does not exceed 31 bar (abs.), additionally taking the coefficient of nitrogen equivalency in accordance with ISO 10156:2017 into account when calculating the partial pressure.

$$\textit{working pressure}\ (\text{bar}) < \frac{31}{x_f}\,(x_f + K_k \times x_k) - 1$$

in which x_f = fluorine concentration in % by volume/100;

K_k = coefficient of equivalency of an inert gas relative to nitrogen (coefficient of nitrogen equivalency); and

x_k = inert gas concentration in % by volume/100.

However, the working pressure for mixtures of fluorine and inert gases shall not exceed 200 bar. The minimum test pressure of pressure receptacles for mixtures of fluorine and inert gases equals 1.5 times the working pressure or 200 bar, with the greater value to be applied."

P200 In table 2:

.1 for UN 1008, replace "387" with "864" in column "LC_{50}, mL/m^3";

.2 for UN 2196, replace "160" with "218" in column "LC_{50}, mL/m^3", insert "X" in columns "Tubes", "Pressure drums" and "MEGCs", and delete ", k" in column "Special packing provisions"; and

.3 for UN 2198, replace "190" with "261" in column "LC_{50}, mL/m³", insert "X" in columns "Tubes", "Pressure drums" and "MEGCs", and delete "k" in column "Special packing provisions" (*twice*).

In table 3, for UN 1052, replace "966" with "1307" in column "LC_{50}, mL/m³".

P205 In paragraphs (5), (6) and (7), replace "ISO 16111:2008" with "ISO 16111:2008 or ISO 16111:2018". In paragraph (7), at the end, add the following new sentence: "See 6.2.2.4 to determine which standard is applicable at the time of periodic inspection and test."

P208 In paragraph (1)(a), replace "ISO 11513:2011 or ISO 9809-1:2010" with "ISO 11513:2011, ISO 11513:2019, ISO 9809-1:2010 or ISO 9809-1:2019". In paragraph (11), replace "Annex A of ISO 11513:2011" with "Annex A of ISO 11513:2011 (applicable until 31 December 2024) or Annex A of ISO 11513:2019".

P408 In paragraph (2), at the end, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P621 In paragraph (1), for "Drums", replace the text in parentheses to read "(1A1, 1A2, 1B1, 1B2, 1N1, 1N2, 1H1, 1H2, 1D, 1G)". For "Jerricans", replace the text in parentheses to read "(3A1, 3A2, 3B1, 3B2, 3H1, 3H2)".

P801 At the end, after paragraph (2), add a new note to read as follows:

"**Note:** The packagings authorized in (1) and (2) may exceed a net mass of 400 kg (see 4.1.3.3)."

P903 In paragraph (2), in the first sentence, at the beginning, replace the words "cells or batteries" with the words "a cell or a battery" and at the end, delete the words ", and assemblies of such cells or batteries". In paragraphs (4) and (5), transfer the phrase "when intentionally active" to the beginning of the sentence to read: "When intentionally active, devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported in strong outer packagings."

At the end, after paragraph (5), add a new note to read as follows:

"**Note:** The packagings authorized in (2), (4) and (5) may exceed a net mass of 400 kg (see 4.1.3.3)."

P905 In the second row after the heading row, after the first sentence, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P906 In paragraph (2), under sub-paragraph (b), add a new note to read as follows:

"**Note 1:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

Under the last paragraph, before the additional provisions, add a new note to read as follows:

"**Note 2:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P907 At the end, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P909 At the end, after paragraph (4), add a new note to read as follows:

"**Note:** The packagings authorized in (3) and (4) may exceed a net mass of 400 kg (see 4.1.3.3)."

P910 In paragraph (3), at the end, add a new note to read as follows:

"**Note:** The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3)."

P911 In note *, at the end, add a new indent to read as follows:

"(i) In the case of multiple batteries and multiple items of equipment containing batteries, additional requirements such as the maximum number of batteries and items of equipment, the total maximum energy content of the batteries, and the configuration inside the package, including separations and protections of the parts, shall be considered."

4.1.4.2 Packing instructions concerning the use of IBCs

IBC02 In special packing provision B15, replace the words "of composite IBCs with a rigid plastics inner receptacle" with the words "of rigid plastics inner receptacles of composite IBCs".

IBC07 Add the following new special packing provision:

"**B40** UN 3550 may be transported in flexible IBCs (13H3 or 13H4) with siftproof liners to prevent any egress of dust during transport."

IBC520 In the second sentence (third row), after the words "The formulations" add the words "not listed in 2.4.2.3.2.3 and 2.5.3.2.4 but".

LP906 Replace the third sentence to read "For batteries and items of equipment containing batteries:"

In paragraph (2), replace the second paragraph to read as follows:

"A verification report shall be made available on request. As a minimum requirement, the name of the batteries, their type as defined in section 38.3.2.3 of the *Manual of Tests and Criteria*, the maximum number of batteries, the total mass of batteries, the total energy content of the batteries, the large packaging identification and the test data according to the verification method as specified by the competent authority shall be listed in the verification report. A set of specific instructions describing the way to use the package shall also be part of the verification report."

Add a fourth paragraph to read as follows:

"(4) The specific instructions for use of the package shall be made available by the packaging manufacturers and subsequent distributors to the consignor. They shall include at least the identification of the batteries and items of equipment that may be contained inside the packaging, the maximum number of batteries contained in the package and the maximum total of the batteries' energy content, as well as the configuration inside the package,

including the separations and protections used during the performance verification test."

In note *, at the end, add a new indent to read as follows:

"(i) In the case of multiple batteries and multiple items of equipment containing batteries, additional requirements such as the maximum number of batteries and items of equipment, the total maximum energy content of the batteries, and the configuration inside the package, including separations and protections of the parts, shall be considered."

4.1.6 Special packing provisions for goods of class 2

4.1.6.1 General provisions

4.1.6.1.6 Add to the end of the first sentence the words "and taking into account the lowest pressure rating of any component".

Insert the following new second sentence:

"Service equipment having a pressure rating lower than other components shall nevertheless comply with 6.2.1.3.1."

Delete the final sentence.

4.1.6.1.8 In the penultimate paragraph, first sentence, replace "1SO 11117:1998 or ISO 11117:2008 + Cor 1:2009" with "1SO 11117:1998, ISO 11117:2008 + Cor 1:2009 or ISO 11117:2019". In the final sentence, after "ISO 16111:2008", add "or ISO 16111:2018".

4.1.6.1.10 In the first sentence, insert the word "closed" before the words "cryogenic receptacles" and replace "P205 or P206" with "P205, P206 or P208".

4.1.9 Special packing provisions for radioactive material

4.1.9.1 General

4.1.9.1.4 In the first sentence, delete the words ", tanks, IBCs".

Chapter 4.2
Use of portable tanks and multiple-element gas containers (MEGCs)

4.2.5 Portable tank instructions and special provisions

4.2.5.2 Portable tank instructions

4.2.5.2.1 At the end, add "or chapter 6.10".

4.2.5.2.2 In the first sentence, in the text in parenthesis, after the words "reference steel", add the words "or the minimum shell thickness of fibre-reinforced plastics".

4.2.5.2.2 In the first sentence, in the text in parenthesis, after "reference steel", add "or the minimum shell thickness of fibre-reinforced plastics".

4.2.5.2.6 In the introductory paragraph, in the second sentence, after the words "(in millimetres of reference steel)", insert the words "or the minimum shell thickness for fibre-reinforced plastics (FRP) portable tanks".

In the table for T1-T22, in the heading row, add the following sentences at the end:

> "The instructions for portable tanks with FRP shells apply to substances of classes or divisions 1, 3, 5.1, 6.1, 6.2, 8 and 9. Additionally, the provisions of chapter 6.10 apply to the portable tanks with FRP shells."

T23 In the paragraph under the heading row, last sentence, after the words "The formulations" add the words "not listed in 2.4.2.3.2.3 and 2.5.3.2.4 but".

For UN No. 3109 "ORGANIC PEROXIDE, TYPE F, LIQUID" add "*tert*-Butyl hydroperoxide, not more than 56% in diluent type B†" under the column "Substance". Add a new note "†" under the table to read "† Diluent type B is *tert*-Butyl alcohol" and renumber existing table notes "†" to "§" to become "‡" to "1*".

4.2.5.3 Portable tank special provisions

TP32 In .1, in the first sentence, after the words "of metal", insert the words "or fibre-reinforced plastics".

PART 5
CONSIGNMENT PROCEDURES

Chapter 5.1
General provisions

5.1.2 Use of overpacks and unit loads

5.1.2.1 In the second sentence, at the end, delete the words ", except as required in 5.2.2.1.12". Add the following new third sentence before the final sentence:

> "Labelling of overpacks containing radioactive materials shall be in accordance with 5.2.2.1.12."

5.1.5 General provisions for class 7

5.1.5.1 Approval of shipments and notification

5.1.5.1.3 *Shipment approval by special arrangement*

Replace the text in paragraph to read as follows:

> "A competent authority may approve provisions under which consignments that do not satisfy all the applicable requirements of this Code may be transported under special arrangement (see 1.5.4)."

Chapter 5.2
Marking and labelling of packages including IBCs

5.2.1 Marking of packages including IBCs

5.2.1.7 Orientation arrows

5.2.1.7.1 At the third indent, replace the words "cryogenic receptacles" with the words "closed or open cryogenic receptacles".

5.2.1.7.2 In .1, replace the words "cryogenic receptacles" with the words "closed or open cryogenic receptacles".

5.2.1.10 Lithium battery mark

5.2.1.10.2 Remove the double asterisk in the figure "Lithium battery mark" and remove the note for the double asterisk below the figure.

At the end, add a new note to read as follows:

> "**Note:** The mark shown in the figure "Lithium battery mark" in 5.2.1.10.2 of the IMDG Code amendment 40-20, showing the telephone number for additional information, may continue to be applied until 31 December 2026."

Chapter 5.4
Documentation

5.4.1 Dangerous goods transport information

5.4.1.4 Information required on the dangerous goods transport document

5.4.1.4.3 *Information which supplements the proper shipping name in the dangerous goods description*

5.4.1.4.3 After .3, add the following new paragraph:

> ".4 *Molten substances*: When a substance which is solid in accordance with the definition in 1.2.1 is offered for transport in the molten state, the qualifying word "MOLTEN" shall be added as part of the proper shipping name, unless it is already part of the proper shipping name (see 3.1.2.5)."

Renumber the existing paragraphs .4, .5, .6 and .7 to .5, .6, .7 and .8, respectively.

At the end, add the following new paragraph:

> ".9 *Stabilized and temperature controlled substances*: Unless already part of the proper shipping name the word "STABILIZED" shall be added to the proper shipping name if stabilization is used and the words "TEMPERATURE CONTROLLED" shall be added to the proper shipping name if stabilization is by temperature control or a combination of chemical stabilization and temperature control (see 3.1.2.6)."

5.4.1.5 Information required in addition to the dangerous goods description

5.4.1.5.3 ***Salvage packagings including large salvage packagings and salvage pressure receptacles***

Replace the text in the paragraph to read as follows:

"For dangerous goods transported in salvage packagings in accordance with 4.1.1.18, including large salvage packagings, larger size packagings or large packagings of appropriate type and performance level to be used as a salvage packaging, the words "SALVAGE PACKAGING" shall be included.

For dangerous goods transported in salvage pressure receptacles in accordance with 4.1.1.19, the words "SALVAGE PRESSURE RECEPTACLE" shall be included."

5.4.1.5.4 ***Substances stabilized by temperature control***

Replace the words "If the word "STABILIZED" is part of" with the words "If the words "**TEMPERATURE CONTROLLED**" are part of" and delete the words "when stabilization is by means of temperature control,".

5.4.1.5.17 ***Transport of UN Nos. 3528, 3529 and 3530***

Replace the paragraph to read as follows:

"**5.4.1.5.17** ***Additional entries in the case of the application of special provisions***

Where, in accordance with a special provision in chapter 3.3, additional information is necessary, this additional information shall be included in the dangerous goods transport document."

PART 6
CONSTRUCTION AND TESTING OF PACKAGINGS, INTERMEDIATE BULK CONTAINERS (IBCs), LARGE PACKAGINGS, PORTABLE TANKS, MULTIPLE-ELEMENT GAS CONTAINERS (MEGCs) AND ROAD TANK VEHICLES

Chapter 6.1
Provisions for the construction and testing of packagings (other than for class 6.2 substances)

6.1.1 Applicability and general provisions

6.1.1.2 General provisions

6.1.1.2.1 In the second sentence, replace the words "successfully to withstand the tests" with the words "to successfully fulfil the requirements".

6.1.1.3 In the note, replace "*ISO 16106:2006*" with "*ISO 16106:2020*" and delete the word "*Packaging –*" in the standard's title.

Chapter 6.2
Provisions for the construction and testing of pressure receptacles, aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas

6.2.1 General provisions

6.2.1.1 Design and construction

6.2.1.1.1 After the words "Pressure receptacles" delete the words "and their closures". At the end of the sentence replace the word "transport" with the words "transport and intended use".

6.2.1.1.4 At the end of the sentence replace the word "used" with the word "welded".

6.2.1.1.5 In the first sentence replace the words "cylinders, tubes, pressure drums" with the words "pressure receptacle shells". In the final sentence after the words "The test pressure of a cylinder" insert the word "shell".

6.2.1.1.6 At the beginning of the first and the second sentences replace the words "Pressure receptacles" with the words "Cylinders or cylinder shells". In the final sentence replace the first words "pressure receptacle" with the words "cylinder shell" and the second and third words "pressure receptacle" with the word "cylinder".

6.2.1.1.8.2 In the third and fourth sentences replace the words "pressure receptacle" with the words "inner vessel". At the end of the fourth sentence replace the word "fittings" with the words "service equipment".

6.2.1.1.9 *Additional requirements for the construction of pressure receptacle for acetylene*

At the end of the heading replace the words "***pressure receptacle for acetylene***" with the words "***acetylene cylinders***". In the first sentence replace the words "Pressure receptacle" with the words "Cylinder shells". In .1, replace the words "pressure receptacle" with the words "cylinder shell". In the final sentence replace the words "compatible with the pressure receptacle" with the words "compatible with those parts of the cylinder that are in contact with it".

6.2.1.2 Materials

6.2.1.2.1 After the words "Construction materials of pressure receptacles" delete the words "and their closures".

6.2.1.2.2 At the beginning of the first sentence, after the words "Pressure receptacles", delete the words "and their closures".

6.2.1.3 Service equipment

6.2.1.3.1 Replace the words "Valves, piping and other fittings" with the words "Service equipment" and replace the words "excluding pressure relief devices" with the words "excluding porous, absorbent or adsorbent material, pressure relief devices, pressure gauges or indicators".

6.2.1.3.2 Replace the paragraph to read as follows:

> "6.2.1.3.2 Service equipment shall be configured or designed to prevent damage and unintended opening that could result in the release of

the pressure receptacle contents during normal conditions of handling and transport. All closures shall be protected in the same manner as is required for valves in 4.1.6.1.8. Manifold piping leading to shut-off valves shall be sufficiently flexible to protect the shut-off valves and the piping from shearing or releasing the pressure receptacle contents."

6.2.1.3.3 Replace the words "shall be fitted with devices" with the words "shall be fitted with handling devices".

6.2.1.4 Approval of pressure receptacles

6.2.1.4.1 Delete the second sentence beginning with the words "Pressure receptacles…".

6.2.1.4.3 Insert a new paragraph 6.2.1.4.3 to read:

"6.2.1.4.3 Pressure receptacle shells and the inner vessels of closed cryogenic receptacles shall be inspected, tested and approved by an inspection body."

6.2.1.4.4 Insert a new paragraph 6.2.1.4.4 as follows:

"6.2.1.4.4 For refillable cylinders, pressure drums and tubes, the conformity assessment of the shell and the closure(s) may be carried out separately. In these cases, an additional assessment of the final assembly is not required.

For bundles of cylinders, the cylinder shells and the valve(s) may be assessed separately, but an additional assessment of the complete assembly is required.

For closed cryogenic receptacles, the inner vessels and the closures may be assessed separately, but an additional assessment of the complete assembly is required.

For acetylene cylinders, conformity assessment shall comprise either:

.1 one assessment of conformity covering both the cylinder shell and the contained porous material; or

.2 a separate assessment of conformity for the empty cylinder shell and an additional assessment of conformity covering the cylinder shell with the contained porous material."

6.2.1.5 Initial inspection and test

6.2.1.5.1 In the first sentence replace the words "closed cryogenic receptacles and metal hydride storage systems" with the words "closed cryogenic receptacles, metal hydride storage systems and bundles of cylinders" and after the words "the applicable design standards" insert the words "or recognized technical codes".

In the line before .1, replace the words "pressure receptacles" with the words "pressure receptacle shells". In .4, at the end delete the words "of the pressure receptacles". In .5, replace the words "neck threads" with the words "threads used to fit closures". In the line before .7,

replace the words "all pressure receptacles" with the words "all pressure receptacle shells". In .7, replace the words "pressure receptacles" with the words "pressure receptacle shells". In .8, both sentences, replace the words "pressure receptacles" with the words "pressure receptacle shells". In .9 replace the words "pressure receptacles" with the words "pressure receptacle shells". In .10 replace the words "pressure receptacles" with the words "cylinder shells".

After .10 insert the following new provisions:

"On an adequate sample of closures:

.11 verification of materials;

.12 verification of dimensions;

.13 verification of cleanliness;

.14 inspection of completed assembly; and

.15 verification of the presence of marks.

For all closures:

.16 testing for leakproofness."

6.2.1.5.2 Replace the paragraph to read as follows:

"6.2.1.5.2 Closed cryogenic receptacles shall be subjected to testing and inspection during and after manufacture in accordance with the applicable design standards or recognized technical codes including the following:

On an adequate sample of inner vessels:

.1 testing of the mechanical characteristics of the material of construction;

.2 verification of the minimum wall thickness;

.3 inspection of the external and internal conditions;

.4 verification of the conformance with the design standard or code; and

.5 inspection of welds by radiographic, ultrasonic or other suitable non-destructive test method according to the applicable design and construction standard or code.

For all inner vessels:

.6 a hydraulic pressure test; the inner vessel shall meet the acceptance criteria specified in the design and construction technical standard or technical code;

Note: With the agreement of the competent authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.

.7 inspection and assessment of manufacturing defects and either repairing them or rendering the inner vessel unserviceable; and

.8 an inspection of the marks.

On an adequate sample of closures:

.9 verification of materials;

.10 verification of dimensions;

.11 verification of cleanliness;

.12 inspection of completed assembly; and

.13 verification of the presence of marks.

For all closures:

.14 testing for leakproofness.

On an adequate sample of completed closed cryogenic receptacles:

.15 testing the satisfactory operation of service equipment; and

.16 verification of the conformance with the design standard or code.

For all completed closed cryogenic pressure receptacles:

.17 testing for leakproofness."

6.2.1.5.3 In the first sentence replace the words "receptacles" with the words "pressure receptacle shells".

6.2.1.5.4 Insert the following new paragraph:

"6.2.1.5.4 For bundles of cylinders the cylinder shells and closures shall be subjected to initial inspection and tests specified in 6.2.1.5.1. An adequate sample of frames shall be proof load tested to two times the maximum gross weight of the bundles of cylinders.

Additionally, all manifolds of bundle of cylinders shall undergo a hydraulic pressure test and all the completed bundles of cylinders shall undergo a leakproofness test.
Note: With the agreement of the competent authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger."

6.2.1.6 Periodic inspection and test

6.2.1.6.1 Replace .3 and .4 with the following:

".3 Checking of the threads either:

.1 if there is evidence of corrosion; or

.2 if the closures or other service equipment are removed;

.4 A hydraulic pressure test of the pressure receptacle shell and, if necessary, verification of the characteristics of the material by suitable tests;"

In note 2, replace the words "cylinders or tubes" with the words "cylinder shells or tube shells".

Replace note 3 to read as follows:

"**Note 3:** The check of internal conditions of 6.2.1.6.1.2 and the hydraulic pressure test of 6.2.1.6.1.4 may be replaced by ultrasonic examination carried out in accordance with ISO 18119:2018 for seamless steel and seamless aluminium alloy cylinder shells. For a transitional period until 31 December 2024 the standard ISO 10461:2005 +A1:2006 may be used for seamless aluminium alloy cylinders and ISO 6406:2005 may be used for seamless steel cylinder shells for this same purpose."

Insert the following new note 4:

"Note 4: For bundles of cylinders the hydraulic test specified in .4 above shall be carried out on the cylinder shells and on the manifold."

Replace current .5 and add a new .6 as follows:

".5 Check of service equipment, if to be reintroduced into service. This check may be carried out separately from the inspection of the pressure receptacle shell.

.6 A leakproofness test of bundles of cylinders after reassembly."

6.2.1.6.2 Replace the words "Pressure receptacles" with the word "Cylinders".

6.2.1.7 Requirements for manufacturers

6.2.1.7.2 Replace the paragraph to read as follows:

"6.2.1.7.2 A proficiency test of the manufacturers of pressure receptacle shells and the inner vessels of closed cryogenic receptacle shall in all instances be carried out by an inspection body approved by the competent authority of the country of approval. Proficiency testing of manufacturers of closures shall be carried out if the competent authority requires it. This test shall be carried out either during design type approval or during production inspection and certification."

6.2.2 Provisions for UN pressure receptacles

In note 2, after the words "UN pressure receptacles", delete the words "and service equipment".

6.2.2.1 Design, construction and initial inspection and test

6.2.2.1.1 In the first sentence replace the words "UN cylinders" with the words "refillable UN cylinder shells".

In the table, for "ISO 9809-1:2010", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 9809-1:2010", add the following new entry:

ISO 9809-1:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa	Until further notice

In the table, for "ISO 9809-2:2010", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 9809-2:2010", add the following new entry:

ISO 9809-2:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa	Until further notice

In the table, for "ISO 9809-3:2010", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 9809-3:2010", add the following new entry:

ISO 9809-3:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 3: Normalized steel cylinders and tubes	Until further notice

In the table, delete the rows for "ISO 11118:1999" and "ISO 11118:2015".

In note 1, after the table, replace the words "composite cylinders" with the words "composite cylinder shells". In note 2, after the table, in the first sentence, replace the words "composite cylinders" with the words "composite cylinder shells". In the second sentence, replace the word "cylinders" with the words "composite cylinder shells". In the last sentence replace the word "cylinder" with the word "cylinder shell".

6.2.2.1.2 In the first sentence replace the words "UN tubes" with the words "UN tube shells". In the table, in the row for ISO 11515:2013, replace the words "Until further notice" with the words "Until 31 December 2026". Add a new row beneath this row as follows:

ISO 11515:2013 + Amd 1:2018	Gas cylinders – Refillable composite reinforced tubes of water capacity between 450 l and 3000 l – Design, construction and testing	Until further notice

At the end of the table, add the following new entries:

ISO 9809-1:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa	Until further notice
ISO 9809-2:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa	Until further notice
ISO 9809-3:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 3: Normalized steel cylinders and tubes	Until further notice

In note 1 after the table, replace the words "composite tubes" with the words "composite tube shells". In note 2 after the table, in the first sentence, replace the words "composite tubes" with the words "composite tube shells". In the second sentence, replace the word "tubes" with the words "composite tube shells". In the last sentence replace the word "tube" with the words "tube shell".

6.2.2.1.3 In the first table, for "ISO 9809-1:2010", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 9809-1:2010", add the following new entry:

ISO 9809-1:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa	Until further notice

In the first table, for "ISO 9809-3:2010", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 9809-3:2010", add the following new entry:

ISO 9809-3:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 3: Normalized steel cylinders and tubes	Until further notice

6.2.2.1.4 Replace the words "UN cryogenic receptacles" with the words "UN closed cryogenic receptacles". In the table, for "ISO 21029-1:2004", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 21029-1:2004", add the following new entry:

ISO 21029-1:2018 + Amd.1:2019	Cryogenic vessels – Transportable vacuum insulated vessels of not more than 1 000 litres volume – Part 1: Design, fabrication, inspection and tests	Until further notice

6.2.2.1.5 In the table, for "ISO 16111:2008", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 16111:2008", add the following new entry:

ISO 16111:2018	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	Until further notice

6.2.2.1.6 In the first sentence, replace the words "The standard shown below" with the words "The following standard". In the second sentence replace the words "UN cylinder" with the words "UN cylinder or UN cylinder shell". In the table, for "ISO 10961:2010", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 10961:2010", add the following new entry:

ISO 10961:2019	Gas cylinders – Cylinder bundles – Design, manufacture, testing and inspection	Until further notice

Replace the current note after the table with the following:

"**Note:** Changing one or more cylinders or cylinder shells of the same design type, including the same test pressure, in an existing UN bundle of cylinders does not require a new conformity assessment of the existing bundle. Service equipment of the bundle of cylinders can also be replaced without requiring a new conformity assessment if it complies with the design type approval."

6.2.2.1.7 In the table, for "ISO 11513:2011", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 11513:2011", add the following new entry:

ISO 11513:2019	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection	Until further notice

In the table, for "ISO 9809-1:2010", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 9809-1:2010", add the following new entry:

ISO 9809-1:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa	Until further notice

6.2.2.1.8 In the table, in the row for "ISO 21172-1:2015", replace the words "Until further notice" with the words "Until 31 December 2026". Add the following new row to the table after "ISO 21172-1:2015":

ISO 21172-1:2015 + Amd 1:2018	Gas cylinders – Welded steel pressure drums up to 3 000 litres capacity for the transport of gases – Design and construction – Part 1: Capacities up to 1 000 litres	Until further notice

6.2.2.1.9 Insert a new paragraph and table as follows:

"6.2.2.1.9 The following standards apply to the design, construction and initial inspection and test of non-refillable UN cylinders except that the inspection requirements related to the conformity assessment system and approval shall be in accordance with 6.2.2.5.

Reference	Title	Applicable for manufacture
ISO 11118:1999	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods	Until 31 December 2020
ISO 13340:2001	Transportable gas cylinders – Cylinder valves for non-refillable cylinders – Specification and prototype testing	Until 31 December 2020
ISO 11118:2015	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods	Until 31 December 2026
ISO 11118:2015 +Amd.1:2019	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods	Until further notice

"

6.2.2.2 Materials

In the first sentence delete the words "pressure receptacle".

6.2.2.3 Service equipment

6.2.2.3 Replace the heading "**Service equipment**" to read "**Closures and their protection**".

Replace the first sentence to read as follows:

"The following standards apply to the design, construction, and initial inspection and test of closures and their protection:"

In the first table, for "ISO 11117:2008 + Cor.1:2009", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 11117:2008 + Cor.1:2009", add the following new entry:

ISO 11117:2019	Gas cylinders – Valve protection caps and guards – Design, construction and tests	Until further notice

In the first table, delete the row for "ISO 13340:2001".

In the first table, for "ISO 17871:2015", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". In the column "Title", add the following new note under the title:

"**Note:** This standard shall not be used for flammable gases."

In the first table, after the entry for "17871:2015", add the following new entry:

ISO 17871:2020	Gas cylinders – Quick-release cylinder valves – Specification and type testing	Until further notice

In the second table, for "ISO 16111:2008", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2026". After the entry for "ISO 16111:2008", add the following new entry:

ISO 16111:2018	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	Until further notice

6.2.2.4 Periodic inspection and test

Replace the first sentence to read "The following standards apply to periodic inspection and testing of UN pressure receptacles:"

In the first table, in the row for "ISO 6406:2005", replace the words "Until further notice" with the words "Until 31 December 2024". Add the following new row to the table after "ISO 6406:2005":

ISO 18119:2018	Gas cylinders – Seamless steel and seamless aluminium-alloy gas cylinders and tubes – Periodic inspection and testing	Until further notice

In the first table, in the row for "ISO 10460:2005", replace the words "Until further notice" with the words "Until 31 December 2024". Add the following new row to the table after "ISO 10460:2005":

ISO 10460:2018	Gas cylinders – Welded aluminium-alloy, carbon and stainless steel gas cylinders – Periodic inspection and testing.	Until further notice

In the first table, in the row for "ISO 10461:2005/Amd 1:2006", replace the words "Until further notice" with the words "Until 31 December 2024".

In the first table, for "ISO 10462:2013", in column "Applicable for manufacture", replace the words "Until further notice" by the words "Until 31 December 2024". After the entry for "ISO 10462:2013", add the following new entry:

ISO 10462:2013 + Amd1:2019	Gas cylinders – Acetylene cylinders – Periodic inspection and maintenance	Until further notice

In the first table, for "ISO 11513:2011", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2024". After the entry for "ISO 11513:2011", add the following new entry:

ISO 11513:2019	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection	Until further notice

Delete the row for "ISO 11623:2002".

At the end of the first table, add the following new entry:

ISO 23088:2020	Gas cylinders – Periodic inspection and testing of welded steel pressure drums – Capacities up to 1 000 l	Until further notice

In the second table, for "ISO 16111:2008", in column "Applicable for manufacture", replace the words "Until further notice" with the words "Until 31 December 2024". After the entry for "ISO 16111:2008", add the following new entry:

ISO 16111:2018	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	Until further notice

6.2.2.5 Conformity assessment system and approval for manufacture of pressure receptacles

At the beginning of 6.2.2.5 renumber 6.2.2.5.1 as 6.2.2.5.0 and insert the following new note at the end (after the definition for "*Verify*"):

"**Note:** In this subsection when separate assessment is used the term pressure receptacle shall refer to pressure receptacle, pressure receptacle shell, inner vessel of the closed cryogenic receptacle or closure, as appropriate."

6.2.2.5.1 Insert a new paragraph 6.2.2.5.1 to read as follows:

"6.2.2.5.1 The requirements of 6.2.2.5 shall be used for the conformity assessments of pressure receptacles. Paragraph 6.2.1.4.3 gives details of which parts of pressure receptacles may be conformity assessed separately. However, the requirements of 6.2.2.5 may be replaced by requirements specified by the competent authority in the following cases:

.1 conformity assessment of closures;

.2 conformity assessment of the complete assembly of bundles of cylinders provided the cylinder shells have been conformity assessed in accordance with the requirements of 6.2.2.5; and

.3 conformity assessment of the complete assembly of closed cryogenic receptacles provided the inner vessel has been conformity assessed in accordance with the requirements of 6.2.2.5."

6.2.2.5.4 *Approval process*

6.2.2.5.4.9 In .3, replace the existing text to read: "as required by the pressure receptacle standard or technical code, carry out or supervise the tests of pressure receptacles as required for design type approval;".

Add the following new sentence at the end of the penultimate paragraph:

"If it was not possible to evaluate exhaustively the compatibility of the materials of construction with the contents of the pressure receptacle when the certificate was issued, a statement that compatibility assessment was not completed shall be included in the design type approval certificate."

6.2.2.7 Marking of refillable UN pressure receptacles

Amend the note by replacing the words "6.2.2.9 and marking" with the words "6.2.2.9, marking" and inserting at the end the words "and marking requirements for closures are given in 6.2.2.11".

6.2.2.7.1 In the first sentence replace the words "pressure receptacles" with the words "pressure receptacle shells and closed cryogenic receptacles". At the end of the second sentence, delete the words "on the pressure receptacle". In the third sentence, after the words "neck of the pressure receptacle" insert the word "shell".

6.2.2.7.2 At the end, insert the following new note:

"**Note:** For acetylene cylinders the standard ISO 3807 shall also be marked."

After (e) insert the following new note:

"**Note:** When an acetylene cylinder is conformity assessed in accordance with 6.2.1.4.4.2 and the inspection bodies for the cylinder shell and the acetylene cylinder are different, their respective marks (d) are required. Only the initial inspection date (e) of the completed acetylene cylinder is required. If the country of approval of the inspection body responsible for the initial inspection and test is different a second mark (c) shall be applied."

6.2.2.7.3 In (g), in the second sentence, replace the words "mass of valve, valve cap" with the words "mass of closure(s), valve protection cap".

In (i), at the end insert the following note:

"**Note:** When a cylinder shell is intended for use as an acetylene cylinder (including the porous material), the working pressure mark is not required until the acetylene cylinder is completed."

In (j), in the first sentence replace the words "liquefied gases and refrigerated liquefied gases" with the words "liquefied gases, refrigerated liquefied gases and dissolved gases".

Replace paragraphs (k) and (l) with the following:

"(k) In the case of cylinders for UN 1001 acetylene, dissolved:

(i) the tare in kilograms consisting of the total of the mass of the empty cylinder shell, the service equipment (including porous material) not removed during filling, any coating, the solvent and the saturation gas expressed to three significant figures rounded down to the last digit followed by the letters "KG". At least one decimal shall be shown after the decimal point. For pressure receptacles of less than 1 kg, the mass shall be expressed to two significant figures rounded down to the last digit;

(ii) the identity of the porous material (e.g. name or trademark); and

(iii) the total mass of the filled acetylene cylinder in kilograms followed by the letters "KG".

(l) In the case of cylinders for UN 3374 acetylene, solvent free:

(i) the tare in kilograms consisting of the total of the mass of the empty cylinder shell, the service equipment (including porous material) not removed during filling and any coating expressed to three significant figures rounded down to the last digit followed by the letters "KG". At least one decimal shall be shown after the decimal point. For pressure receptacles of less than 1 kg, the mass shall be expressed to two significant figures rounded down to the last digit;

(ii) the identity of the porous material; and

(iii) the total mass of the filled acetylene cylinder in kilograms followed by the letters "KG"."

In (n), after the existing text insert the following new note:

"**Note:** For acetylene cylinders, if the manufacturer of the acetylene cylinder and the manufacturer of the cylinder shell are different, only the mark of the manufacturer of the completed acetylene cylinder is required."

6.2.2.7.8 Replace the paragraph to read as follows:

"6.2.2.7.8 The marks in accordance with 6.2.2.7.7 may be engraved on a metallic ring affixed to the cylinder or pressure drum when the valve is installed, and which is removable only by disconnecting the valve from the cylinder or pressure drum."

6.2.2.8 Marking of non-refillable UN pressure receptacles

In the heading replace the words "**pressure receptacles**" with the word "**cylinders**".

6.2.2.8.1 In the first sentence replace the words "pressure receptacles" with the word "cylinders" and the words "pressure receptacle" by the word "cylinder". In the second sentence replace the words "pressure receptacle" with the word "cylinder". In the third sentence replace the words "pressure receptacle" at the first occurrence with the words "cylinder shell" and at the second occurrence by the word "cylinder". In the fourth sentence replace the words "pressure receptacles" with the word "cylinders" (*twice*). In the fifth sentence replace the words "pressure receptacles" with the word "cylinders" (*twice*).
6.2.2.8.3 In the note, replace the word "*pressure receptacles*" with the word "*cylinders*".

6.2.2.10 Marking of UN bundles of cylinders

6.2.2.10.1 Replace the word "cylinders" with the words "cylinder shells".

Insert a new second sentence as follows:

"Individual closures in a bundle of cylinders shall be marked in accordance with 6.2.2.11."

6.2.2.10.3 In (b), in the first sentence replace the phrase in brackets with "cylinder shells and service equipment". In the second sentence after the word "tare" delete the word "mass".

6.2.2.11 Insert a new paragraph 6.2.2.11 as follows:

"**6.2.2.11 Marking of closures for refillable UN pressure receptacles**

For closures the following permanent marks shall be applied clearly and legibly, (e.g. stamped, engraved or etched):

.1 manufacturer's identification mark;

.2 design standard or design standard designation;

.3 date of manufacture (year and month or year and week); and

.4 the identity mark of the inspection body responsible for the initial inspection and test, if applicable.

The valve test pressure shall be marked when it is less than the test pressure which is indicated by the rating of the valve filling connection."

6.2.4 Provisions for aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas

Below the heading, add a new paragraph to read as follows:

"6.2.4.1 The internal pressure of aerosol dispensers at 50°C shall not exceed 1.2 MPa (12 bar) when using flammable liquefied gases, 1.32 MPa (13.2 bar) when using non-flammable liquefied gases, and 1.5 MPa (15 bar) when using non-flammable compressed or dissolved gases. In case of a mixture of several gases, the stricter limit shall apply."

The existing paragraph below the heading becomes 6.2.4.2.

Renumber the following sub-paragraphs as follows: 6.2.4.1 to 6.2.4.2.1, 6.2.4.1.1 to 6.2.4.2.1.1, 6.2.4.1.2 to 6.2.4.2.1.2, 6.2.4.2 to 6.2.4.2.2, 6.2.4.2.1 to 6.2.4.2.2.1, 6.2.4.2.2 to 6.2.4.2.2.2, 6.2.4.2.2.1 to 6.2.4.2.2.2.1, 6.2.4.2.2.2 to 6.2.4.2.2.2.2, 6.2.4.2.3 to 6.2.4.2.2.3, 6.2.4.2.3.1 to 6.2.4.2.2.3.1, 6.2.4.2.3.2 to 6.2.4.2.2.3.2 and 6.2.4.3 to 6.2.4.2.3.

In the renumbered 6.2.4.2, replace "6.2.4.1" with "6.2.4.2.1" and "6.2.4.2" with "6.2.4.2.2".

In the renumbered 6.2.4.2.2, replace "6.2.4.2.1" with "6.2.4.2.2.1" and "6.2.4.2.2" with "6.2.4.2.2.2".

In the renumbered 6.2.4.2.3, replace "6.2.4.1" with "6.2.4.2.1" and "6.2.4.2" with "6.2.4.2.2".

Chapter 6.3
Provisions for the construction and testing of packagings for class 6.2 infectious substances of category A

6.3.2 Provisions for packagings

6.3.2.1 In the second sentence, replace the words "successfully to withstand the tests" with the words "to successfully fulfil the provisions".

6.3.2.2 In the note, replace "ISO 16106:2006" with "ISO 16106:2020" and delete the word "Packaging –" in the standard's title.

Chapter 6.4
Provisions for the construction, testing and approval of packages for radioactive material and for the approval of such material

6.4.12 Test procedures and demonstration of compliance

6.4.12.1 In the first sentence, delete "2.7.2.3.1.3, 2.7.2.3.1.4," and after "2.7.2.3.4.2", insert ", 2.7.2.3.4.3".

6.4.12.2 Delete "2.7.2.3.1.3, 2.7.2.3.1.4," and after "2.7.2.3.4.2", insert ", 2.7.2.3.4.3".

6.4.24 Transitional measures for class 7

6.4.24.1 Replace the heading above 6.4.24.1 to read "**Packages not requiring competent authority approval of design under the 1985, 1985 (as amended 1990), 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material**".

6.4.24.1 In (a), replace the text to read "Packages that meet the requirements of the 1985 or 1985 (as amended 1990) editions of the IAEA Regulations for the Safe Transport of Radioactive Material:"

In (b), replace the text to read "Packages that meet the requirements of the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material:"

6.4.24.2 Replace the heading above 6.4.24.2 to read "**Package designs approved under the 1985, 1985 (as amended 1990), 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material**".

6.4.24.2 In (a), replace the text to read "Packagings that were manufactured to a package design approved by the competent authority under the provisions of the 1985 or 1985 (as amended 1990) editions of the IAEA Regulations for the Safe Transport of Radioactive Material may continue to be used provided that all of the following conditions are met:"

In (b), replace the text to read "Packagings that were manufactured to a package design approved by the competent authority under the provisions of the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material may continue to be used provided that all of the following conditions are met:"

6.4.24.3 Replace the words "Editions of IAEA Safety Series No.6" by the words "editions of the IAEA Regulations for the Safe Transport of Radioactive Material".

6.4.24.4 Replace the paragraph to read "No new manufacture of packagings of a package design meeting the provisions of the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material shall be permitted to commence after 31 December 2028."

6.4.24.5 In the heading above 6.4.24.5, replace the words "(2009 Edition of IAEA Safety Standard Series No.TS-R-1)" by the words "(2009 edition of the IAEA Regulations for the Safe Transport of Radioactive Material)".

In the paragraph, replace the words "or (iii) of the 2009 Edition of IAEA Regulations" by the words "or (iii) of the 2009 edition of the IAEA Regulations".

6.4.24.6 Replace the heading above 6.4.24.6 to read "**Special form radioactive material approved under the 1985, 1985 (as amended 1990), 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material**".

Replace the paragraph to read as follows:

> "Special form radioactive material manufactured to a design which had received unilateral approval by the competent authority under the 1985, 1985 (as amended 1990), 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material may continue to be used when in compliance with the mandatory management system in accordance with the applicable requirements of 1.5.3.1. There shall be no new manufacture of special form radioactive material to a design that had received unilateral approval by the competent authority under the 1985 or 1985 (as amended 1990) editions of the IAEA Regulations for the Safe Transport of Radioactive Material. No new manufacture of special form radioactive material to a design that had received unilateral approval by the competent authority under the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material shall be permitted to commence after 31 December 2025."

Chapter 6.5
Provisions for the construction and testing of intermediate bulk containers (IBCs)

6.5.1 General requirements

6.5.1.1.2 Replace the paragraph to read as follows:

> "6.5.1.1.2 The requirements for IBCs in 6.5.3 are based on IBCs currently in use. In order to take into account progress in science and technology, there is no objection to the use of IBCs having specifications different from those in 6.5.3 and 6.5.5, provided that they are equally effective, acceptable to the competent authority and able to successfully fulfil the requirements described in 6.5.4 and 6.5.6. Methods of inspection and testing other than those described in this Code are acceptable, provided they are equivalent."

6.5.2 Marking

6.5.2.1 Primary marking

6.5.2.1.2 Add a new 6.5.2.1.2 to read as follows:

> "6.5.2.1.2 IBCs manufactured from recycled plastics material as defined in 1.2.1 shall be marked "REC". For rigid IBCs, this mark shall be

placed near the marks prescribed in 6.5.2.1.1. For the inner receptacle of composite IBCs, this mark shall be placed near the marks prescribed in 6.5.2.2.4."

Renumber current 6.5.2.1.2 and 6.5.2.1.3 as 6.5.2.1.3 and 6.5.2.1.4, respectively.

6.5.4 Testing, certification and inspection

6.5.4.1 Quality assurance

6.5.4.1 In the note, replace "*ISO 16106:2006*" by "*ISO 16106:2020*" and delete the word "*Packaging* –" in the standard's title.

6.5.5 Specific provisions for IBCs

6.5.5.3 Specific provisions for rigid plastics IBCs

6.5.5.3.2 After the first sentence, add the following new sentence: "Except for recycled plastics material as defined in 1.2.1, no used material other than production residues or regrind from the same manufacturing process may be used."

6.5.5.3.5 Delete the paragraph.

6.5.5.4.6 After the first sentence, add the following new sentence: "Except for recycled plastics material as defined in 1.2.1, no used material other than production residues or regrind from the same manufacturing process may be used."

6.5.5.4.9 Delete the paragraph.
Renumber current 6.5.5.4.10 to 6.5.5.4.26 as 6.5.5.4.9 to 6.5.5.4.25, respectively.

In renumbered 6.5.5.4.19, replace "6.5.5.4.9" by "6.5.5.4.8".

Chapter 6.6
Provisions for the construction and testing of large packagings

6.6.1 General

6.6.1.2 In the note, replace "ISO 16106:2006" by "ISO 16106:2020" and delete the word "Packaging –" in the standard's title.

6.6.1.3 In the second sentence, replace the words "successfully to withstand the tests" with the words "to successfully fulfil the provisions".

Chapter 6.7
Provisions for the design, construction, inspection and testing of portable tanks and multiple-element gas containers (MEGCs)

6.7 Add a new note at the beginning of chapter 6.7, after the existing note, to read as follows:

"**Note 2**: The provisions of this chapter also apply to portable tanks with shells made of fibre-reinforced plastics (FRP) to the extent indicated in chapter 6.10."

Renumber the existing "**Note**" as "**Note 1**".

6.7.2 Provisions for the design, construction, inspection and testing of portable tanks intended for the transport of substances of class 1 and classes 3 to 9

6.7.2.1 Definitions

In the definition for "portable tank", replace the last sentence to read:

> "Road tank-vehicles, rail tank-wagons, non-metallic tanks (except FRP portable tanks, *see* chapter 6.10), gas cylinders, large receptacles, and intermediate bulk containers (IBCs) are not considered to fall within this definition;"

6.7.3 Provisions for the design, construction, inspection and testing of portable tanks intended for the transport of non-refrigerated liquefied gases of class 2

6.7.3.8 Capacity of relief devices

6.7.3.8.1.1 Delete the footnote. At the end of 6.7.3.8.1.1, add a new note with the text of the footnote, to read as follows:

> "**Note**: This formula applies only to non-refrigerated liquefied gases which have critical temperatures well above the temperature at the accumulating condition. For gases which have critical temperatures near or below the temperature at the accumulating condition, the calculation of the pressure-relief device delivery capacity shall consider further thermodynamic properties of the gas (see, e.g. CGA S-1.2-2003 Pressure Relief Device Standards – Part 2 – Cargo and Portable Tanks for Compressed Gases)."

Chapter 6.10

After chapter 6.9, add a new chapter 6.10 to read as follows:
"

Chapter 6.10
Provisions for the design, construction, inspection and testing of portable tanks with shells made of fibre-reinforced plastics (FRP) materials

6.10.1 Application and general requirements

6.10.1.1 The requirements of section 6.10.2 apply to portable tanks with an FRP shell intended for the transport of dangerous goods of classes or divisions 1, 3, 5.1, 6.1, 6.2, 8 and 9 by all modes of transport. In addition to the requirements of this chapter, unless otherwise specified, the applicable requirements of the International Convention for Safe Containers (CSC) 1972, as amended, shall be fulfilled by any multimodal portable tank with FRP shell which meets the definition of a "container" within the terms of that Convention.

6.10.1.2 The provisions of this chapter do not apply to offshore portable tanks.

6.10.1.3 The provisions of chapter 4.2, and section 6.7.2 apply to FRP portable tank shells except for those concerning the use of metal materials for the construction of a portable tank shell and additional provisions stated in this chapter.

6.10.1.4 In recognition of scientific and technological advances, the technical requirements of this chapter may be varied by alternative arrangements. These alternative arrangements shall offer a level of safety not less than that given by the provisions of this chapter with respect to compatibility with substances transported and the

ability of the FRP portable tank to withstand impact, loading and fire conditions. For international transport, alternative arrangement FRP portable tanks shall be approved by the applicable competent authorities.

6.10.2 Provisions for the design, construction, inspection and testing of FRP portable tanks

6.10.2.1 Definitions

For the purposes of this section, the definitions of 6.7.2.1 apply except for definitions related to metal materials ("Fine grain steel", "Mild steel" and "Reference steel") for the construction of the shell of a portable tank.

Additionally, the following definitions apply to portable tanks with an FRP shell:

External layer means the part of the shell which is directly exposed to the atmosphere.

Fibre-reinforced plastic (FRP) means material consisting of fibrous and/or particulate reinforcement contained within a thermoset or thermoplastic polymer (matrix).

Filament winding means a process for constructing FRP structures in which continuous reinforcements (filament, tape, or other), either previously impregnated with a matrix material or impregnated during winding, are placed over a rotating mandrel. Generally, the shape is a surface of revolution and may include heads.

FRP shell means a closed part of cylindrical shape with an interior volume intended for transport of chemical substances.

FRP tank means a portable tank constructed with an FRP shell and heads, service equipment, safety relief devices and other installed equipment.

Glass transition temperature (Tg) means a characteristic value of the temperature range over which the glass transition takes place.

Hand layup means a process for moulding reinforced plastics in which reinforcement and resin are placed on a mould.

Liner means a layer on the inner surface of an FRP shell preventing contact with the dangerous goods being transported.

Mat means a fibre reinforcement made of random, chopped or twisted fibres bonded together as sheets of various length and thickness.

Parallel shell sample means an FRP specimen, which must be representative of the shell, constructed in parallel to the shell construction if it is not possible to use cut-outs from the shell itself. The parallel shell sample may be flat or curved.

Representative sample means a sample cut out from the shell.

Resin infusion means an FRP construction method by which dry reinforcement is placed into a matched mould, single sided mould with vacuum bag, or otherwise, and liquid resin is supplied to the part through the use of external applied pressure at the inlet and/or application of full or partial vacuum pressure at the vent.

Structural layer means FRP layers of a shell required to sustain the design loads.

Veil means a thin mat with high absorbency used in FRP product plies where polymeric matrix surplus fraction content is required (surface evenness, chemical resistance, leakage-proof, etc.).

6.10.2.2 General design and construction provisions

6.10.2.2.1 The provisions of 6.7.1 and 6.7.2.2 apply to FRP portable tanks. For areas of the shell that are made from FRP, the following provisions of chapter 6.7 are exempt: 6.7.2.2.1, 6.7.2.2.9.1, 6.7.2.2.13 and 6.7.2.2.14. Shells shall be designed and constructed in accordance with the requirements of a pressure vessel code, applicable to FRP materials, recognized by the competent authority.

In addition, the following requirements apply.

6.10.2.2.2 *Manufacturer's quality system*

6.10.2.2.2.1 The quality system shall contain all the elements, requirements and provisions adopted by the manufacturer. It shall be documented in a systematic and orderly manner in the form of written policies, procedures and instructions.

6.10.2.2.2.2 The contents shall in particular include adequate descriptions of:

.1 the organizational structure and responsibilities of personnel with regard to design and product quality;

.2 the design control and design verification techniques, processes, and procedures that will be used when designing the portable tanks;

.3 the relevant manufacturing, quality control, quality assurance and process operation instructions that will be used;

.4 quality records, such as inspection reports, test data and calibration data;

.5 management reviews to ensure the effective operation of the quality system arising from the audits in accordance with 6.10.2.2.2.4;

.6 the process describing how customer requirements are met;

.7 the process for control of documents and their revision;

.8 the means for control of non-conforming portable tanks, purchased components, in-process and final materials; and

.9 training programmes and qualification procedures for relevant personnel.

6.10.2.2.2.3 Under the quality system, the following minimum requirements shall be met for each FRP portable tank manufactured:

.1 use of an inspection and test plan (ITP);

.2 visual inspections;

.3 verification of fibre orientation and mass fraction by means of documented control process;

.4 verification of fibre and resin quality and characteristics by means of certificates or other documentation;

.5 verification of liner quality and characteristics by means of certificates or other documentation;

.6 verification of whichever is applicable of formed thermoplastic resin characteristic or degree of cure of thermoset resin, by direct or indirect means (e.g. Barcol test or differential scanning calorimetry) to be determined in accordance with 6.10.2.7.1.2.8, or by creep testing of a representative sample or parallel shell specimen in accordance with 6.10.2.7.1.2.5 for a period of 100 hours;

.7 documentation of whichever is applicable of thermoplastic resin forming processes or thermoset resin cure and post-cure processes; and

.8 retention and archiving of shell samples for future inspection and shell verification (e.g. from manhole cut-out) for a period of five years.

6.10.2.2.2.4 *Audit of the quality system*

The quality system shall be initially assessed to determine whether it meets the provisions in 6.10.2.2.2.1 to 6.10.2.2.2.3 to the satisfaction of the competent authority.

The manufacturer shall be notified of the results of the audit. The notification shall contain the conclusions of the audit and any corrective actions required.

Periodic audits shall be carried out, to the satisfaction of the competent authority, to ensure that the manufacturer maintains and applies the quality system. Reports of the periodic audits shall be provided to the manufacturer.

6.10.2.2.2.5 *Maintenance of the quality system*

The manufacturer shall maintain the quality system as approved in order that it remains adequate and efficient.

The manufacturer shall notify the competent authority that approved the quality system of any intended changes. The proposed changes shall be evaluated to determine whether the amended quality system will still satisfy the provisions in 6.10.2.2.2.1 to 6.10.2.2.2.3.

6.10.2.2.3 *FRP Shells*

6.10.2.2.3.1 FRP shells shall have a secure connection with structural elements of the portable tank frame. FRP shell supports and attachments to the frame shell shall cause no local stress concentrations exceeding the design allowables of the shell structure in accordance with the provisions stated in this chapter for all operating and test conditions.

6.10.2.2.3.2 Shells shall be made of suitable materials, capable of operating within a minimum design temperature range of -40°C to +50°C, unless temperature ranges are specified for specific more severe climatic or operating conditions (e.g. heating elements), by the competent authority of the country where the transport operation is being performed.

6.10.2.2.3.3 If a heating system is installed, it shall comply with 6.7.2.5.12 to 6.7.2.5.15 and with the following provisions:

.1 the maximum operating temperature of the heating elements integrated or connected to the shell shall not exceed the maximum design temperature of the tank;

.2 the heating elements shall be designed, controlled, and utilized so that the temperature of the carried substance cannot exceed the maximum design temperature of the tank or a value at which the internal pressure exceeds MAWP; and

.3 structures of the tank and its heating elements shall allow examination of the shell with respect to possible effects of overheating.

6.10.2.2.3.4 Shells shall consist of the following elements:

- liner;
- structural layer; and
- external layer.

Note: The elements may be combined if all applicable functional criteria are met.

6.10.2.2.3.5 The liner is the inner element of the shell designed as the primary barrier to provide for the long-term chemical resistance in relation to the substances to be carried, to prevent any dangerous reaction with the contents or the formation of dangerous compounds and any substantial weakening of the structural layer owing to the diffusion of products through the internal liner. Chemical compatibility shall be verified in accordance with 6.10.2.7.1.3.

The liner may be an FRP liner or a thermoplastic liner.

6.10.2.2.3.6 FRP liners shall consist of the following two components:

.1 Surface layer ("gel-coat"): adequate resin rich surface layer, reinforced with a veil, compatible with the resin and contents. This layer shall have a maximum fibre mass content of 30% and have a minimum thickness of 0.25 mm and a maximum thickness of 0.60 mm.

.2 Strengthening layer(s): layer or several layers with a minimum thickness of 2 mm, containing a minimum of 900 g/m² of glass mat or chopped fibres with a mass content in glass of not less than 30% unless equivalent safety is demonstrated for a lower glass content.

6.10.2.2.3.7 If the liner consists of thermoplastic sheets, they shall be welded together in the required shape, using a qualified welding procedure and personnel. Welded liners shall have a layer of electrically conductive media placed

against the non-liquid contact surface of the welds to facilitate spark testing. Durable bonding between liners and the structural layer shall be achieved by the use of an appropriate method.

6.10.2.2.3.8 The structural layer shall be designed to withstand the design loads according to 6.7.2.2.12, 6.10.2.2.3.1, 6.10.2.3.2, 6.10.2.3.4 and 6.10.2.3.6.

6.10.2.2.3.9 The external layer of resin or paint shall provide adequate protection of the structural layers of the tank from environmental and service exposure, including to UV radiation and salt fog, and occasional splash exposure to cargoes.

6.10.2.2.3.10 *Resins*

The processing of the resin mixture shall be carried out in compliance with the recommendations of the supplier. These resins can be:

- unsaturated polyester resins;
- vinyl ester resins;
- epoxy resins;
- phenolic resins; and
- thermoplastic resins.

The resin heat distortion temperature (HDT), determined in accordance with 6.10.2.7.1.1 shall be at least 20°C higher than the maximum design temperature of the shell as defined in 6.10.2.2.3.2, but shall in any case not be lower than 70°C.

6.10.2.2.3.11 *Reinforcement material*

The reinforcement material of the structural layers shall be selected such that they meet the requirements of the structural layer.

For the internal surface liner glass fibres of at a minimum type C or ECR according to ISO 2078:1993 + Amd 1:2015 shall be used. Thermoplastic veils may only be used for the internal liner when their compatibility with the intended contents has been demonstrated.

6.10.2.2.3.12 *Additives*

Additives necessary for the treatment of the resin, such as catalysts, accelerators, hardeners and thixotropic substances as well as materials used to improve the tank, such as fillers, colours, pigments etc. shall not cause weakening of the material, taking into account lifetime and temperature expectancy of the design.

6.10.2.2.3.13 FRP shells, their attachments and their service and structural equipment shall be designed to withstand the loads mentioned in 6.7.2.2.12, 6.10.2.2.3, 6.10.2.3.2, 6.10.2.3.4 and 6.10.2.3.6 without loss of contents (other than quantities of gas escaping through any degassing vents) during the design lifetime.

6.10.2.2.3.14 *Special provisions for the carriage of substances with a flashpoint of not more than 60°C*

6.10.2.2.3.14.1 FRP tanks used for the carriage of flammable liquids of class 3 with a flashpoint of not more than 60°C shall be constructed to ensure the elimination of static electricity from the various component parts to avoid the accumulation of dangerous charges.

6.10.2.2.3.14.2 The electrical surface resistance of the inside and outside of the shell as established by measurements shall not be higher than 10^9 Ω. This may be achieved by the use of additives in the resin or interlaminate conducting sheets, such as metal or carbon network.

6.10.2.2.3.14.3 The discharge resistance to earth as established by measurements shall not be higher than 10^7 Ω.

6.10.2.2.3.14.4 All components of the shell shall be electrically connected to each other and to the metal parts of the service and structural equipment of the tank and to the vehicle. The electrical resistance between components and equipment in contact with each other shall not exceed 10 Ω.

6.10.2.2.3.14.5 The electrical surface-resistance and discharge resistance shall be measured initially on each manufactured tank or a specimen of the shell in accordance with the procedure recognized by the competent authority. In the event of damage to the shell, requiring repair, the electrical resistance shall be re-measured.

6.10.2.2.3.15 The tank shall be designed to withstand, without significant leakage, the effects of a full engulfment in fire for 30 minutes as specified by the test requirements in 6.10.2.7.1.5. Testing may be waived with the agreement of the competent authority, where sufficient proof can be provided by tests with comparable tank designs.

6.10.2.2.3.16 *Construction process for FRP shells*

6.10.2.2.3.16.1 Filament winding, hand layup, resin infusion or other appropriate composite production processes shall be used for construction of FRP shells.

6.10.2.2.3.16.2 The weight of the fibre reinforcement shall conform to that set forth in the procedure specification with a tolerance of +10% and −0%. One or more of the fibre types specified in 6.10.2.2.3.11 and in the procedure specification shall be used for reinforcement of shells.

6.10.2.2.3.16.3 The resin system shall be one of the resin systems specified in 6.10.2.2.3.10. No filler, pigment, or dye additions shall be used which will interfere with the natural colour of the resin except as permitted by the procedure specification.

6.10.2.3 Design criteria

6.10.2.3.1 FRP shells shall be of a design capable of being stress-analysed mathematically or experimentally by resistance strain gauges, or by other methods approved by the competent authority.

6.10.2.3.2 FRP shells shall be designed and constructed to withstand the test pressure. Specific provisions are laid down for certain substances in the applicable portable tank instruction indicated in column 13 of the Dangerous Goods List and described in 4.2.5, or by a portable tank special provision indicated in column 14 of the

Dangerous Goods List and described in 4.2.5.3. The minimum wall thickness of the FRP shell shall not be less than that specified in 6.10.2.4.

6.10.2.3.3 At the specified test pressure the maximum tensile relative deformation measured in mm/mm in the shell shall not result in the formation of microcracks, and therefore not be greater than the first measured point of elongation based fracture or damage of the resin, measured during tensile tests prescribed under 6.10.2.7.1.2.3.

6.10.2.3.4 For internal test pressure, external design pressure specified in 6.7.2.2.10, static loads specified in 6.7.2.2.12 and static gravity loads caused by the contents with the maximum density specified for the design and at maximum filling degree, failure criteria (FC) in the longitudinal direction, circumferential direction, and any other in-plane direction of the composite layup shall not exceed the following value:

$$FC \leq \frac{1}{K}$$

where:

$$K = K_0 \times K_1 \times K_2 \times K_3 \times K_4 \times K_5$$

where:

K shall have a minimum value of 4.

$\boldsymbol{K_0}$ is a strength factor. For the general design the value for $\boldsymbol{K_0}$ shall be equal to or more than 1.5. The value of $\boldsymbol{K_0}$ shall be multiplied by a factor of two, unless the shell is provided with protection against damage consisting of a complete metal skeleton including longitudinal and transverse structural members.

$\boldsymbol{K_1}$ is a factor related to the deterioration in the material properties due to creep and ageing. It shall be determined by the formula:

$$K_1 = \frac{1}{\alpha\beta}$$

where "α" is the creep factor and "β" is the ageing factor determined in accordance with 6.10.2.7.1.2.5 and .6, respectively. When used in calculation, factors α and β shall be between 0 and 1.

Alternatively, a conservative value of $\boldsymbol{K_1}$ = 2 may be applied for the purpose of undertaking the numerical validation exercise in 6.10.2.3.4 (this does not remove the need to perform testing to determine α and β).

$\boldsymbol{K_2}$ is a factor related to the service temperature and the thermal properties of the resin, determined by the following equation, with a minimum value of 1: $\boldsymbol{K_2}$ = 1.25 - 0.0125 (HDT - 70) where HDT is the heat distortion temperature of the resin, in °C.

$\boldsymbol{K_3}$ is a factor related to the fatigue of the material; the value of $\boldsymbol{K_3}$ = 1.75 shall be used unless otherwise agreed with the

competent authority. For the dynamic design as outlined in 6.7.2.2.12 the value of K_3 = 1.1 shall be used.

K_4 is a factor related to resin curing and has the following values:

1.0 where curing is carried out in accordance with an approved and documented process, and the quality system described under 6.10.2.2.2 includes verification of degree of cure for each FRP portable tank using a direct measurement approach, such as differential scanning calorimetry (DSC) determined via ISO 11357- 2:2016, as per 6.10.2.7.1.2.9.

1.1 where thermoplastic resin forming or thermoset resin curing is carried out in accordance with an approved and documented process, and the quality system described under 6.10.2.2.2 includes verification of whichever is applicable formed thermoplastic resin characteristics or degree of cure of thermoset resin, for each FRP portable tank using an indirect measurement approach as per 6.10.2.7.1.2.8, such as Barcol testing via ASTM D2583:2013-03 or EN 59:2016, HDT via ISO 75-1:2013, thermo-mechanical analysis (TMA) via ISO 11359-1:2014, or dynamic thermo-mechanical analysis (DMA) via ISO 6721- 11:2019.

1.5 in other cases.

K_5 is a factor related to the portable tank instruction in 4.2.5.2.6:

1.0 for T1 to T19.

1.33 for T20.

1.67 for T21 to T22.

A design validation exercise using numerical analysis and a suitable composite failure criterion is to be undertaken to verify that the plies in the shell are below the allowables. Suitable composite failure criteria include, but are not limited to, Tsai-Wu, Tsai-Hill, Hashin, Yamada-Sun, Strain Invariant Failure Theory, Maximum Strain or Maximum Stress. Other relations for the strength criteria are allowed upon agreement with the competent authority. The method and results of this design validation exercise are to be submitted to the competent authority.

The allowables are to be determined using experiments to derive parameters required by the chosen failure criteria combined with factor of safety K, the strength values measured as per 6.10.2.7.1.2.3, and the maximum elongation strain criteria prescribed in 6.10.2.3.5. The analysis of joints is to be undertaken in accordance with the allowables determined in 6.10.2.3.7 and the strength values measured as per 6.10.2.7.1.2.7. Buckling is to be considered in accordance with 6.10.2.3.6.

Design of openings and metallic inclusions is to be considered in accordance with 6.10.2.3.8.

6.10.2.3.5 At any of the stresses as defined in 6.7.2.2.12 and 6.10.2.3.4, the resulting elongation in any direction shall not exceed the value indicated in the following table or one tenth of the elongation at fracture of the resin determined by ISO 527-2:2012, whichever is lower.

Examples of known limits are presented in the table below.

Type of resin	**Maximum strain in tension (%)**
Unsaturated polyester or phenolic	0.2
Vinylester	0.25
Epoxy	0.3
Thermoplastic	See 6.10.2.3.3

6.10.2.3.6 For the external design pressure the minimum safety factor for linear buckling analysis of the shell shall be as defined in the applicable pressure vessel code but not less than three.

6.10.2.3.7 The adhesive bondlines and/or overlay laminates used in the joints, including the end joints, connection between the equipment and shell, the joints of the surge plates and the partitions with the shell shall be capable of withstanding the loads of 6.7.2.2.12, 6.10.2.2.3.1, 6.10.2.3.2, 6.10.2.3.4 and 6.10.2.3.6. In order to avoid concentrations of stresses in the overlay lamination, the applied taper shall not be steeper than 1:6. The shear strength between the overlay laminate and the tank components to which it is bonded shall not be less than:

$$\tau = \gamma \frac{Q}{l} \leq \frac{\tau_R}{K}$$

where:

τ_R is the interlaminar shear strength according to ISO 14130:1997 and Cor 1:2003;

Q is the load per unit width of the interconnection;

K is the safety factor determined as per 6.10.2.3.4;

l is the length of the overlay laminate;

γ is the notch factor relating average joint stress to peak joint stress at failure initiation location.

Other calculation methods for the joints are allowed following approval with the competent authority.

6.10.2.3.8 Metallic flanges and their closures are permitted to be used in FRP shells, under design provisions of 6.7.2. Openings in the FRP shell shall be reinforced to provide at least the same safety factors against the static and dynamic stresses as specified in 6.7.2.2.12, 6.10.2.3.2, 6.10.2.3.4 and 6.10.2.3.6 as that for the shell

itself. The number of openings shall be minimized. The axis ratio of oval-shaped openings shall be not more than 2.

If metallic flanges or componentry are integrated into the FRP shell using bonding, then the characterization method stated in 6.10.2.3.7 shall apply to the joint between the metal and FRP. If the metallic flanges or componentry are fixed in an alternative fashion, e.g. threaded fastener connections, then the appropriate provisions of the relevant pressure vessel standard shall apply.

6.10.2.3.9 Check calculations of the strength of the shell shall be performed by finite element method simulating the shell layups, joints within FRP shell, joints between the FRP shell and the container frame, and openings. Treatment of singularities shall be undertaken using an appropriate method according to the applicable pressure vessel code.

6.10.2.4 Minimum wall thickness of the shell

6.10.2.4.1 Minimum thickness of the FRP shell shall be confirmed by check calculations of the strength of the shell considering strength provisions given in 6.10.2.3.4.

6.10.2.4.2 Minimum thickness of the FRP shell structural layers shall be determined in accordance with 6.10.2.3.4; however, in any case the minimum thickness of the structural layers shall be at least 3 mm.

6.10.2.5 Equipment components for portable tanks with FRP shell

Service equipment, bottom openings, pressure relief devices, gauging devices, supports, frameworks, lifting and tie-down attachments of portable tanks shall meet the provisions of 6.7.2.5 to 6.7.2.17. If any other metallic features are required to be integrated into the FRP shell, then the provisions of 6.10.2.3.8 shall apply.

6.10.2.6 Design approval

6.10.2.6.1 Design approval of FRP portable tanks shall be as per 6.7.2.18 provisions. The following additional provisions apply to FRP portable tanks.

6.10.2.6.2 The prototype test report for the purpose of the design approval shall additionally include the following:

.1 results of the material tests used for FRP shell fabrication in accordance with 6.10.2.7.1 provisions;

.2 results of the ball drop test in accordance with the provisions of 6.10.2.7.1.4; and

.3 results of the fire resistance test in accordance with the provisions of 6.10.2.7.1.5.

6.10.2.6.3 A service life inspection programme shall be established, which shall be a part of the operation manual, to monitor the condition of the tank at periodic inspections. The inspection programme shall focus on the critical stress locations identified in the design analysis performed under 6.10.2.3.4. The inspection method shall take into account the potential damage mode at the critical stress location (e.g. tensile stress or interlaminate stress). The inspection shall be a combination of visual and non-destructive testing (e.g. acoustic emissions, ultrasonic evaluation, thermographic). For heating elements, the service life inspection programme shall

allow an examination of the shell or its representative locations to take into account the effects of overheating.

6.10.2.6.4 A representative prototype tank shall be subjected to tests as specified below. For this purpose, service equipment may be replaced by other items if necessary.

6.10.2.6.4.1 The prototype shall be inspected for compliance with the design type specification. This shall include an internal and external inspection and measurement of the main dimensions.

6.10.2.6.4.2 The prototype, equipped with strain gauges at all locations of high strain, as identified by the design validation exercise in accordance with 6.10.2.3.4, shall be subjected to the following loads and the strain shall be recorded:

.1 Filled with water to the maximum filling degree. The measuring results shall be used to calibrate the design calculations according to 6.10.2.3.4.

.2 Filled with water to the maximum filling degree and subjected to static loads in all three directions mounted by the base corner castings without additional mass applied external to the shell. For comparison with the design calculation according to 6.10.2.3.4 the strains recorded shall be extrapolated in relation to the quotient of the accelerations required in 6.7.2.2.12 and measured.

.3 Filled with water and subjected to the specified test pressure. Under this load, the shell shall exhibit no visual damage or leakage. The stress corresponding to the measured strain level shall not exceed the minimum factor of safety calculated in 6.10.2.3.4 under any of these loading conditions.

6.10.2.7 Additional provisions applicable to FRP portable tanks

6.10.2.7.1 *Material testing*

6.10.2.7.1.1 *Resins*

Resin tensile elongation shall be determined in accordance with ISO 527- 2:2012. The heat distortion temperature (HDT) of the resin shall be determined in accordance with ISO 75-1:2013.

6.10.2.7.1.2 *Shell*

Prior to testing, all coatings shall be removed from the samples. If shell samples are not possible then parallel shell samples may be used. The tests shall cover:

.1 Thickness of the laminates of the central shell wall and the ends.

.2 Mass content and composition of composite reinforcement by ISO 1172:1996 or ISO 14127:2008, as well as orientation and arrangement of reinforcement layers.

.3 Tensile strength, elongation at fracture and modulus of elasticity according to ISO 527-4:1997 or ISO 527-5:2009 for the

circumferential and longitudinal directions of the shell. For areas of the FRP shell, tests shall be performed on representative laminates in accordance with ISO 527-4:1997 or ISO 527-5:2009, to permit evaluation of the suitability of safety factor (K). A minimum of six specimens per measure of tensile strength shall be used, and the tensile strength shall be taken as the average minus two standard deviations.

.4 Bending deflection and strength shall be established by the three-point or four-point bending test according to ISO 14125:1998 + Amd 1:2011 using a sample with a minimum width of 50 mm and a support distance of at least 20 times the wall thickness. A minimum of five specimens shall be used.

.5 Creep factor α shall be determined by taking the average result of at least two specimens with the configuration described in .4, subject to creep in three-point or four-point bending, at the maximum design temperature nominated under 6.10.2.2.4, for a period of 1,000 hours. The following test is to be undertaken for each specimen:

.1 Place specimen into bending apparatus, unloaded, in oven set to maximum design temperature and allow to acclimatize for a period of not less than 60 minutes.

.2 Load specimen bending in accordance with ISO 14125:1998 + Amd 1:2011 at flexural stress equal to the strength determined in .4 divided by four. Maintain mechanical load at maximum design temperature without interruption for not less than 1,000 hours;

.3 Measure the initial deflection six minutes after full load application in sub-paragraph .2 above. Specimen shall remain loaded in test rig.

.4 Measure the final deflection 1,000 hours after full load application in sub-paragraph .2 above.

.5 Calculate the creep factor α by dividing the initial deflection from sub-paragraph .3 above by the final deflection from sub-paragraph .4 above.

.6 Ageing factor β shall be determined by taking the average result of at least two specimens with the configuration described in .4, subject to loading in static three-point or four-point bending, in conjunction with immersion in water at the maximum design temperature nominated under 6.10.2.2.4 for a period of 1,000 hours. The following test is to be undertaken for each specimen:

.1 Prior to testing or conditioning, specimens shall be dried in an oven at 80°C for a period of 24 hours.

.2 The specimen shall be loaded in three-point or four-point bending at ambient temperature, in accordance with ISO 14125:1998 + Amd 1:2011, at the flexural stress level

equal to the strength determined in .4 divided by four. Measure the initial deflection six minutes after full load application. Remove specimen from test rig.

.3 Immerse unloaded specimen in water at the maximum design temperature for a period of not less than 1,000 hours without interruption to the water conditioning period. When conditioning period has lapsed, remove specimens, keep damp at ambient temperature, and complete sub-paragraph .4 below within three days.

.4 The specimen shall be subject to a second round of static loading, in a manner identical to sub-paragraph .2 above. Measure the final deflection six minutes after full load application. Remove specimen from test rig.

.5 Calculate the ageing factor β by dividing the initial deflection from sub-paragraph .2 above by the final deflection from sub-paragraph .4.

.7 The interlaminar shear strength of the joints shall be measured by testing representative samples in accordance with ISO 14130:1997.

.8 The efficiency of whichever is applicable of thermoplastic resin forming characteristics or thermoset resin cure and post-cure processes for laminates are to be determined using one or more of the following methods:

.1 direct measurement formed thermoplastic resin characteristics or thermoset resin degree of cure: glass transition temperature (Tg) or melting temperature (Tm) determined using differential scanning calorimetry (DSC) via ISO 11357-2:2016; or

.2 indirect measurement of formed thermoplastic resin or thermoset resin degree of cure:

- HDT via ISO 75-1:2013;
- Tg or Tm using thermo-mechanical analysis (TMA) via ISO 11359-1:2014;
- dynamic thermo-mechanical analysis (DMA) via ISO 6721-11:2019;
- Barcol testing via ASTM D2583:2013-03 or EN 59:2016.

6.10.2.7.1.3 The chemical compatibility of the liner and chemical contact surfaces of service equipment with the substances to be carried shall be demonstrated by one of the following methods. This demonstration shall account for all aspects of the compatibility of the materials of the shell and its equipment with the substances to be carried, including chemical deterioration of the shell, initiation of critical reactions of the contents and dangerous reactions between both.

.1 In order to establish any deterioration of the shell, representative samples taken from the shell, including any internal liners with welds, shall be subjected to the chemical compatibility test according to EN 977:1997 for a period of 1,000 hours at 50°C or the maximum temperature at which a particular substance is approved for transport. Compared with a virgin sample, the loss of strength and elasticity modulus measured by the bending test according to EN 978:1997 shall not exceed 25%. Cracks, bubbles, pitting effects as well as separation of layers and liners and roughness shall not be acceptable.

.2 Certified and documented data of positive experiences on the compatibility of filling substances in question with the materials of the shell with which they come into contact at given temperatures, times and other relevant service conditions.

.3 Technical data published in relevant literature, standards or other sources, acceptable to the competent authority.

.4 Upon agreement with the competent authority other methods of chemical compatibility verification may be used.

6.10.2.7.1.4 *Ball drop test as per EN 976-1:1997*

The prototype shall be subjected to the ball drop test according to EN 976-1:1997, No. 6.6. No visible damage inside or outside the tank shall occur.

6.10.2.7.1.5 *Fire resistance test*

6.10.2.7.1.5.1 A representative prototype tank with its service and structural equipment in place and filled to 80% of its maximum capacity with water, shall be exposed to a full engulfment in fire for 30 minutes, caused by an open heating oil pool fire or any other type of fire with the same effect. The fire shall be equivalent to a theoretical fire with a flame temperature of 800°C, emissivity of 0.9 and to the tank a heat transfer coefficient of 10 W/(m²K) and surface absorptivity of 0.8. A minimum net heat flux of 75 kW/m² shall be calibrated according to ISO 21843:2018. The dimensions of the pool shall exceed those of the tank by at least 50 cm to each side and the distance between fuel level and tank shall be between 50 cm and 80 cm. The rest of the tank below liquid level, including openings and closures, shall remain leakproof except for drips.

6.10.2.8 Inspection and testing

6.10.2.8.1 Inspection and testing of portable FRP tanks shall be carried out as per provisions of 6.7.2.19. In addition, welded thermoplastic liners shall be spark tested under a suitable standard, after pressure tests performed in accordance with the periodic inspections specified in 6.7.2.19.4.

6.10.2.8.2 In addition, the initial and periodic inspections shall follow the service life inspection programme and any associated inspection methods per 6.10.2.6.3.

6.10.2.8.3 The initial inspection and test shall verify that construction of the tank is made in accordance with the quality system required by 6.10.2.2.2.

6.10.2.8.4 Additionally, during inspection of the shell the position of the areas heated by heating elements shall be indicated or marked, be available on design drawings or shall be made visible by a suitable technique (e.g. infrared). Examination of the shell shall take into account the effects of overheating, corrosion, erosion, overpressure and mechanical overloading.

6.10.2.9 Retention of samples

Shell samples (e.g. from manhole cut-out) for each tank manufactured shall be maintained for future inspection and shell verification for a period of five years from the date of the initial inspection and test and until successful completion of the required five-year periodic inspection.

6.10.2.10 Marking

6.10.2.10.1 The requirements of 6.7.2.20.1 apply to portable tanks with an FRP shell except those of 6.7.2.20.1 (f) (ii).

6.10.2.10.2 The information required in 6.7.2.20.1 (f) (i) shall be "Shell structural material: Fibre-reinforced plastic", the reinforcement fibre e.g. "Reinforcement: E-glass", and resin e.g. "Resin: Vinyl Ester".

6.10.2.10.3 Requirements of provision 6.7.2.20.2 apply to portable tank with an FRP shell."

PART 7
PROVISIONS CONCERNING TRANSPORT OPERATIONS

Chapter 7.2
General segregation provisions

7.2.5 Segregation groups

7.2.5.2 In the table, delete the entry for "SGG1a".

7.2.7 Segregation of goods of class 1

7.2.7.1.4 *Permitted mixed stowage for goods of class 1*

Under the table, in note 1, with regard to the text in brackets, delete the words "and those requiring special stowage".

7.2.8 Segregation codes

In the table, delete the entry for "SG75".

Chapter 7.3
Consigning operations concerning the packing and use of cargo transport units (CTUs) and related provisions

7.3.7 Cargo transport units under temperature control

7.3.7.2 General provisions

7.3.7.2.3.1 Replace the words "the word "STABILIZED"" with the words "the words "TEMPERATURE CONTROLLED"".

7.3.7.2.3.2 Delete the footnote.

CHAPTER 7.6
STOWAGE AND SEGREGATION ON GENERAL CARGO SHIPS

7.6.2 Stowage and handling provisions

7.6.2.7 Provisions for classes 4.1, 4.2 and 4.3

7.6.2.7.2.1 Replace the word "packagings" with the word "packages".

Chapter 7.9
Exemptions, approvals and certificates

7.9.3 Contact information for the main designated national competent authorities

Replace the text in paragraph to read:

"Contact information for the main designated national competent authorities concerned is reproduced in this paragraph and obtained from the GISIS Module on Contact Points.*"

Replace the existing footnotes with the following new footnote:

"* Member States are invited to access GISIS in order to update their corresponding main designated national competent authorities' contact information through their GISIS Account Managers. Public access to GISIS Module of Contact Points, in order to electronically obtain the most updated contact information, is provided through the following link: https://gisis.imo.org/Public/."

INDEX

Delete the entry for "Iron powder, *see*".

In the entries for "Bromoethane, *see*" and "ETHYL BROMIDE", in column "Class", replace "6.1" with "3".

Amend the entry for "EXTRACTS, AROMATIC, LIQUID" to read as follows:

Substance, material or article	MP	Class	UN. No.
Extracts, aromatic, liquid, *see*		3	1197

Amend the entry for "EXTRACTS, FLAVOURING, LIQUID" to read as follows:

Substance, material or article	MP	Class	UN. No.
Extracts, flavouring, liquid, *see*		3	1197

Add the following new entries in alphabetical order:

"

Substance, material or article	MP	Class	UN. No.
1-butylene, *see*		2.1	1012
cis-2-butylene, *see*		2.1	1012
trans-2-butylene, *see*		2.1	1012
COBALT DIHYDROXIDE POWDER, containing not less than 10% respirable particles	**P**	6.1	3550
EXTRACTS, LIQUID, for flavour or aroma		3	1197

"

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MSC.1/Circ.1588/Rev.2
24 May 2022

CARRIAGE OF DANGEROUS GOODS

INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG) CODE

REVISED EMERGENCY RESPONSE PROCEDURES FOR SHIPS CARRYING DANGEROUS GOODS (EMS GUIDE)

1 The Maritime Safety Committee, at its ninety-ninth session (16 to 25 May 2018), approved the *Revised emergency response procedures for ships carrying dangerous goods* (EmS Guide), which had been prepared by the Sub-Committee on Carriage of Cargoes and Containers (CCC) at its fourth session (11 to 15 September 2017), and finalized by the Sub- Committee's Editorial and Technical Group.

2 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), approved a revision of MSC.1/Circ.1588 (MSC.1/Circ.1588/Rev.1), resulting from the amendments (40-20) to the International Maritime Dangerous Goods (IMDG) Code, as adopted by resolution MSC.477(102).

3 The Maritime Safety Committee, at its 105th session (20 to 29 April 2022), approved amendments to MSC.1/Circ.1588/Rev.1, resulting from the amendments (41-22) to the IMDG Code, as adopted by resolution MSC.501(105). Consequently, the Maritime Safety Committee decided that it would be preferable to prepare a revised consolidated version of the EmS Guide, with a view to dissemination as MSC.1/Circ.1588/Rev.2.

4 Member States are invited to bring the annexed Revised EmS Guide to the attention of all parties concerned, taking into account the voluntary application date of 1 January 2023 of amendments (41-22) to the IMDG Code, pending their envisaged mandatory entry-into-force date of 1 January 2024.

5 This circular supersedes MSC.1/Circ.1588/Rev.1.

***

ANNEX

Revised Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS Guide)

Contents

Foreword

This EmS Guide contains guidance on Emergency Response Procedures for Ships Carrying Dangerous Goods including the emergency schedules (EmS) to be followed in case of incidents involving dangerous substances, materials or articles, or harmful substances (marine pollutants), regulated under the *International Maritime Dangerous Goods Code* (IMDG Code).

This edition takes into account the Amendment 41-22 to the IMDG Code. The EmS Guide will be further amended as and when necessary to reflect amendments made to the IMDG Code.

Preamble

The purpose of this Guide is to provide guidance for dealing with fires and spillages (leakages) on board ships involving the dangerous goods listed in the *International Maritime Dangerous Goods Code* (IMDG Code).

In accordance with the *International Safety Management Code* (ISM Code), all ships, and the companies responsible for their operation, are required to maintain a safety management system (SMS). Within the SMS, procedures for responding to potential shipboard emergencies are required. This Guide is intended to assist shipowners, ship operators and other parties concerned with developing such emergency response procedures, which should be integrated into the ship's contingency plan.

In November 1997, the IMO Assembly adopted resolution A.852(20) on *Guidelines for a structure of an integrated system of contingency planning for shipboard emergencies*, which were further revised by resolution A.1072(28) in December 2013 and amended by its Corr.1 in May 2014. This Guide should be integrated into Module IV on Response actions, as contained in paragraph 3.2.4.6 of the latter resolution, for cargo-related incidents.

In the event of a fire or spillage incident, initial actions should be carried out in accordance with the shipboard emergency plan. Where dangerous goods are involved, the responses in the emergency plan should be based on this Guide for specific dangerous goods having regard to, inter alia, the type of ship, the quantity and type of packaging of the dangerous goods and whether the goods are stowed on or under deck.

How to use this Guide

1 The guidance contained in this Guide is intended for fire and/or spillage (leakage) emergencies on board a ship involving packaged dangerous goods transported in accordance with the provisions of the IMDG Code. The Guide should not be used for emergencies involving bulk cargoes or any other fire and/or spillage on board a ship which does not involve packaged dangerous goods as cargo.

2 This guidance is for shipboard use where master and crew have to respond to a fire or a spillage without external assistance. The recommendations are based on the fire safety provisions contained in chapter II-2 of the *International Convention for the Safety of Life at Sea, 1974* as amended, and the provisions of the IMDG Code. The guidance should be integrated into the contingency plan for shipboard emergencies, which should be specific to the individual ship and should take into account the equipment on board.

3 There are international and national requirements for ships to contact or report to the nearest coastal State when an incident takes place involving the loss or likely loss of packaged dangerous goods (see Reporting procedures). Contacting shore-based experts at an early stage irrespective of how insignificant the incident may seem to be is recommended. However, it should be noted that shore-based personnel or rescue/ coastguard experts may use different techniques to fight a fire or to deal with spillage on board a ship.

4 In this Guide, there is separate advice for fire and spillage emergencies which should be consulted accordingly.

5 This Guide should be used as follows:

.1 for fire and spillage, read and incorporate into the ship's training regime the INTRODUCTIONS to the emergency schedules, before any emergency occurs;

.2 in the event of an emergency involving packaged dangerous goods, consult the GENERAL GUIDELINES as a first step; and

.3 obtain detailed advice for the specific cargo(es) involved by reading the relevant EMERGENCY SCHEDULE(S) (EmS) for the cargo(es).

Fire

Introduction to the emergency schedules for FIRE

1 Be prepared

1.1 Preventing a fire from occurring is the most important part of a shipboard safety programme. However, once a fire has started, a well trained crew is the best defence for bringing the fire under control. Given the complexity of extinguishing a fire involving dangerous goods, it is essential that the advice in this Guide be incorporated into the ship's training regime so that the crew will be able to respond to a fire casualty in a timely and effective manner.

1.2 This Guide should be integrated into a safety management system (SMS). Procedures contained in the shipboard emergency plan should be tailored to the individual ship.

1.3 The firefighting procedures within the EmS SCHEDULES are different for "on deck" and "under deck" stowage. For specific ship types (e.g. hatchless containerships) or cargo holds (e.g. open vehicle decks of ferries), these two procedures have to be assigned specifically to the individual ship.

1.4 Given the toxic nature of some of the dangerous goods involved, accommodation spaces should be protected from fire and smoke as far as possible (e.g. water spray). Therefore, the ventilation systems for working and living spaces should be shut off, closed and secured to reduce the possibility of vapours, dusts and gases penetrating these spaces. In some instances, it may be necessary to turn the ship's accommodation spaces upwind, if possible.

1.5 The safety of firefighting personnel is most important. Use of appropriate protective clothing (i.e. a firefighter's outfit when dealing with a fire) and self-contained breathing apparatus, to protect skin and lungs from toxic and/or corrosive liquids, vapours, dusts and gases, is essential. This equipment should be suitable for each individual member of the firefighting team, as working with such equipment requires a high level of fitness and training. It should be kept in mind that even a weak acute illness may interfere with a crew member's fitness. In addition, pregnant crew members should not be exposed to dangerous vapours.

1.6 It is also essential to ensure that there is always an escape route for firefighting personnel despite the limitations due to narrow exit paths and the danger of falling overboard.

2 Identification of the dangerous good(s) involved

2.1 It is essential to identify the dangerous good(s) involved in the fire in order that the specific EmS FIRE SCHEDULE(S) for the cargo(es) may be consulted and appropriate action taken. This is important because some dangerous goods are incompatible with some firefighting media and could exacerbate the situation (e.g. use of a water-based extinguishing medium on water-reactive cargoes).

2.2 An identification number with four digits preceded by the letters "UN" is assigned to all dangerous goods. From the UN Number, it is possible to find the appropriate EmS FIRE SCHEDULE. The Dangerous Goods List in part 3, chapter 3.2, of the IMDG Code contains the names and the UN numbers, as well as the EmS SCHEDULE NUMBERS. The special Dangerous Goods Manifest and the detailed Stowage Plan required by SOLAS regulation VII/4.2 will also contain the proper shipping name and UN number of the dangerous good(s) concerned. Packages will usually be labelled as well.

2.3 Specific information as to properties of dangerous goods may also be found in the Dangerous Goods List in the IMDG Code. Dangerous goods are classified and labelled according to their hazards. Labels and marks on packages provide a warning of the general risks to be encountered. Personnel should understand the labelling system.

2.4 Emergency preparedness should form part of the ship's Safety Management System as required by the ISM Code. Prepared information can reduce errors during a fire emergency. Therefore, it is recommended that the EmS SCHEDULE(S) be identified and included on the Dangerous Goods Manifest and Stowage Plan recording the stowage position of the cargo. That will enable key members of the crew to know in advance which emergency procedures could be necessary. In the event of a fire, the allocation of a specific EmS FIRE SCHEDULE via identification of cargo

via the UN number takes time and is open to error, especially in mixed cargoes in one container. Furthermore, some firefighting procedures may require specific media and operations could be affected by the stowage location of such media. The advice given in the EmS FIRE SCHEDULE should be directly usable based on the stowage information, without time-consuming identification and location of the cargo involved.

3 Cool and suffocate

3.1 In general, fires require heat (energy) and oxygen to start burning. Only a limited number of chemicals do not need oxygen from the air. Therefore, the aim of firefighting is to exclude oxygen and to cool the cargo(es). On board ship, this is generally carried out by using water spray or gas extinguishing systems.

3.2 Some burning cargoes will need special firefighting media (like dry inert material) to suffocate the fire. In such circumstances, normal firefighting procedures are often impracticable, and concentrating on cooling nearby cargo and ship structures is recommended in such cases.

3.3 Firefighters should be made aware of the hazards of opening doors of an over-heated space or freight container which is suspected of containing cargo on fire. There may be a lack of oxygen inside and fresh air from outside the space may instantly start a fire, and cause a flashback that could injure the firefighters. Cool down the container first!

4 Seek advice

4.1 Expert advice should be sought irrespective of how insignificant the fire may seem to be when dealing with dangerous goods fires. Such advice could be given by:

.1 ship operating companies (e.g. designated persons);

.2 emergency information centres (such as CHEMTREC in the USA);

.3 specialized agencies;

.4 professional responders;

.5 port State authorities;

.6 coastguard;

.7 fire brigades; and

.8 manufacturers of the products.

5 Evacuation

Within some EmS FIRE SCHEDULES the phrase “Sudden or short-term events (e.g. explosions) may endanger the safety of the ship” or the phrase “The danger of uncontrolled spread of fire should be considered” has been introduced. Depending on the type of ship and on the volume of dangerous goods allocated to this specific FIRE SCHEDULE, it may be necessary to consider abandoning the ship at an early stage. In this case, the master should be aware of the hazard and should decide whether the ship requires assistance.

6 Firefighting media

6.1 Water

6.1.1 Water is the obvious firefighting medium at sea and is recommended for most fires involving dangerous goods. However, it should be noted that shore-based firefighters may use a different medium.

6.1.2 When water is applied to a burning cargo, the temperature is reduced and the fire will be extinguished when the temperature drops below the ignition point. However, water is not suitable to extinguish all fires involving dangerous goods. Different firefighting media should be used if so indicated on the specific EmS FIRE SCHEDULE.

6.1.3 If the fire is under deck, consideration should be given to the stability of the ship when flooding the hold with water.

6.1.4 Some dangerous goods will react chemically with water, producing flammable and/or toxic gases. The most effective way to extinguish a fire involving these dangerous goods is to smother them with a dry inert powdered material. However, the availability of suitable inert material on board is limited. It may also be dangerous to approach the fire in order to use inert material properly. Consequently, the most appropriate method of extinguishing the fire may be to use copious quantities of water. This would have an overall cooling effect on the fire even though the water may react with the dangerous goods involved.

6.1.5 Ships are equipped with a number of dual-purpose spray/jet nozzles as required by SOLAS. Most EmS FIRE SCHEDULES recommend that the nozzles be set to spray when used to fight fires. Water spray may also be achieved by using water jets from some distance. This method of producing water spray is generally recommended. However, it is dangerous to direct a water jet onto the fire at close range because this could result in the spread of burning material.

6.1.6 The term “copious quantities of water” used within the EmS FIRE SCHEDULES refers to the minimum total quantities of water provided for optimal firefighting using four jets of water, as required by SOLAS regulation II-2/10. The master and crew should know the practical limitations that may be encountered at specific stowage locations in this respect.

6.1.7 Following the advice “use copious quantities of water” or “water spray from as many hoses as possible” may interfere with the safety of the ship with regard to the ship’s stability. Stress forces on the hull due to increased quantities of water in the ship should be considered.

6.2 Fixed gas fire-extinguishing systems

6.2.1 If a fixed gas fire-extinguishing system is used for incidents under deck, all hatches and vent dampers should be closed and ventilation shut off before the system is activated. If smoke is seen coming from around the hatches, the leaks should be sealed with any suitable material available.

6.2.2 The majority of the fixed gas fire-extinguishing systems use carbon dioxide (CO_2), but some use nitrogen (N_2) as the extinguishing medium. The instructions on board should be followed. The fire control plan will sometimes specify a given volume of gas to be applied to a given space. No advantage will be gained by exceeding this volume of gas where burning dangerous goods are involved.

6.2.3 It is important to realise that it will take an appreciable time for the space to cool after the fire has been extinguished. Therefore it would be extremely dangerous to reopen the hatches since the extinguishing gas would escape and air would enter the space again, thus allowing the fire to re-ignite. The ship’s on-board instructions for such cases should be followed.

6.2.4 Fixed gas fire-extinguishing systems are not effective against all fires. EmS FIRE SCHEDULES may contain specific information in this regard.

6.3 Fixed pressure water spraying systems

6.3.1 In some ships (e.g. ro-ro ships and car ferries), some cargo spaces may be fitted with a water drencher or spray system instead of a fixed gas fire-extinguishing system. There will be instructions on board which should be followed.

6.3.2 A closed cargo space should be ventilated to clear it of smoke and toxic gases after the fire has been extinguished and the space has cooled. The ventilation equipment should be of a certified safe type for smoke removal. Evidence that the space is cooling down can be obtained by monitoring adjacent bulkheads and decks. Thereafter, a firefighting team should look for any small remaining fires and inspect the surrounding cargo. After the fire has been extinguished, the cargo should be kept under surveillance until its normal temperature is reached.

6.4 Foam

In general, foam is an effective firefighting medium for fires involving flammable liquids. The foam forms a layer on the liquid thereby excluding oxygen and reducing heat. However, it is less effective on solid substances on fire. Most foams contain water and should not be used on fires where the use of water is restricted because of adverse chemical reaction.

6.5 Dry chemicals

Dry chemicals may be an effective extinguishing medium for fires involving water-reactive substances and metals. The dry chemical should not react with the dangerous goods involved in the fire. Some dangerous goods require a specific dry chemical to extinguish a fire.

7 Dangerous goods exposed to fire

7.1 Rupture and cooling

7.1.1 Where possible, packages should be removed from the vicinity of the fire. In general, heated material will expand, thus needing more volume and creating pressure in the package. This will affect the integrity of the package which could lead to rupture and dispersal of the contents. Effective cooling can lower the possibility of rupture.

7.1.2 Where there is a danger that heat will have already started to cause a chemical or physical change to the dangerous substance, packages should not be moved. Care should always be exercised, for example, with those substances liable to polymerize, as this reaction may continue for a long time after the removal of the heat source. Provided no discharge or pumping overboard problem arises, cooling should continue for many hours after the fire has been extinguished. After heat evolution has ceased, cooling with water may be stopped. A careful watch should be kept on the stability of the ship.

7.1.3 The EmS FIRE SCHEDULES advise that a number of dangerous goods should be removed or jettisoned if there is a likelihood of their involvement in a fire. However, where full or nearly full cargo transport units are involved, such guidance may be impractical. In that case, the advice should be taken to indicate that the goods are particularly dangerous. Personnel on board should fight the fire and cool nearby cargo as far as possible. It should be borne in mind that some heated dangerous goods may have already damaged the packaging or may explode during handling. Consequently, moving or jettisoning burning cargo should only be attempted with utmost caution.

7.2 Spillage

7.2.1 It should be remembered that leakage of dangerous goods can be very dangerous for the crew and for the ship. Fire and explosion can rupture nearby packages or tanks, creating a spillage.

7.2.2 If a leak is discovered, the hazards associated with that leak should be ascertained immediately. In cases involving leaks of flammable liquids or flammable gases (class 3 and class 2.1 labels respectively), the crew should withdraw to a well-protected position. Air-vapour and air-gas mixtures are liable to explode and such an explosion may injure crew members and damage the ship.

7.2.3 Many toxic gases are odourless and colourless. A number of liquids will produce toxic vapours if exposed to heat. In an emergency, the ship should be manoeuvred to keep the bridge, living quarters and crew upwind as far as possible.

7.2.4 The EmS SPILLAGE SCHEDULES should be consulted when dealing with a leakage.

8 Personal protection

8.1 Ship's personnel

8.1.1 Many vapours and gases of dangerous goods produced by a fire are hazardous to health. In the case of fire, the use of a firefighter's outfit and self-contained breathing apparatus is essential. Only trained personnel should use this equipment, which should be well maintained. Particular attention should be given to ensuring that toxic vapours or fumes do not penetrate occupied areas of the ship (e.g. bridge, living quarters, machinery spaces, working areas, etc).

8.1.2 According to the ship's fire emergency plan, ventilation systems to living and working spaces should be shut off, closed and secured to reduce the possibility of vapours, dusts, and gases from penetrating these areas.

8.2 Firefighting team

8.2.1 Chapter II-2 of SOLAS requires firefighter's outfits, full chemical protective suits and self-contained breathing apparatus to be readily available on board. Masters are reminded that personnel will need regular training in the use of self-contained breathing apparatus and that special attention should be given to ensure that face masks fit satisfactorily at all times.

8.2.2 Self-contained breathing apparatus is essential for firefighting because dangerous goods on fire produce various substances hazardous to health. Handling water jets from some distance or cooling of heated cargo may not require the use of self-contained breathing apparatus. However, decisions not to use self-contained breathing apparatus should be undertaken carefully and on a case-by-case basis.

8.2.3 Firefighting outfits offer only limited protection from dangerous goods. Firefighting outfits are not chemical suits. Chemical protective clothing is designed to protect against specific properties of chemicals. In general, there will be no such thing as a single type chemical protective suit on board. Therefore, contact with dangerous goods should be avoided. Chemical protective clothing is not resistant to fire or heat.

9 First aid and actions after termination of firefighting

9.1 Any contamination with hazardous material should be immediately removed from the skin and then washed, for example with copious quantities of water. Information on medical first aid is provided in the IMO/WHO/ ILO *Medical First Aid Guide for Use in Accidents Involving Dangerous Goods* (MFAG) published by IMO. Be prepared to use the MFAG!

9.2 Cargo may re-ignite after a fire has been extinguished. An efficient patrol should be maintained in the spaces in which the fire occurred and in any adjoining spaces to ensure that any new ignition or leakages are dealt with promptly. Fire-extinguishing systems should remain on stand-by. Post a fire watch.

9.3 After extinguishing the fire, all emergency team personnel should ensure that all contamination of equipment and protective clothing is removed and washed immediately. Equipment should be restored and re-stowed for use.

9.4 There are reporting procedures under SOLAS and MARPOL which have to be followed (see Reporting procedures).

10 Special notes on classes of dangerous goods

10.1 Explosives – class 1

10.1.1 In the event of a fire, everything should be done to prevent the spread of the fire to containers which contain class 1 goods. If it is not possible to prevent the spread of the fire, all personnel should immediately withdraw from the area.

10.1.2 Many explosives will burn to the point of an explosion. The master's main concern will be whether or not there is likely to be a mass explosion. Such an explosion could damage the ship. If goods of division 1.1 or division 1.5 are involved, this likelihood will exist. The time between fire reaching the explosives and the subsequent mass explosion will be of the order of a few seconds to minutes. The master should ascertain how large a quantity of such explosives is involved. A few kilograms are unlikely to sink the ship, but above this a clear risk to the safety of the crew and the stability of the ship should be considered. Sudden or short- term events may endanger the safety of the ship.

10.1.3 Explosives of divisions 1.2, 1.3, 1.4, and 1.6 are unlikely to explode *en masse.* Irrespective of the division of the explosives, any firefighting should take place from behind substantial cover. If the risk to firefighters is too high, hoses could be lashed to the rail or other suitable fixtures and left unmanned.

10.1.4 Neither exclusion of air nor the use of smothering material is likely to be effective against a fire involving explosives. The use of the largest possible quantity of water in the shortest possible time is the only means of attempting to prevent a rise in temperature that could affect the chemical stability of the explosives.

10.1.5 Some dangerous goods of this class have been wetted or immersed in water. As they dry, they become unstable. The master should seek advice (see section 4 above).

10.2 Gases – class 2

10.2.1 Gases are substances usually transported in cylinders, flasks, portable tanks, aerosol dispensers and bottles under varying degrees of pressure. The gases may be flammable, toxic or corrosive and may be compressed, liquefied or refrigerated.

10.2.2 Gases will not start burning at the valve, unless there has been an ignition source nearby (e.g. fire or heat). The location of the burning gas needs to be identified because it may be the heart of the fire. The heating of the receptacle is the most serious danger because of the possibility of rupture, rocketing or explosion. In the event of a fire, receptacles containing gas should be liberally sprayed with water to keep them as cool as possible.

10.2.3 Non-burning leakages from receptacles of flammable gases may give rise to explosive mixtures in air. If a fire caused by the ignition of leaking gas is extinguished within a cargo space before the leak is stopped, accumulation of gas will occur. This will result in an explosive mixture or a toxic or suffocating atmosphere. The EmS SPILLAGE SCHEDULES should be consulted.

10.2.4 Extremely low temperatures around leakages of some liquefied gases are an additional hazard (other than flammability and toxicity). Emergency teams should avoid contact with such leakages and the immediate vicinity.

10.3 Flammable liquids – class 3

10.3.1 It is dangerous to direct a jet of water onto a fire involving flammable liquids. Many flammable liquids float on water and the water jet would spread the liquid, thus creating a greater danger. Closed containers exposed to fire will become pressurized and a rupture will occur.

10.3.2 Heated flammable liquid will release vapours that may start burning instantly with explosive effect. Consequently, firefighting personnel should stay in a well-protected position and use water spray on the area of the fire. This will cool down the temperature of the liquid and the air-vapour mixture

10.4 Flammable solids, self-reactive substances, solid desensitized explosives and polymerizing substances – class 4.1

10.4.1 This class of substances includes flammable solids, water-wetted explosives (i.e. desensitized explosives) and self-reactive substances.

10.4.2 Flammable solids will easily ignite, and the appropriate EmS FIRE SCHEDULE should be consulted. In the event of a fire, water-wetted explosives (i.e. desensitized explosives) will effectively have the properties of a class 1 product. The special notes on class 1 explosives (see 10.1) and the relevant EmS FIRE SCHEDULES should be consulted.

10.4.3 Self-reactive substances are sometimes transported under temperature controlled conditions where the control temperature will depend upon the specific properties of the substance being transported. If the control temperature is exceeded, the refrigeration unit has to be inspected. If the temperature control cannot be restored, the manufacturer should be consulted as soon as possible. The manufacturer should be similarly consulted if smoke is observed. The cargo should then be kept under surveillance.

10.5 Substances liable to spontaneous combustion – class 4.2

10.5.1 This class of substances includes pyrophoric substances, which will instantly burn on contact with air, and self-heating substances, which lead to spontaneous combustion.

10.5.2 Although the use of dry inert powdered material to smother the fire would be the preferred option, in most circumstances such a procedure may not be possible. Two methods of dealing with such fires are possible:

.1 controlled burning: stay in a well-protected position. Let the goods burn. Many goods of this class react dangerously with water: refer to the relevant EmS FIRE SCHEDULE. In such cases, contact with water may intensify burning. Therefore, it is not recommended to apply water directly on the burning goods. When portable water monitors providing water shield function are available: generate a water screen to prevent spread of fire. The fire involving the goods should be left to burn out completely. If the fire has already spread to the adjacent cargo which is not reacting with water (see relevant EmS FIRE SCHEDULE): fight this fire from a safe distance;

.2 fight the fire from a safe distance: if the location of the fire makes it possible, copious quantities of water should be used immediately. Although the goods on fire will react with water and create heat, a large quantity of water will cool down the reaction and prevent further heat radiation. However, water should not be used when the location of the fire makes it impossible to apply copious amounts of water directly onto the goods. Refer to the relevant EmS FIRE SCHEDULE.

10.6 Substances which, in contact with water, emit flammable gases – class 4.3

10.6.1 This class of substances reacts violently with water, evolving flammable gases. The heat of the reaction is sometimes sufficient to initiate a fire.

10.6.2 Although the use of dry inert powdered material to smother the fire would be the preferred option, in most circumstances such a procedure may not be possible. Two methods of dealing with such fires are possible:

.1 controlled burning: stay in a well-protected position. Let the goods burn. All goods of this class react dangerously with water: refer to the relevant EmS FIRE SCHEDULE. Contact with water will intensify burning. Therefore, it is not recommended to apply water directly on the burning goods. When portable water monitors providing water shield function are available: generate water screen to prevent spread of fire. The fire involving the goods should be left to burn out completely. If the fire has already spread to adjacent cargo which is not reacting with water (see relevant EmS FIRE SCHEDULE): fight this fire from a safe distance;

.2 fight the fire from a safe distance: refer to the relevant EmS FIRE SCHEDULE, since it is possible that firefighting with water may intensify the fire and generate the evolution of flammable gases which could explode in mixtures with air.

10.7 Oxidizing substances – class 5.1

10.7.1 This class of substances is liable to evolve oxygen and therefore to accelerate a fire. These substances, while in themselves not necessarily combustible, may cause the combustion of other material (e.g. sawdust or paper) or contribute to the fire, leading to an explosion.

10.7.2 Fires in which these substances are present are difficult to extinguish, because the ship's firefighting installation may not be effective. Everything possible should be done to prevent the spread of fire to containers containing these dangerous goods. However, if fire reaches the cargo, personnel should be withdrawn immediately to a well-protected position.

10.8 Organic peroxides – class 5.2

10.8.1 This class of substances is liable to burn vigorously. Some substances have a low decomposition temperature and are transported under temperature controlled conditions, where the control temperature will depend upon the specific properties of the substance being transported.

10.8.2 If the temperature control cannot be restored, the manufacturer should be consulted as soon as possible even if evolution of smoke has ceased. The cargo should then be kept under surveillance. The surrounding area should be kept isolated because liquid may be ejected from relief arrangements.

10.9 Toxic substances – class 6.1

Substances of this class are poisonous by contact or inhalation, and the use of self-contained breathing apparatus and firefighters' outfits is therefore essential.

10.10 Infectious substances – class 6.2

These are substances which are known or reasonably expected to contain pathogens (i.e. micro-organisms that are known or reasonably expected to cause infectious disease in humans or animals). Pathogens may survive the fire and self-contained breathing apparatus should therefore be used.

10.11 Radioactive material – class 7

10.11.1 Many radioactive materials are transported in packages designed to retain their containment and shielding in accidents. However, under extreme fire conditions, failure of containment or loss of shielding or criticality safety could result in significant hazard to personnel. Long-term exposure of any class 7 package to extreme heat should be avoided and in emergencies they should be kept as cool as possible using copious quantities of water. If a packaging of radioactive material has been exposed to any significant fire, expert advice should be sought. Suspected contamination of safety and firefighting equipment should be removed as quickly as possible.

10.11.2 Some packages may have a class 7 label and other hazard labels. Such additional hazards may be greater than the radiation hazard. In that case, actions as specified in the applicable EmS FIRE SCHEDULE should be followed.

10.11.3 Although radiation monitors are not required by regulation on board ships, applicable relevant provisions on segregation, separation or radiation protection programmes (e.g. section 1.5.2 and paragraph 7.1.4.5.18 of the IMDG Code) or the INF Code may require monitors on board. For ships carrying radiation monitoring equipment, monitoring of radiation levels is recommended.

10.12 Corrosive substances – class 8

These substances are extremely dangerous to humans, and many may cause destruction of safety equipment. Burning cargo of this class will produce highly corrosive vapours. Consequently, wearing self-contained breathing apparatus is essential.

10.13 Miscellaneous dangerous substances and articles and environmentally hazardous substances – class 9

This class includes those substances, materials and articles which are deemed to possess some danger, but which are not classified within the criteria of classes 1 to 8. No general guidelines are applicable to these goods. They have been allocated to the relevant EmS FIRE SCHEDULE according to their hazards in the event of a fire.

10.14 Marine pollutants

10.14.1 A number of substances within all of the above classes have also been designated as marine pollutants. Packages containing these substances will bear a marine pollutant mark.

10.14.2 In the case of leakage resulting from burning cargo, it is important to be aware that any spillage of a marine pollutant which is washed overboard will pollute the sea. It is, however, more important to fight a fire on board a ship rather than to prevent pollution of the sea.

General guidelines for FIRE

- Think safety first!
- Avoid any contact with dangerous substances.
- Keep away from fire, smoke, fumes and vapours.
- Sound the fire alarm and start firefighting procedures.
- Keep the bridge and living quarters upwind if possible.
- Locate stowage position of cargo that is burning or evolving smoke.
- Identify cargo.
- Obtain UN numbers and the EmS FIRE SCHEDULE of the dangerous goods involved.
- Consider which measures of the EmS FIRE SCHEDULE are applicable and should be followed.
- Check if other dangerous goods may potentially be involved in the fire and identify the relevant EmS FIRE SCHEDULE.
- Wear suitable protective clothing and self-contained breathing apparatus.
- Be prepared to use the Medical First Aid Guide (MFAG).
- Contact the designated person of the company responsible for the operation of the ship or a rescue coordination centre to obtain expert advice on dangerous goods emergency response measures.

Precaution: Contamination of the skin with dangerous goods should be removed and washed immediately.

Emergency schedules for FIRE

FIRE SCHEDULE Alfa

F–A

GENERAL FIRE SCHEDULE

General comments		In a fire, exposed cargoes may explode or their containment may rupture. Fight fire from a protected position from as far away as possible.
Cargo on fire on deck	Packages	Create water spray from as many hoses as possible.
	Cargo transport units	
Cargo on fire under deck		Stop ventilation and close hatches. Use cargo space fixed fire-extinguishing system. If this is not available, create water spray using copious quantities of water.
Cargo exposed to fire		If practicable, remove or jettison packages which are likely to be involved in fire. Otherwise, keep cool using water.
Special cases: UN 1381, UN 2447		After extinguishing the fire, treat immediately as for spillage (see relevant EmS SPILLAGE SCHEDULE).

FIRE SCHEDULE Bravo

F–B

EXPLOSIVE SUBSTANCES AND ARTICLES

General comments		In a fire, exposed cargoes may explode or their containment may rupture. Fight fire from a protected position from as far away as possible. All crew members should be made aware of the explosion hazard and instructed to take appropriate action. SUDDEN OR SHORT-TERM EVENTS (e.g. EXPLOSIONS) MAY ENDANGER THE SAFETY OF THE SHIP.
Cargo on fire on deck	Packages	Use copious quantities of water from as many hoses as possible.
	Cargo transport units	Cargo will explode or burn fiercely. Extinguishing may not be possible.
Cargo on fire under deck		Cargo will explode or burn fiercely. Extinguishing will not be possible. Stop ventilation and close hatches. Use cargo space fixed fire-extinguishing system. If this is not available, create water spray using copious quantities of water.
Cargo exposed to fire		Do not move packages that have been exposed to heat. If practicable, remove or jettison packages which are likely to be involved in the fire. If the packages are not directly involved in the fire, efforts should be concentrated on preventing the fire from reaching the cargo. This is done by keeping the packages wet by using water jets from as far away as practicable to drive the fire away. If the fire reaches the cargo, the firefighters should withdraw to a safe area and continue to fight the fire. Where practicable, articles having been exposed to the fire should be kept separated from unexposed articles. They should be kept wet and monitored from a safe distance.
Special cases:		
UN 0018, UN 0019, UN 0020, UN 0021, UN 0301		Ammunition producing tear or toxic gas. The crew should be aware of the hazard. After explosion, only self-contained breathing apparatus will protect efficiently. Consult SPILLAGE SCHEDULE S-Z.
UN 0248, UN 0249		These water-activated devices will become more liable to explosion on contact with water.
UN 3268		SAFETY DEVICES, electrically initiated, could be subject to self-sustaining decomposition if heated. The temperature could reach 500°C, producing gas. This process may lead to an explosion of the cargo even after the exposure to heat has ended.

FIRE SCHEDULE Charlie

F–C

NON-FLAMMABLE GASES

General comments		Gases in closed tanks exposed to heat may explode suddenly in or after a fire situation by a *boiling liquid – expanding vapour explosion* (BLEVE). Heated or ruptured cylinders may rocket. Gases listed under this schedule are non-flammable. However, some gases will support combustion though not flammable itself. Fire may produce leakages. Most gases allocated to this schedule are hazardous to health. Some are corrosive. Create water spray. Identify the source of the fire and take appropriate action.
Cargo on fire on deck	Packages	Use copious quantities of water from as many hoses as possible.
	Cargo transport units	
Cargo on fire under deck		Use fixed fire-extinguishing system.
Cargo exposed to fire		If practicable, remove or jettison packages which are likely to be involved in the fire. Otherwise, cool for several hours using water. Heated or ruptured cylinders may rocket.
Special cases: UN 1003, UN 1070, UN 1072, UN 1073, UN 2201, UN 3156, UN 3157, UN 3513, UN 3515, UN 3518		Although these cargoes are non-flammable, they will intensify the fire.

FIRE SCHEDULE Delta

F–D

FLAMMABLE GASES

General comments		Gases in closed tanks exposed to heat may explode suddenly in or after a fire situation by a *boiling liquid – expanding vapour explosion* (BLEVE). Crew members should be aware of the explosion hazard and take appropriate action. Keep tanks cool with copious quantities of water. Fight fire from a protected position from as far away as possible. Extinguishing a burning gas leak may lead to the formation of an explosive atmosphere. Flames may be invisible.
Cargo on fire on deck	Packages	Create water spray from as many hoses as possible. Do not try to extinguish a gas flame.
	Cargo transport units	Cool burning transport units and nearby cargo exposed to the fire with copious quantities of water. Do not try to extinguish a gas flame.
Cargo on fire under deck		Stop ventilation and close hatches. Use cargo space fixed fire-extinguishing system. If this is not available, create water spray using copious quantities of water.
Cargo exposed to fire		If practicable, remove or jettison packages which are likely to be involved in the fire. Otherwise, keep cool for several hours using water.
Special cases: UN 1038, UN 1075, UN 1965, UN 1966, UN 1972, UN 3138, UN 3160, UN 3309, UN 3312		SUDDEN OR SHORT-TERM EVENTS (e.g. EXPLOSIONS) MAY ENDANGER THE SAFETY OF THE SHIP.
UN 1001, UN 3374		*Acetylene* is a gas which is particularly dangerous due to its potential to explode. Rough handling or local heating may lead to delayed explosion. Keep cool for several hours using water. Do not move receptacles. All cylinders that have been subjected to rough handling or to local heating should be jettisoned.
UN 3501, UN 3504, UN 3505		A flammable liquid, paste or powder may be expelled if the package is ruptured. Also consult FIRE SCHEDULE F-E.

FIRE SCHEDULE Echo

F–E

NON-WATER-REACTIVE FLAMMABLE LIQUIDS

General comments		Cargoes in tanks exposed to heat may explode suddenly in or after a fire situation by a *boiling liquid – expanding vapour explosion* (BLEVE). Keep tanks cool with copious quantities of water. Fight fire from a protected position from as far away as possible. Stop leakage or close open valve if practicable. Flames may be invisible.
Cargo on fire on deck	Packages	Create water spray from as many hoses as possible.
	Cargo transport units	Cool burning transport units and nearby cargo exposed to the fire with copious quantities of water.
Cargo on fire under deck		Stop ventilation and close hatches. Use cargo space fixed fire-extinguishing system. If this is not available, create water spray using copious quantities of water.
Cargo exposed to fire		If practicable, remove or jettison packages which are likely to be involved in the fire. Otherwise, keep cool for several hours using water.
Special cases: UN 1162, UN 1250, UN 1298, UN 1717, UN 2985		Cargoes will create hydrochloric acid in contact with water: stay away from effluent.

FIRE SCHEDULE Foxtrot Part 1 of 2

F–F

TEMPERATURE-CONTROLLED SELF-REACTIVES AND ORGANIC PEROXIDES

General comments		Exposed cargoes may decompose violently. Crew members should be aware of the explosion hazard and take appropriate action. Fight fire from a protected position from as far away as possible. Switch off electrical power supplies only during firefighting. Check temperature readings if possible. Measures have to be taken to alert the crew when the temperature of the cargo increases. In case of a temperature increase or smoke evolution, follow the relevant instructions. Contact the manufacturer (consignor) of the cargo as soon as possible.
Cargo on fire on deck	Packages	Not applicable.
	Cargo transport units	Cool burning transport units and nearby cargo exposed to the fire with copious quantities of water. After the fire has been extinguished, do not open the unit until well after smoke evolution has ceased. If possible, restore cooling. Keep under surveillance.
Cargo on fire under deck		Not applicable. According to the IMDG Code, under deck stowage is not allowed. Radio for expert ADVICE.
Cargo exposed to fire	Cargo transport units with IBCs, packages	Cool units exposed to fire with water. After the fire has been extinguished, check and restore cooling. Keep under surveillance. Check temperature frequently. In case of temperature increase or smoke evolution, follow the relevant instructions.
	Tanks	Keep personnel away from tanks as liquid may be ejected from relief arrangements. Cool units exposed to fire with copious quantities of water. After the fire has been extinguished, check and restore cooling. Keep under surveillance. After the fire has been extinguished, water spray should be continued to cool down the outer parts of the tanks. Check refrigeration unit, keep tanks under surveillance. Check temperature frequently.
Temperature increase	Cargo transport units with IBCs, packages	If the *control temperature* is exceeded, the refrigeration unit has to be inspected (consult manual) and repaired. If not possible and/or temperature control cannot be restored, contact the manufacturer of the cargo. If the *emergency temperature* is reached but the refrigeration unit is operating correctly, contact the manufacturer of the cargo and consider disposal of packagings. Keep firefighting team on stand-by. If the *emergency temperature* is reached due to cooling unit failure, contact the manufacturer of the cargo. When emergency temperature is reached, 12 hours are left for repairing the cooling unit and/or disposal of packaging. After that time, keep a safe distance and prepare for firefighting.
	Tanks	If the *control temperature* is exceeded, the refrigeration unit has to be inspected (consult manual) and repaired. If not possible and/or temperature control cannot be restored, contact manufacturer of the cargo. If the *emergency temperature* is reached but the refrigeration unit is operating correctly, contact the manufacturer of the cargo. Keep at a safe distance and consider emptying of tank overboard via bottom outlet using a flexible hose. If the *emergency temperature* is reached due to failure of the cooling unit, repairs may be undertaken as long as the temperature has not exceeded the emergency temperature by more than 5°C. After that, consider emptying the tank using a flexible hose attached to the bottom opening of the tank if provided.
Special cases: None.		

FIRE SCHEDULE Foxtrot *(continued)* Part 2 of 2

F–F

TEMPERATURE-CONTROLLED SELF-REACTIVES AND ORGANIC PEROXIDES

Smoke evolution	Cargo transport units with IBCs, packages	Keep firefighting team on stand-by. The freight container should not be approached. When smoke evolution increases, keep safe distance and prepare for firefighting. After smoke has ceased, check refrigeration system. Follow guidelines for temperature increase. Keep under surveillance, as new smoke evolution might take place.
	Tanks	Keep personnel away from the tank, as liquid may be ejected from relief arrangements. Cool unit exposed to fire with water. Use water spray from a protected position. In case smoke or pressure-relief venting is moderate and temperature is below the emergency temperature, consider emptying the tank overboard via bottom outlet, using a flexible hose. Even when smoke evolution or pressure-relief venting has ceased, water spray should be continued for some hours and the tank should be kept under surveillance, as new smoke evolution might take place.
Special cases: None.		

FIRE SCHEDULE Golf

F–G

WATER-REACTIVE SUBSTANCES

General comments		In a fire, exposed cargoes may explode or their containment may rupture. Liquid material leaking from ruptured receptacles may be ignited and spread the fire. Cargoes in tanks exposed to heat may explode suddenly in or after a fire situation by a *boiling liquid – expanding vapour explosion* (BLEVE). Fight fire from a protected position from as far away as possible. Use of copious quantities of water at once is recommended to cool down the heat radiation and to cool down heated cargo nearby. Water in direct contact with the material will start or intensify burning of that material. Only in locations where direct access to the cargo is possible and where the cargo on fire can be submerged with water, large quantities of water may significantly reduce the thermal reactivity and stop the fire. THE DANGER OF UNCONTROLLED SPREAD OF FIRE SHOULD BE CONSIDERED.
Cargo on fire on deck	Packages	DO NOT use water or foam; smother with dry inert powdered material when available or let fire burn. Cool nearby cargo with copious quantities of water.
	Cargo transport units	Let the fire burn. Cool nearby cargo with copious quantities of water. Use the water shield function of portable water monitors when available, to prevent the spread of fire. Try to avoid getting water into the cargo transport unit on fire.
Cargo on fire under deck		Stop ventilation and close hatches. The fixed gas fire-extinguishing system should be used. If this is not available: DO NOT use water onto the material in enclosed spaces under deck. Cool nearby cargo with copious quantities of water.
Cargo exposed to fire		If practicable, remove or jettison packages which are likely to be involved in the fire. Otherwise cool the cargo with copious quantities of water. Use the water shield function of portable water monitors when available, to prevent the spread of fire.
Special cases: Class 4.3, packing group I		In contact with water, large volumes of flammable gases are produced, which when not instantly ignited may form a highly dangerous explosive atmosphere.

FIRE SCHEDULE Hotel

F–H

OXIDIZING SUBSTANCES WITH EXPLOSIVE POTENTIAL

General comments		In a fire, exposed cargoes may explode or their containment may rupture. Crew members should be aware of the explosion hazard and take appropriate action. Fight fire from a protected position from as far away as possible. SUDDEN OR SHORT-TERM EVENTS (e.g. EXPLOSIONS) MAY ENDANGER THE SAFETY OF THE SHIP.
Cargo on fire on deck	Packages	Create water spray from as many hoses as possible.
	Cargo transport units	
Cargo on fire under deck		OPEN HATCHES to provide maximum ventilation. Fixed gas fire-extinguishing systems may not be effective on these fires. Create water spray from as many hoses as possible.
Cargo exposed to fire		Do not move packages that have been exposed to heat. If practicable, remove or jettison packages which are likely to be involved in the fire. If the packages are not directly involved in the fire, efforts should be concentrated on preventing the fire from reaching the cargo. This is done by keeping the packages wet by using water jets from as far away as practicable to drive the fire away. If the fire reaches the cargo, the firefighters should withdraw to a safe area and continue to fight the fire from a safe position. Where practicable, articles having been exposed to the fire should be kept separated from unexposed articles. They should be kept wet and monitored from a safe distance.
Special cases: None.		

FIRE SCHEDULE India

F–I

RADIOACTIVE MATERIAL

General comments		Evacuate compartment or downwind area of non-essential personnel. Do not touch damaged packages. In cases of suspected radioactive contamination, limit entry of firefighters for the shortest time possible. For ships carrying radiation monitoring equipment, measure radiation levels. Radio for expert ADVICE. After the fire has been extinguished, clean ship's surfaces with copious quantities of water. Decontaminate firefighters before protective clothing is removed. Isolate potentially contaminated clothing and equipment. If exposure of personnel is suspected, clean body and hair with warm water and soap; discharge resultant washings directly overboard. Record the names of potentially exposed persons. Ensure medical examination of these persons after reaching any medical staff. For ships carrying radiation monitoring equipment, continue monitoring of radiation levels after fire is extinguished.
Cargo on fire on deck	Packages	Create water spray from as many hoses as possible.
	Cargo transport units	Create water spray from as many hoses as possible. Cool burning transport units and nearby cargo exposed to the fire with copious quantities of water.
Cargo on fire under deck		Stop ventilation and close hatches. Use cargo space fixed fire-extinguishing system. If this is not available, create water spray using copious quantities of water.
Cargo exposed to fire		If practicable, remove or jettison packages which are likely to be involved in the fire. Otherwise, cool for several hours using copious quantities of water.
Special cases: UN 2977, UN 2978, UN 3507		Chemical hazard greatly exceeds radiation hazard. Material reacts with moisture to form toxic and corrosive gas. The run-off may be corrosive. Keep clear. Exposed cargoes may explode in a fire. Create water spray. Leak may be evident by visible and irritating vapours. Released vapours may also react violently with hydrocarbons (fuel).
UN 3332, UN 3333		If the source capsule is identified as being out of its packaging, do not touch. Stay away, minimize exposure to radiation by limiting time near material and by maximizing distance. Radio for expert ADVICE.
Subsidiary hazard label class 4.2 or class 4.3		All radioactive material with subsidiary hazard label 4.2 or 4.3 affixed (e.g. pyrophoric uranium or thorium metal): Radio for expert ADVICE. *On deck:* Do not use water onto the material. Cool nearby cargo with copious quantities of water, although the fire could intensify for a short period. Do not spray small quantities of water onto the fire, use copious quantities of water. *Under deck:* Stop ventilation and close hatches. The fixed gas fire-extinguishing system should be used. If this is not available, do not use water onto the material in enclosed spaces under deck. With open hatches, cool nearby cargo with copious quantities of water, although the fire could intensify for a short period. Do not spray small quantities of water onto the fire, use copious quantities of water only.

FIRE SCHEDULE Juliet

F–J

NON-TEMPERATURE-CONTROLLED SELF-REACTIVES AND ORGANIC PEROXIDES

General comments		Exposed cargoes may decompose violently. Crew members should be aware of the explosion hazard and take appropriate action. Fight fire from a protected position from as far away as possible. Exposed cargoes may decompose violently in a fire.
Cargo on fire on deck	Packages	Not applicable.
	Cargo transport units	Cool burning transport units and nearby cargo exposed to the fire with copious quantities of water. After the fire has been extinguished, carry on water spraying of the container for several hours. Do not open container until well after smoke evolution has ceased. After this, cool down packages or IBCs if practicable for at least one hour with water. Otherwise, check contents on regular intervals. In case smoke is evolved again, apply further water cooling. Dispose of residues overboard. Clean the area thoroughly. After the fire has been extinguished, keep cargo transport unit under surveillance.
Cargo on fire under deck		Not applicable – According to the IMDG Code, under deck stowage is not allowed. Radio for expert ADVICE.
Cargo exposed to fire	Cargo transport units with IBCs, packages	Cool unit exposed to the fire with water. After the fire has been extinguished, keep transport unit under surveillance. In case of smoke evolution, follow the relevant instructions.
	Tanks	Keep personnel away from tank, as fluid ejection from relief arrangements might take place. Cool unit exposed to the fire with water. Contact the manufacturer (consignor) of the cargo. Cooling the tank should be continued until the temperature is below 50°C. Check temperature frequently. If temperature increases again, cool unit with water. Consider emptying the tank overboard via bottom outlet, using a flexible hose.
Smoke evolution	Cargo transport units with IBCs, packages	Cool unit with water. Use water spray from a protected position. Do not open the unit until well after smoke evolution has ceased. After this, cool down packages or IBCs if practicable for at least one hour with water. Otherwise, check contents on regular intervals. In case smoke is evolved again, apply further water cooling. Dispose of residues overboard. Clean the area thoroughly.
	Tanks	Keep personnel away from the tank, as fluid ejection from relief arrangements might take place. Cool unit exposed to fire with water. Use water spray from a protected position. Even when smoke evolution or pressure-relief venting has ceased, cooling the tank should be continued until the temperature is below 50°C. Check temperature frequently. If temperature increases again, cool unit with water. Consider emptying tank overboard via bottom outlet, using a flexible hose.
Special cases: None.		

Spillage

Introduction to the emergency schedules for SPILLAGE

1 Be prepared

1.1 Incidents involving dangerous goods may result in spillages from such goods, and the magnitude of the effects of an incident depends upon the type and amount of product released, together with the type of any other product involved and whether the spillage is on deck or in enclosed spaces.

1.2 Spillages could create additional hazards to those indicated by classification and labelling of the dangerous goods (e.g. the spillage of a flammable liquid may create an explosive atmosphere). Of particular concern are leakages of reactive chemicals, which in contact with other materials or further spillages will produce additional or other chemicals (e.g. toxic gases).

1.3 When dealing with a spillage on board a ship, the value of crew training and of familiarity with the general contingency plan will become evident. Drills and exercises specific to the cargoes on board at the time should be a part of shipboard routine.

1.4 This Guide should be integrated into the ship's Safety Management System. Procedures contained within the shipboard emergency plan have to be tailored to the individual ship. Spillage response procedures within the EmS SPILLAGE SCHEDULES are differentiated for "on deck" and "under deck" stowage. For specific ship types (e.g. hatchless containerships) or cargo spaces (e.g. open vehicle decks of ferries) these two procedural categories have to be assigned specifically to the individual ship (e.g. run-off considerations concerning bilges and drains).

2 Personal protection

2.1 The safety of the emergency personnel is of paramount importance.

2.2 The likelihood of the development of an explosive, flammable or toxic atmosphere should be considered.

2.3 Full protective clothing resistant to the effects of the specific dangerous substance involved should be worn. The protective clothing should cover all skin so that no part of the body is unprotected. Wearing self-contained breathing apparatus is essential to protect against inhalation of toxic or corrosive dusts, vapours or gases.

2.4 Emergency teams should avoid direct contact with any dangerous goods regardless of the protective clothing being used. If direct contact takes place when dealing with a spillage, the contact time should be kept to a minimum.

2.5 It is a requirement of SOLAS that four sets of full protective clothing resistant to chemical attack should be provided in addition to firefighters' outfits.

2.6 Firefighters' outfits are not designed to protect against chemical hazards and chemical-resistant clothing is not designed to protect against fire. Masters are reminded that personnel should have regular training in the use of self-contained breathing apparatus, and that special attention should be paid to ensuring that face masks fit satisfactorily at all times.

2.7 Responders should also ensure that any chemical protective clothing is used with other suitable protection against the specific hazards involved.

3 General response

3.1 The safety of the emergency personnel is most important.

3.2 Working spaces and living quarters should be protected by water spray wherever possible. Ventilation systems for living quarters and working spaces should be shut off, closed and secured to reduce the possibility of smoke, dust, fumes and gases from entering these areas. Particular care should be given to ventilation inlets (e.g. machinery and accommodation spaces). It may be necessary to turn the ship to ensure that the accommodation spaces are upwind.

3.3 Before entering cargo holds or compartments, the emergency personnel should determine the oxygen content of the space's atmosphere and should test for the presence of dangerous vapours. If a confined space entry is attempted, the use of self-contained breathing apparatus is essential. Only trained personnel should use this equipment, which should be well maintained.

3.4 It is essential to ensure that there is always an escape route for emergency personnel despite the limited means of escape due to narrow exit paths and the danger of falling overboard.

3.5 Decontamination and medical first aid also need to be considered. Arrange for a decontamination station to be set up at a suitable safe location.

3.6 The general response to spillage involving dangerous goods can be subdivided into the following tactical objectives:

.1 Identification;

.2 Rescue;

.3 Isolation; and

.4 Response.

Experience from previous incidents has shown that these objectives can normally be achieved in this order.

4 Identification of the dangerous goods involved

4.1 It is essential to identify the dangerous good(s) involved in the spillage in order that the specific EmS SPILLAGE SCHEDULE(S) for the cargo(es) may be consulted and appropriate action taken. This is important because some dangerous goods are incompatible with some media available for dealing with a spillage.

4.2 An identification number with four digits preceded by the letters "UN" is assigned to each dangerous good. From the UN number, it is possible to find the appropriate EmS SPILLAGE SCHEDULE. The Dangerous Goods List in part 3 of chapter 3.2 of the IMDG Code contains the names and the UN numbers, as well as the EmS SCHEDULE numbers. The Dangerous Goods Manifest and the Stowage Plan required by SOLAS regulation VII/4.2 will also contain the proper shipping name and UN number of the dangerous good(s) concerned. Packages will usually be labelled as well.

4.3 Specific information as to properties of dangerous goods may also be found in the Dangerous Goods List in the IMDG Code. Dangerous goods are classified and labelled according to their hazards. Labels and marks on packages provide a warning of the general risks to be encountered. Personnel should understand the labelling system. It will also be beneficial to consult other sources of information. A safety data sheet provided by the manufacturer may be one such source of additional information. Seek expert advice from manufacturers, specialized agencies or professional responders.

4.4 Emergency preparedness should form part of the ship's Safety Management System as required by the ISM Code. Prepared information can reduce errors during a spillage emergency. Therefore, it is recommended that the EmS SCHEDULE(S) be identified and included within the Dangerous Goods Manifest and Stowage Plan, so directly connected to the stowage position of the cargo. This will enable key members of the crew to know in advance which emergency procedures would be necessary. In the event of a spillage, the allocation of a specific EmS SPILLAGE SCHEDULE via identification of the cargo via the UN number takes time and is open to error, especially in mixed cargoes in one container. Furthermore, some spillage response procedures may require specific use of material which could be hampered by an inaccessible stowage location. After locating the spillage area, the advice given in the EmS SPILLAGE SCHEDULE should be directly available from the Dangerous Goods Manifest and Stowage Plan.

5 Rescue

5.1 The safety of personnel should be the highest priority. One of the first concerns after evaluating the situation of the incident is finding and rescuing victims. This includes searching for and evacuating persons who may be exposed or who are disoriented or disabled by the release. It might be necessary to rescue persons from elevated places or confined spaces or those who are pinned under wreckage.

5.2 Appropriate equipment will need to be available, and prior training is essential for such circumstances.

6 Isolation

6.1 The objective of isolation is to limit the number of personnel exposed to the spilled material. This may be achieved by simply roping or taping off dangerous areas. Consider sealing off ventilation, air conditioning and other openings to living and working spaces.

6.2 At sea, the master has the capability and discretion to alter course and speed to ensure that dangerous gases or vapours are kept away from personnel, living quarters or ventilation inlets.

6.3 Consider the evacuation of passengers and members of the crew.

7 Response

7.1 At sea, human and other resources are limited. So in most cases involving spillage of dangerous goods, the most effective response will probably be to wash the substance overboard or jettison it. Attempts to repack dangerous goods may expose personnel to unreasonable risks.

7.2 The response to the spillage should be in accordance with the appropriate EmS SPILLAGE SCHEDULE(S) for the dangerous good(s) involved in the incident. The emergency team should take all reasonable precautions when dealing with the spillage and remember that the safety of personnel is most important.

8 Seek advice

8.1 Always seek expert ADVICE when dealing with dangerous goods spills. Such ADVICE could be given by:

.1 ship operating companies (e.g. designated persons);

.2 emergency information centres (such as CHEMTREC in the USA);

.3 specialized agencies;

.4 professional responders;

.5 port State authorities;

.6 coastguard;

.7 fire brigades; and

.8 manufacturers of the products.

9 Materials to be used

9.1 Water is the obvious medium to be used when dealing with a spillage on board a ship. It is recommended in the majority of cases to be used in copious quantities to wash the spillage overboard. However, certain dangerous goods react violently with water, producing flammable and toxic vapours. Others, for example marine pollutants, will produce pollution if washed overboard.

9.2 The term “copious quantities of water” used within the EmS SPILLAGE SCHEDULE(S) refers to the minimum total quantities of water provided for optimal firefighting with four jets as defined by SOLAS regulation II-2/10, Construction requirements. Master and crew should consider practical limitations at specific stowage locations in this respect.

9.3 Inert material should be used for spillages where it would be dangerous to use water. The inert material should be dry.

9.4 Sawdust should not be used as it is liable to be ignited by ignition sources or in contact with a number of substances. Cement may be used as an inert material for barricading.

9.5 An electric discharge may ignite some materials (e.g. explosives). Therefore, the use of non-certified safe type equipment within spillage areas may be dangerous. For some materials, “non-sparking footwear” is recommended (e.g. rubber boots without metal parts).

10 Action after spillage has been dealt with

10.1 Decontamination of personnel, clothing and ship’s structures

10.1.1 After the spillage has been dealt with, the emergency team personnel should ensure that all contamination of equipment and protective clothing is removed and washed immediately. All equipment should be restored and re-stowed for further use.

10.1.2 Areas not affected initially may have been contaminated during response procedures. Crew members coming in contact with improperly decontaminated areas may become contaminated. Clean the site thoroughly before any unprotected personnel are allowed to enter.

10.1.3 Contaminated material should be properly disposed of or be cleaned.

11 First aid

11.1 Information on medical first aid is provided in the IMO/WHO/ILO *Medical First Aid Guide for Use in Accidents Involving Dangerous Goods* (MFAG).Be prepared to use the MFAG!

11.2 Any contamination of the skin with a dangerous substance should be immediately removed and then washed, for example with water. Radio for expert advice if personnel have been exposed to dangerous goods.

12 Special notes on specific dangerous goods classes

12.1 Based on the specific properties of the individual dangerous goods listed under one UN number, experts have allocated the substances, articles and materials to EmS SPILLAGE SCHEDULES. The allocation has not been based on the classification and labelling of the substances only. However, to help the mariner who is used to the handling and labelling of packaged dangerous goods to understand the advice given in the EmS SPILLAGE SCHEDULES, this introduction based on classification properties of substances is given.

12.2 Explosives – class 1

12.2.1 Properly packaged explosives are unlikely to detonate unless exposed to a fire or source of ignition. Within the divisions of this class, there are differences in explosive power. From a mariner's standpoint, the volumes of explosives concerned are of primary importance for the safety of the ship. However, even small volumes of spilled material may ignite and injure individual crew members. In general, spilled explosive substances are less hazardous when kept wet (see SPILLAGE SCHEDULE S-X).

12.2.2 Some explosive mixtures are stabilized in such a way that water will separate explosives from the stabilizer, thus creating a higher risk. The explosive component becomes very sensitive to shock and heat. The explosive should be kept mixed under water and washed overboard. Wetted articles should be jettisoned (see SPILLAGE SCHEDULE S-Y).

12.2.3 Some ammunition types contain a toxic material or a tear-gas substance. In addition to the explosive hazard, the toxicity hazard has to be realized. Use of self-contained breathing apparatus is essential (see SPILLAGE SCHEDULE S-Z).

12.3 Gases – class 2

12.3.1 A release of a flammable gas (class 2.1) is the preliminary step leading to a potential *vapour cloud explosion* (VCE). For a blast to take place, the substance has to mix with air in a quantity that will allow the mixture to form a cloud. As soon as a friction (electrostatic potential) lies within the explosive range and encounters an ignition source, a flash fire, a deflagration or, sometimes, even a detonation may occur, with devastating consequences. In dealing with gas leakages, let the gas evaporate and drift away. Keep away all sources of ignition. Water spray could reduce the ignition potential of the cloud (see SPILLAGE SCHEDULE S-U).

12.3.2 Non-toxic, non-flammable gases (class 2.2) may displace oxygen, creating a suffocation hazard. Ventilation of all areas concerned is important (see SPILLAGE SCHEDULE S-V).

12.3.3 Toxic gases (class 2.3) when released may fill an area of the ship or a compartment with a toxic atmosphere. Therefore, it is important to shut off, close and secure all ventilation supplying the accommodation, machinery spaces and bridge to protect against such gases. Self-contained breathing apparatus is essential for the emergency team (see SPILLAGE SCHEDULE S-U).

12.3.4 Liquefied gases can cause the additional hazard of very low temperatures around the point of leakage. Such a leakage will be particularly dangerous when the leakage is in the liquid phase from a container where very low temperatures will be experienced. The emergency team should avoid contact with liquefied gases if at all possible.

12.3.5 Oxidizing gases can react violently with a number of organic materials. These reactions can generate heat, produce flammable gases and are liable to ignite combustible materials.

12.4 Flammable liquids – class 3

12.4.1 The release of a vaporized flammable liquid is the preliminary step leading to a potential *vapour cloud explosion* (VCE). For a blast to take place, the vapour has to mix with air in a quantity that will allow the mixture to form a cloud. As soon as a friction (electrostatic potential) lies within the explosive range and encounters an ignition source, a flash fire, a deflagration or, sometimes, even a detonation may occur, with devastating consequences. Water spray will reduce the vaporization and the ignition potential of the cloud. Keep away all sources of ignition (see SPILLAGE SCHEDULE S-D).

12.4.2 At high concentrations, many flammable liquids exhibit a narcotic effect (which is not labelled accordingly), a short-term potentially lethal effect (which is identified by a class 6.1 label) or a long-term toxic effect (not labelled). In all cases, the use of self-contained breathing apparatus is therefore recommended (see SPILLAGE SCHEDULE S-D).

12.4.3 Some flammable liquids are corrosive to human skin, the ship's hull or normal personal protection equipment. Their vapours are toxic by inhalation. Therefore, washing of spillages and forcing vapours overboard with water spray is the method of choice. It is important to close all ventilation to protect the accommodation and machinery spaces and the bridge from the vapours. Crew members should stay away from any effluent (see SPILLAGE SCHEDULE S-C).

12.4.4 Many flammable liquids are not soluble in water and will float on the water (e.g. mineral oil, gas oil, petroleum). In general, high concentrations of these substances are not lethal but exhibit a narcotic effect. The crew should be aware of that and stay away from highly concentrated vapours. Mineral oil is considered to be a marine pollutant although not classified nor labelled as such. Depending on the quantities, oil spilt into the sea may cause problems and is usually given a high profile by the media. In case of spillage on board, the dominating hazard is flammability. Keep away all sources of ignition (see SPILLAGE SCHEDULE S-E).

12.5 Flammable solids, self-reactive substances, solid desensitized explosives and polymerizing substances – class 4

12.5.1 This class contains many different substances and varying hazards within its three sub-classes. Many are not solids. Some of these materials require special agents to be used for cleaning/absorbing as they react unfavourably with water, sand or other inert material. The procedures and materials to be used in case of a spillage are identified in ten different schedules.

12.5.2 Spilled flammable solids may create an explosive atmosphere that could be ignited easily. Whereas some solids (e.g. articles) can be repacked (see SPILLAGE SCHEDULE S-I), others will contaminate ships' surfaces, which have to be cleaned thoroughly by washing the substances overboard (see SPILLAGE SCHEDULE S-G).

12.5.3 A few flammable substances are transported in a molten state. To clean contaminated areas, the use of inert materials is possible to enable the emergency team to shovel up the spillage and dispose of it overboard (see SPILLAGE SCHEDULE S-H).

12.5.4 Flammable solids that exhibit explosive properties when spilt from a package should be kept wet and disposed of overboard. Drying material being ignited (e.g. by heat or friction) would lead to a detonation (see SPILLAGE SCHEDULE S-J).

12.5.5 Temperature-controlled self-reactive substances are also classified as flammable solids under class 4.1. Spillage is often connected to a failure of temperature control, leading to chemical reaction and creating a fire hazard. If not disposed of overboard, the relevant FIRE SCHEDULE should be consulted (see SPILLAGE SCHEDULE S-K).

12.5.6 Some spontaneously combustible substances could react with water (see SPILLAGE SCHEDULE S-L). Smothering with dry inert material and the immediate disposal overboard could limit the ignition hazard. Others will ignite within minutes (see SPILLAGE SCHEDULE S-M) and firefighting will be necessary (see FIRE SCHEDULE F-G).

12.5.7 Depending on the chemical properties, substances which are dangerous when wet (class 4.3) could be collected and disposed of overboard (see SPILLAGE SCHEDULE S-P), or could be kept dry and disposed of overboard or could be washed overboard with copious quantities of water even though a reaction with water will occur (see SPILLAGE SCHEDULES S-N and S-O). The use of water spray is recommended in case of the development of flammable gases (see SPILLAGE SCHEDULE S-O).

12.5.8 Many flammable solids, substances liable to spontaneous combustion and most substances that are dangerous when wet are hazardous to health by skin contact or by inhalation of dust. The use of self-contained breathing apparatus and appropriate chemical protection (e.g. chemical suit) is therefore recommended in all cases.

12.6 Oxidizing substances and organic peroxides – class 5

12.6.1 Dangerous goods of class 5 contain oxygen, and some will ignite combustible material on contact. In general, contact with substances of class 5 will be harmful to the skin, eyes and mucous membranes. The use of self-contained breathing apparatus and appropriate chemical protection (e.g. chemical suit) is therefore recommended.

12.6.2 Spilled oxidizing substances (class 5.1) could ignite combustible material or destroy materials (e.g. personal protection) by their chemical reactivity. Such spillages should be washed overboard. All crew members should stay away from effluent (see SPILLAGE SCHEDULE S-Q).

12.6.3 Organic peroxides (class 5.2) are highly reactive and some may explode when ignited. Class 5.2 liquids are flammable liquids which should be kept away from all sources of ignition. These substances will instantly destroy eyes. Some substances are transported under temperature control which is necessary to prevent reaction (mostly noticed as smoke evolution) and development of heat which may lead to fire (see SPILLAGE SCHEDULE S-R).

12.7 Toxic and infectious substances – class 6

12.7.1 The effects of toxic substances (class 6.1) may appear at once during exposure to them or may be delayed until after exposure. Inhalation is the major route for vapours, gases, mists and dusts. Skin and eye contact is of concern for the emergency team. The use of self-contained breathing apparatus and appropriate chemical protection (e.g. chemical suit) is recommended in all cases. Vapours of toxic liquids may fill an area of the ship or a space with a toxic atmosphere. Therefore, in case of vapour development, it is important to shut off, close and seal off all ventilation leading to accommodation and machinery spaces and the bridge (see SPILLAGE SCHEDULE S-A).

12.7.2 Some toxic substances are also flammable. In this case, the safety advice for both flammable and toxic liquids should be followed (see SPILLAGE SCHEDULE S-D).

12.7.3 In case of spillage of toxic substances, be prepared to use the MFAG.

12.7.4 The substances of class 6.2 are infectious, biological products, diagnostic specimens, clinical waste, etc. In case of spillage of such substances, different types of a biohazard may develop. Some spilled goods of class 6.2 could create illness of crew members after skin contact or inhalation. Whereas washing overboard is advised for on-deck spillage, waiting for expert ADVICE is recommended for under-deck spillages. Any skin contact or inhalation of mists or dusts should be avoided. Expert ADVICE is particularly important in respect of exposure risk, decontamination methods and reporting procedures (see SPILLAGE SCHEDULE S-T).

12.7.5 Most toxic substances and many infectious substances are also toxic to marine animals. Consult safety data sheets or experts for individual properties if needed.

12.8 Radioactive material – class 7

12.8.1 Many radioactive materials are transported in packages designed to retain their containment and shielding under accident conditions. Failure of the containment resulting in spillage that could be a significant hazard to personnel would only be expected under very severe conditions. Damp surfaces on undamaged or slightly damaged packages are seldom an indication of packaging failure. If a packaging of radioactive material appears to have leaked its accidental contents, expert ADVICE should be sought.

12.8.2 Some packages may have both a class 7 label and other hazard labels. Such additional hazards may be greater than the radiation hazard. In that case, actions as specified in the applicable SPILLAGE SCHEDULES should be followed.

12.8.3 Although radiation monitors are not required by regulation on board ships, applicable relevant provisions on segregation, separation or radiation protection programme (e.g. section 1.5.2 and paragraph 7.1.4.5.18 of the IMDG Code) or the INF Code may require monitors on board. For ships carrying radiation monitoring equipment, monitoring the extent of contamination is possible.

12.8.4 Spillage may constitute a release of any solid, liquid or gaseous radioactive material from its packaging. Personal protection material and equipment on board cannot generally provide protection against the health effects of penetrating ionizing radiation. Therefore, to protect personnel from the potential effects of radiation from spilled cargo (which may include the release from the packaging of special form radioactive material), two parameters are important when responding to spillages of these materials: TIME and DISTANCE. Entry of personnel into the area involving the spill of radioactive material should be limited to the shortest time possible, and the distance between the spillage and any personnel should be maximized. In addition, radiation contamination of personnel by inhalation, ingestion or skin contact should be of concern, and appropriate protective actions should be taken (protective clothing and self-contained breathing apparatus is recommended in all cases) (see SPILLAGE SCHEDULE S-S).

12.9 Corrosive substances – class 8

12.9.1 Corrosive solids and liquids can permanently damage human tissue. Some substances may corrode steel and destroy other materials (e.g. personal protection equipment). Corrosive vapours are highly toxic, often lethal by destroying lung tissue. All corrosive chemicals will be dangerous to human health (toxic). Avoid direct contact with the skin, protect against inhalation of vapours or mists. The use of self-contained breathing apparatus and appropriate chemical protection (e.g. chemical suit) is recommended in all cases. Washing spillages and forcing vapours overboard with water spray is the method in all cases. It is important to shut off, close and secure all ventilation leading into the accommodation of choice, machinery spaces and the bridge. All personnel should stay away from effluent (see SPILLAGE SCHEDULE S-B).

12.9.2 Some corrosive substances are also flammable. In these cases, the safety advice for both flammable and corrosive substances should be followed. Use of copious quantities of water and water spray is recommended. In general, the flammability hazard is more important than the corrosive properties for the safety of the ship and the crew (see e.g. SPILLAGE SCHEDULES S-C and S-G).

12.10 Miscellaneous dangerous substances and articles and environmentally hazardous substances – class 9

This class contains miscellaneous dangerous substances that do not fit easily under the criteria for other hazard classes. Nonetheless, these substances represent hazards. There are no common properties that apply to all goods of this class. They have been allocated to the relevant EmS SPILLAGE SCHEDULE according to their hazards in the event of a spillage.

12.11 Marine pollutants

12.11.1 A number of substances within all classes have also been designated as marine pollutants because they are hazardous to marine life. Packages containing these substances will bear a marine pollutant mark.

12.11.2 In the case of spillage, it is important to be aware that any marine pollutant which is washed overboard will pollute the sea and must therefore be reported in accordance with the Reporting procedures by the fastest telecommunication channel available with the highest possible priority to the nearest coastal State (see Reporting Procedures).

12.11.3 It is, however, more important to ensure the safety of the crew and the integrity of the laden ship, rather than to prevent pollution of the sea by marine pollutants.

General guidelines for SPILLAGE

- Think of safety first!
- Avoid any contact with dangerous substances. Do not walk through spilled liquids or dust (solids).
- Keep away from vapours or gases.
- Sound alarm.
- Keep the bridge and living quarters upwind if possible.
- Wear full protective clothing resistant to chemical attack and self-contained breathing apparatus.
- Locate stowage position of leaking cargo.
- Identify cargo.
- Obtain UN numbers and the EmS SPILLAGE SCHEDULE of dangerous goods involved.
- Consider which measures of the EmS SPILLAGE SCHEDULE are applicable and should be followed.
- Be prepared to use the Medical First Aid Guide (MFAG).
- Contact the designated person of the company responsible for the operation of the ship to obtain expert advice on dangerous goods emergency response measures.

Precaution: Contamination of the skin with any dangerous goods should be removed and washed immediately.

Emergency schedules for SPILLAGE

SPILLAGE SCHEDULE Alfa

S–A

TOXIC SUBSTANCES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid contact, even when wearing protective clothing. Stop leak if practicable. Contaminated clothing should be washed off with water and then removed.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Do not direct water jet straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
	Cargo transport units (large spillage)	Keep bridge and living quarters upwind. Wash overboard with copious quantities of water. Do not direct water jet straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
Spillage under deck	Packages (small spillage)	Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapours evaporate. Keep clear. *Liquids:* Provide good ventilation of the space. Restrict flow of liquid to an enclosed area (e.g. by barricading with inert material or cement if available). *Solids:* Collect spillage. Dispose of overboard. Otherwise, keep clear. Radio for expert ADVICE.
	Cargo transport units (large spillage)	Keep clear. Radio for expert ADVICE. After hazard evaluation by experts, you may proceed. Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapour evaporate, keep clear. Where the ventilation system is used, particular attention should be taken to prevent toxic vapours or fumes entering occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. *Liquids:* Provide good ventilation of the space. Wash down to the bottom of the hold. Pump overboard. *Solids:* Collect spillage. Keep spilt solids dry and cover with plastic sheet. Dispose of overboard. Otherwise, close hatches. Wait until the ship arrives in port.
Special cases:		
Marine pollutant mark		Keep disposal overboard as low as possible. Dilute with copious quantities of water. Report incident according to MARPOL reporting requirements.
UN 3546		Substances might be spilled when the articles are damaged. Undamaged articles can be collected.

SPILLAGE SCHEDULE Bravo

S–B

CORROSIVE SUBSTANCES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid contact, even when wearing protective clothing. Keep clear of effluent. Keep clear of evolving vapours. Even short-time inhalation of small quantities of vapour can cause breathing difficulties. Use of water on the substance may cause a violent reaction and produce toxic vapours. Substance may damage ship's construction materials. Contaminated clothing should be washed off with water and then removed.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Do not direct water jet straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
	Cargo transport units (large spillage)	Keep bridge and living quarters upwind. Protect crew and living quarters against corrosive or toxic vapours by using water spray to drive vapours away. Wash overboard with copious quantities of water. Do not direct water jet straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
Spillage under deck	Packages (small spillage)	Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapour evaporate. Keep clear. *Liquids:* Provide good ventilation of the space. Wash down to the bottom of the hold. Use copious quantities of water. Pump overboard. *Solids:* Collect spillage. Dispose of overboard. Wash residues down to the bottom of the hold. Use copious quantities of water. Pump overboard.
	Cargo transport units (large spillage)	Keep bridge and living quarters upwind. Protect crew and living quarters against corrosive or toxic vapours by using water spray to drive vapours away. Do not enter space. Keep clear. Radio for expert ADVICE. After hazard evaluation by experts, you may proceed. Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapours evaporate, keep clear. Where a ventilation system is used, particular attention should be taken in order to prevent toxic vapours or fumes entering occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. *Liquids:* Provide good ventilation of the space. Wash down to the bottom of the hold. Use copious quantities of water. Pump overboard. *Solids:* Collect spillage. Dispose of overboard. Wash residues down to the bottom of the hold. Use copious quantities of water. Pump overboard.
Special cases: Marine pollutant mark UN 2802, UN 2809, UN 3506 UN 3547		 Report incident according to MARPOL reporting requirements. No reaction with water. Not highly corrosive to protective clothing. Collect spillages if practicable. Try to avoid disposal overboard. Radio for expert ADVICE. Substances might be spilled when the articles are damaged. Undamaged articles can be collected.

SPILLAGE SCHEDULE Charlie

S–C

FLAMMABLE, CORROSIVE LIQUIDS

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid contact, even when wearing protective clothing. Keep clear of effluent. Keep clear of evolving vapours. Even short-time inhalation of small quantities of vapour can cause breathing difficulties. Use of water on the substance may cause violent reaction and produce toxic vapours. Substance may damage the ship's construction materials. Spillage or reaction with water may evolve flammable vapours. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Contaminated clothing must be washed off with water and then removed.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Do not direct water jets straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
	Cargo transport units (large spillage)	Keep bridge and living quarters upwind. Protect crew and living quarters against corrosive or toxic vapours by using water spray to drive vapours away. Wash overboard with copious quantities of water. Do not direct water jets straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
Spillage under deck	Packages (small spillage)	Provide adequate ventilation. Do not enter deck without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapours evaporate, keep clear. *Liquids:* Provide good ventilation of the space. Use water spray on effluent in hold to avoid ignition of flammable vapours. Wash down to the bottom of the hold. Use copious quantities of water. Pump overboard. *Solids:* Collect spillage. Dispose of overboard. Wash residues down to the bottom of the hold. Use copious quantities of water. Pump overboard.
	Cargo transport units (large spillage)	Keep bridge and living quarters upwind. Protect crew and living quarters against corrosive or toxic vapours by using water spray to drive vapours away. Do not enter space. Keep clear. Radio for expert ADVICE. After hazard evaluation by experts, you may proceed. Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapours evaporate, keep clear. Where a ventilation system is used, particular attention should be taken in order to prevent toxic vapours or fumes entering occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. *Liquids:* Provide good ventilation of the space. Use water spray on effluent to avoid ignition of flammable vapours. Wash down to the bottom of the hold. Use copious quantities of water. Pump overboard. *Solids:* Collect spillage. Dispose of overboard. Wash residues down to the bottom of the hold. Use copious quantities of water. Pump overboard.
Special cases: Marine pollutant mark UN 2029, UN 3484		Report incident according to MARPOL reporting requirements. Self-ignition of spilt material is possible.

SPILLAGE SCHEDULE Delta

S–D

FLAMMABLE LIQUIDS

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Stop leak if practicable. Avoid contact, even when wearing protective clothing. Spillage may evolve flammable vapours. Contaminated clothing must be washed off with water and then removed.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Do not direct water jet straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
	Cargo transport units (large spillage)	Keep bridge and living quarters upwind. Wash overboard with copious quantities of water. Do not direct water jet straight onto the spillage. Keep clear of effluent. Clean the area thoroughly.
Spillage under deck	Packages (small spillage)	Shut off all possible sources of ignition in the space. Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If the atmosphere cannot be checked, do not enter. Let vapours evaporate, keep clear. Provide good ventilation of the space. Use water spray on effluent in hold to avoid ignition of flammable vapours. Wash down to the bottom of the hold. Pump overboard.
	Cargo transport units (large spillage)	Keep bridge and living quarters upwind. Protect crew and living quarters against corrosive or toxic vapours by using water spray to drive vapours away. Do not enter space. Keep clear. Radio for expert ADVICE. After hazard evaluation by experts, you may proceed. Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapour evaporate, keep clear. Where a ventilation system is used, particular attention should be taken in order to prevent toxic vapours or fumes entering occupied areas of the vessel, e.g. living quarters, machinery spaces, working areas. Provide good ventilation of the space. Use water spray on effluent in the space to avoid ignition of flammable vapours. Wash down to the bottom of the hold. Use copious quantities of water. Pump overboard.
Special cases: Marine pollutant mark UN 2749 UN 3359 UN 3540		Report incident according to MARPOL reporting requirements. Self-ignition of spilt material is possible. This is a cargo transport unit under fumigation. When opened, it will be ventilated. However, experience has shown that toxic fumigants will stay within packaging material and in non-ventilated areas. Obtain information about the fumigation agent. Substances might be spilled when the articles are damaged. Undamaged articles can be collected and repacked.

SPILLAGE SCHEDULE Echo

S–E

FLAMMABLE LIQUIDS, FLOATING ON WATER

General comments		Avoid sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools). Liquid is flammable and spillage may evolve flammable vapours. Wear suitable protective clothing and self-contained breathing apparatus. Stop leak if practicable. In general, substances covered under this schedule will have fuel-oil-like properties. They are immiscible with water and are liable to float on the surface of water. The use of inert absorbent material, as used in machinery spaces, is appropriate in all cases. For sticky liquids, shovels may be used, preferably shovels made of non-sparking or non-ferrous material. You may use light oil or soap-like products (surfactants) to clean small areas. Clean the area thoroughly because of the flammability hazard. Any pumping of spilled liquid overboard will create an oil spill on the sea surface. In this case, contact coastal authorities. Report discharge overboard according to MARPOL reporting requirements.
Spillage on deck	Packages (small spillage)	Collect spillage in oil drums, metal boxes or salvage packagings. You may use inert absorbent material.
	Cargo transport units (large spillage)	Restrict flow of leakage to an enclosed area (e.g. by diking with inert material or cement). Collect spillage in oil drums, metal boxes or salvage packagings. You may use inert absorbent material. Otherwise, wash overboard with copious quantities of water.
Spillage under deck	Packages (small spillage)	Shut off possible sources of ignition in the space. Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapours evaporate. Collect spillage in oil drums, metal boxes or salvage packagings. You may use inert absorbent material. Keep collected spillages in well ventilated areas or on deck only.
	Cargo transport units (large spillage)	Shut off possible sources of ignition in the space. Provide adequate ventilation. Do not enter deck without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). If atmosphere cannot be checked, do not enter. Let vapours evaporate. Where a ventilation system is used, particular attention should be taken in order to prevent toxic vapours or fumes entering occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. Provide good ventilation of the space. Use water spray on effluent in the space to avoid ignition of flammable vapours. Wash down to the bottom of the hold. Use copious quantities of water. Treat effluent according to Shipboard Oil Pollution Emergency Plan. Otherwise, radio for expert ADVICE.
Special cases: UN 1136, UN 1993 UN 1139, UN 1263, UN 1866		 These substances may be miscible with water and hence not float on the surface. In this case, SPILLAGE SCHEDULE S–D will be appropriate. No thorough cleaning of spillage site necessary. Residues will dry out and coat surfaces.

SPILLAGE SCHEDULE Foxtrot

S–F

WATER-SOLUBLE MARINE POLLUTANTS

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Stop leak if practicable. Substances covered under this schedule will present a hazard to the marine environment. Try to avoid disposal overboard. The use of inert absorbent material, as used in machinery spaces, is appropriate in all cases. For sticky liquids, shovels may be used. Discharge of spilled substance overboard will damage the marine environment, including living resources of the sea. In this case, contact coastal authorities. Report discharge overboard according to MARPOL reporting requirements.
Spillage on deck	Packages (small spillage)	*Liquids:* Smother spillage with inert absorbent material. Collect spillage in oil drums, metal boxes or salvage packagings. *Solids:* Collect material.
	Cargo transport units (large spillage)	Restrict flow of leakage to an enclosed area (e.g. by barricading with inert material or cement if available). *Liquids:* Collect spillage in empty tanks, oil drums, metal boxes or salvage packagings. You may use inert absorbent material. *Solids:* Collect spillage in oil drums or metal boxes.
Spillage under deck	Packages (small spillage)	*Liquids:* Smother spillage with inert absorbent material. Collect spillage in oil drums, metal boxes or salvage packagings. *Solids:* Collect material.
	Cargo transport units (large spillage)	Restrict flow of leakage to an enclosed area (e.g. by barricading with inert material or cement if available). *Liquids:* Collect spillage in empty tanks, oil drums, metal boxes or salvage packagings. You may use inert absorbent material. *Solids:* Collect spillage in oil drums or metal boxes. Otherwise, wash down to the bottom of the hold. Use copious quantities of water. Treat effluent according to Shipboard Oil Pollution Emergency Plan.
Special cases: None.		

SPILLAGE SCHEDULE Golf

S–G

FLAMMABLE SOLIDS AND SELF-REACTIVE SUBSTANCES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Stop leak if practicable.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). Collect and contain spillage if practicable. Dispose of overboard. Collect spillage using soft brushes and plastic trays.
	Cargo transport units (large spillage)	Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Check atmosphere before entering (toxicity and explosion hazard). Collect and contain spillage if practicable. Dispose of overboard. Collect spillage using soft brushes and plastic trays.
Special cases: UN 3541		Substances might be spilled when the articles are damaged. Undamaged articles can be collected.

SPILLAGE SCHEDULE Hotel

S–H

FLAMMABLE SOLIDS (MOLTEN MATERIAL)

<table>
<tr><td colspan="2">General comments</td><td>Wear suitable protective clothing and self-contained breathing apparatus.
Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear.
Stop leak if practicable.
Do not touch or walk on spilled material.</td></tr>
<tr><td rowspan="2">Spillage on deck</td><td>Packages (small spillage)</td><td rowspan="4">Smother with dry inert material. Dispose of overboard.</td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td rowspan="2">Spillage under deck</td><td>Packages (small spillage)</td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td colspan="3">Special cases: None.</td></tr>
</table>

SPILLAGE SCHEDULE India

S–I

FLAMMABLE SOLIDS (REPACKING POSSIBLE)

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Stop leak if practicable.
Spillage on deck	Packages (small spillage)	Collect spillage and repack if practicable. Otherwise, wash overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Collect spillage and repack if practicable.
	Cargo transport units (large spillage)	
Special cases: None.		

SPILLAGE SCHEDULE Juliet

S–J

WETTED EXPLOSIVES AND CERTAIN SELF-HEATING SUBSTANCES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Stop leak if practicable. Dried out material may explode if exposed to heat, flame, friction, or shock.
Spillage on deck	Packages (small spillage)	Keep spillage wet. Dispose of solid material overboard. Wash overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Keep spillage wet. Collect and contain spillage if practicable. Dispose of overboard. Collect spillage using soft brushes and plastic trays.
	Cargo transport units (large spillage)	
Special cases: UN 3542		Substances might be spilled when the articles are damaged. Undamaged articles can be collected.

SPILLAGE SCHEDULE Kilo

S–K

TEMPERATURE-CONTROLLED SELF-REACTIVE SUBSTANCES

General comments		If smoke is observed, see FIRE SCHEDULE F-F. Check temperature reading if possible. If temperature is increasing: see FIRE SCHEDULE F-F. Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	Wash overboard with copious quantities of water. Keep clear of effluent. Leave units closed.
Spillage under deck	Packages (small spillage)	Not applicable. According to the IMDG Code, under deck stowage not allowed. Radio for expert ADVICE.
	Cargo transport units (large spillage)	
Special cases:		

SPILLAGE SCHEDULE Lima

S–L

SPONTANEOUSLY COMBUSTIBLE, WATER-REACTIVE SUBSTANCES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. DO NOT USE WATER.
Spillage on deck	Packages (small spillage)	Avoid getting water on spilled substances or inside cargo transport units. Smother with dry inert material. Dispose of overboard immediately.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Not applicable. According to the IMDG Code, under deck stowage not allowed. Radio for expert ADVICE.
	Cargo transport units (large spillage)	
Special cases: UN 2210, UN 2968		These substances are allowed to be carried under deck. Take action as given for on deck stowage.

SPILLAGE SCHEDULE Mike

S–M

HAZARD OF SPONTANEOUS IGNITION

<table>
<tr><td colspan="2">General comments</td><td>Substances covered by this schedule may ignite within 5 minutes after contact with air. See firefighting guidance: FIRE SCHEDULE F–G.</td></tr>
<tr><td rowspan="2">Spillage on deck</td><td>Packages (small spillage)</td><td rowspan="4"></td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td rowspan="2">Spillage under deck</td><td>Packages (small spillage)</td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td colspan="2">Special cases:
UN 3542</td><td>Substances might be spilled when the articles are damaged.
Undamaged articles can be collected.</td></tr>
</table>

SPILLAGE SCHEDULE November

S–N

SUBSTANCES REACTING VIGOROUSLY WITH WATER

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Stop leak if practicable.
Spillage on deck	Packages (small spillage)	If dry, contain and collect spillage if practicable. Dispose of overboard. Avoid contact with water except to wash residues overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Provide adequate ventilation. Check atmosphere before entering space (toxicity and explosion hazards). If atmosphere cannot be checked, do not enter. Do not enter space without self-contained breathing apparatus. Keep dry. Collect spillages using soft brushes and plastic trays. *If dry*, collect and contain spillage if practicable. Dispose of overboard. *If wet*, use inert absorbent material. Do not use combustible material. Dispose of overboard.
	Cargo transport units (large spillage)	
Special cases: UN 3543		Substances might be spilled when the articles are damaged. Undamaged articles can be collected.

SPILLAGE SCHEDULE Oscar

S–O

SUBSTANCES DANGEROUS WHEN WET (NON-COLLECTABLE ARTICLES)

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Stop leak if practicable.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Do not enter space without self-contained breathing apparatus. *If dry*, collect and contain spillage if practicable. Keep dry. Dispose of overboard. Avoid contact with water except to wash residues with copious quantities of water. Keep clear of effluent. *If wet*, wash down to the bottom of the hold. Use copious quantities of water. Pump overboard. If gas is developing, provide good ventilation of the hold. Use water spray on effluent in hold to avoid ignition of flammable vapours.
	Cargo transport units (large spillage)	Do not enter space without self-contained breathing apparatus. *If dry*, collect and contain spillage if practicable. Keep dry. Dispose of overboard. Avoid contact with water except to wash residues with copious quantities of water. Keep clear of effluent. *If wet*, wash down to the bottom of the hold. Use copious quantities of water. Pump overboard. If gas is developing, provide good ventilation of the hold. Use water spray on effluent in hold to avoid ignition of flammable vapours. Where a ventilation system is used, particular attention should be taken in order to prevent toxic vapours or fumes entering occupied spaces of the ship, e.g. living quarters, machinery spaces, working areas.
Special cases: UN 1295		Beware of a highly flammable atmosphere.

SPILLAGE SCHEDULE Papa

S–P

SUBSTANCES DANGEROUS WHEN WET (COLLECTABLE ARTICLES)

General comments		Wear suitable protective clothing and self-contained breathing apparatus.
Spillage on deck	Packages (small spillage)	Contain and collect spillage if practicable. Dispose of overboard.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. Contain and collect spillages if practicable. Dispose of overboard.
	Cargo transport units (large spillage)	
Special cases: UN 3257, UN 3258 UN 3316 UN 3363, UN 3548		Hot substance. No hazard when cool. If FIRST AID KIT, collect articles and repack. Substances might be spilled when the articles or machinery are damaged. Undamaged articles can be collected. Take care of hazardous properties according to transport documents or radio for expert ADVICE.

SPILLAGE SCHEDULE Quebec

S–Q

OXIDIZING SUBSTANCES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. May ignite combustible material (e.g. wood, paper, clothing). Stop leak if practicable.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Do not enter space without self-contained breathing apparatus. *If dry*, contain and collect spillage if practicable. Dispose of overboard. *If wet*, use inert absorbent material. Do not use combustible material. *If liquid*, wash down to the bottom of the hold, using copious quantities of water. Pump overboard. Dispose of overboard.
	Cargo transport units (large spillage)	Provide adequate ventilation. Do not enter space without self-contained breathing apparatus. *If dry*, contain and collect spillage if practicable. Dispose of overboard. *If wet*, use inert absorbent material. Do not use combustible material. *If liquid*, wash down to the bottom of the hold, using copious quantities of water. Pump overboard. Dispose of overboard.
Special cases: UN 3544		Substances might be spilled when the articles are damaged. Undamaged articles can be collected.

SPILLAGE SCHEDULE Romeo

S–R

ORGANIC PEROXIDES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Contact of substance (or vapour) with eyes may cause blindness within minutes. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Stop leak if practicable. Substances covered by this schedule are liable to explode by exposure to heat or ignition. In case of *smoke evolution*, see appropriate FIRE SCHEDULE. Radio for expert ADVICE or contact manufacturer.
Spillage on deck	Packages (small spillage)	Wash overboard with copious quantities of water. Keep clear of effluent. Collect damaged or leaking receptacles and dispose of overboard. Handle with care.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Not applicable. According to the IMDG Code, under deck stowage not allowed. Radio for expert ADVICE.
	Cargo transport units (large spillage)	
Special cases: UN 3545		Substances might be spilled when the articles are damaged. Undamaged articles can be collected.

SPILLAGE SCHEDULE Sierra (Part 1 of 2)

S–S

RADIOACTIVE MATERIAL

General comments		Evacuate compartment or downwind area of non-essential personnel. Provide respiratory protection to personnel in downwind area. For ships carrying radiation monitoring equipment, measure radiation levels. In this case, assess the extent of contamination and resultant radiation level of the package, the adjacent areas and, if necessary, all other material which has been carried in the conveyance. Define a zone for restricted entry. Personnel should not enter this zone without suitable protective clothing and self-contained breathing apparatus. Limit entry of personnel to the restricted zone for the shortest time possible. Cover liquid spill with inert absorbent materials, if available. Cover powder spills with plastic sheet or tarpaulin to minimize spread. If exposure of personnel is suspected, clean body and hair with warm water and soap; discharge resultant washings directly overboard. Record the names of potentially exposed persons. Ensure medical examination of these persons after reaching any medical staff. Emergency procedures, if established for the ship or the specific cargo by relevant authorities or the shipper, should be followed. For ships carrying radiation monitoring equipment, continue monitoring the radiation levels. Radio for expert ADVICE.
Spillage on deck	Packages (small spillage)	Wash spillages overboard with copious quantities of water. Keep clear of effluent. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority.
	Cargo transport units (large spillage)	Let released gas escape. Keep clear. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours (water curtain). Absorb liquid spillage, where practicable, using absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Wash residues of liquids or solids overboard with copious quantities of water (use spray nozzles). Do not allow water to enter receptacles.
Spillage under deck	Packages (small spillage)	Provide adequate ventilation. Let released gas escape, keep clear. Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours or fumes entering occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. Keep solids dry. Absorb liquid spillage, where practicable, using inert absorbent material. Isolate and sheet over. Packages damaged or leaking radioactive contents may be removed to an acceptable restricted access interim location. Isolate and sheet over. Do not remove packages from restricted access zone until approved by the competent authority. Keep working period of emergency team in space as short as possible.
	Cargo transport units (large spillage)	Do not enter space. Radio for expert ADVICE. *If liquid, or vapour is developing:* Where a ventilation system is used, particular attention should be taken in order to prevent radioactive vapours entering occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. Use water spray to protect bridge, living quarters and personnel from precipitation of vapours evolving from the hold (water curtain).

SPILLAGE SCHEDULE Sierra *(continued)* (Part 2 of 2)

S–S

RADIOACTIVE MATERIAL

Special cases:	
UN 2977, UN 2978, UN 3507	Avoid contact, even when wearing protective clothing. Keep clear of evolving vapours. Even short-time inhalation of small quantities of vapour can cause breathing difficulties. Bear in mind that gases are heavier than air. Measures should be taken to prevent leaking gases from penetrating into any other part of the ship. Keep bridge and living quarters upwind. Protect crew and living quarters against corrosive and toxic vapours by using water spray to drive vapours away. Do not enter space without protective equipment. Keep clear. Radio for expert ADVICE.
UN 3332, UN 3333	If a special form radioactive material is identified as being outside its packaging, do not touch. Stay away and radio for expert ADVICE.
UN 2919, UN 3331	For radioactive material, *transported under special arrangement*, use special precautions, operational controls or emergency procedures as specifically designated by the competent authorities in their approval certificates and declared by the shipper in its transport documents.
Subsidiary labels class 4.2 or class 4.3	These are pyrophoric substances, water will ignite the material. DO NOT USE WATER. Radio for expert ADVICE.
Restowing of packages	
UN 2977, UN 3324, UN 3325, UN 3326, UN 3327, UN 3328, UN 3329, UN 3330, UN 3331	Check package labels and transport documents to determine whether packages contain fissile material. Prior to any restowing of these packages, radio for expert ADVICE.

SPILLAGE SCHEDULE Tango

S–T

DANGEROUS GOODS WITH BIOHAZARD

<table>
<tr><td colspan="2">General comments</td><td>Wear suitable protective clothing and self-contained breathing apparatus.
Avoid handling leaking or damaged packages or keep handling to a minimum.
Inform the public health, veterinary or other competent authority if persons or the marine environment might have been exposed. A competent authority to which actual or suspected leakage is reported should notify the authorities of any countries in which the goods may have been handled, including countries of transit.
Radio for expert ADVICE.
Notify consignor/consignee.</td></tr>
<tr><td rowspan="2">Spillage on deck</td><td>Packages (small spillage)</td><td rowspan="2">Stop leak if practicable.
Collect potentially contaminated packages or equipment. Isolate and sheet over.
Wash spillage or residues overboard with copious quantities of water. Keep clear of effluent.
Clean contaminated area thoroughly using bleach-like products (like sodium hypochlorite 1–6% solution or Javel water). Keep clear of effluent.</td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td rowspan="2">Spillage under deck</td><td>Packages (small spillage)</td><td rowspan="2">Do not enter space.</td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td colspan="3">Special cases: None.</td></tr>
</table>

SPILLAGE SCHEDULE Uniform (Part 1 of 2)

S–U

GASES (FLAMMABLE, TOXIC OR CORROSIVE)

General comments		Spaces and areas where leakages or spillages have occurred should be evacuated downwind immediately. Take care: Flames may be invisible. Leaking gas may be extremely cold. Measures should be taken to prevent leaking gases from penetrating into any other part of the ship. Bear in mind that some gases are heavier than air or may otherwise accumulate in lower or non-ventilated parts of the ship. Ensure that there is no smoking or any other open fire on board unless the leak has been closed and all spaces have been ventilated. Particular attention should be taken in order to prevent gases drifting into occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. Wear protective clothing suitable for gas protection and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Even short inhalation of small quantities of gas can cause breathing difficulties. Keep clear of evolving gases. Avoid all skin contact. Let *spilt liquefied gas* evaporate. When in contact with cold liquefied gases, most materials become brittle and are likely to break without warning. Avoid all contact, even when wearing protective clothing. If practicable, protect ship's superstructure with copious quantities of water. Do not direct water jet onto the spill.
Spillage on deck	Packages (small spillage)	Let gas dissipate. Keep clear.
	Cargo transport units (large spillage)	Let gas dissipate. Keep bridge and living quarters upwind. Otherwise, protect crew and living quarters against flammable or toxic gases by using water spray to drive gases away (water curtain). *Spilt liquefied gas:* Use water jets from as far as practicable to accelerate evaporation, not directing them straight onto the spill.
Spillage under deck	Packages (small spillage)	Do not enter space. Provide adequate ventilation. Where a ventilation system is used, particular attention should be taken in order to prevent gases penetrating into other areas of the ship. Let gas evaporate. Keep clear. Radio for expert ADVICE. Check atmosphere before entering (toxicity and explosion hazard). Do not enter space without self-contained breathing apparatus.
	Cargo transport units (large spillage)	Do not enter space. Provide adequate ventilation. Where a ventilation system is used, particular attention should be taken in order to prevent gases drifting into other areas of the ship. Keep bridge and living quarters upwind. Otherwise, protect crew and living quarters against flammable or toxic gases by using water spray to drive gases away (water curtain). If practicable, use water spray to avoid ignition of flammable gases in the space. Radio for expert ADVICE. Check atmosphere before entering (toxicity and explosion hazard). Do not enter deck without self-contained breathing apparatus.

SPILLAGE SCHEDULE Uniform *(continued)* (Part 2 of 2)

S–U

GASES (FLAMMABLE, TOXIC OR CORROSIVE)

Special cases:	
UN 1001, UN 3374	Heated or roughly handled receptacles may explode even after several hours of being removed from external sources of heat. Cool for several hours by using water.
UN 1614	The gas is absorbed in a porous inert material, but will evaporate if the receptacle is damaged.
UN 3501	A flammable liquid, paste or powder may be expelled if the package is ruptured. Also consult SPILLAGE SCHEDULES S-D or S-G, as appropriate.
UN 3504	A flammable or toxic liquid, paste or powder may be expelled if the package is ruptured. Also consult SPILLAGE SCHEDULES S-D, S-G or S-A, as appropriate.
UN 3505	A flammable or corrosive liquid, paste or powder may be expelled if the package is ruptured. Also consult SPILLAGE SCHEDULES S-C or S-G, as appropriate.
UN 3537, UN 3539	Gases might be released when the articles are damaged. Undamaged articles can be collected and repacked.

SPILLAGE SCHEDULE Victor

S–V

GASES (NON-FLAMMABLE, NON-TOXIC)

General comments		Measures should be taken to prevent leaking gases from penetrating into any other part of the ship. Bear in mind that some gases are heavier than air or may otherwise accumulate in lower or non-ventilated parts of the ship. Particular attention should be taken in order to prevent gases drifting into occupied areas of the ship, e.g. living quarters, machinery spaces, working areas. Leaking gas may be extremely cold. Wear suitable protective clothing and self-contained breathing apparatus (suffocation hazard). Let *spilt liquefied gas* evaporate. When in contact with cold liquefied gases, most materials become brittle and are likely to break without warning. Avoid all contact, even when wearing protective clothing. If practicable, protect ship's superstructure with copious quantities of water. Do not direct water jet onto the spill.
Spillage on deck	Packages (small spillage)	Let gas dissipate. Keep clear.
	Cargo transport units (large spillage)	Let gas dissipate. *Spilt liquefied gas:* Use water jets from as far as practicable to accelerate evaporation, not directing them straight onto the spill. Keep clear of evolving gases.
Spillage under deck	Packages (small spillage)	Provide adequate ventilation. Stop leak if practicable. Otherwise, let gas evaporate. Keep clear. Check atmosphere before entering space (suffocation hazard). Do not enter space without self-contained breathing apparatus.
	Cargo transport units (large spillage)	Provide adequate ventilation. Stop leak if practicable. Otherwise, let gas evaporate. Keep clear. *Spilt liquefied gas:* Use water jets from as far as practicable to accelerate evaporation, not directing them straight onto the spill. Check atmosphere before entering space (suffocation hazard). Do not enter space without self-contained breathing apparatus.
Special cases:		
UN 2990, UN 3072		No suffocation hazard. Collect articles and repack.
UN 3502		A toxic liquid, paste or powder may be expelled if the package is ruptured. Also consult SPILLAGE SCHEDULE S-A.
UN 3503		A corrosive liquid, paste or powder may be expelled if the package is ruptured. Also consult SPILLAGE SCHEDULES S-C or S-G, as appropriate.
UN 3538		Gases might be released when the articles are damaged. Undamaged articles can be collected and repacked.

SPILLAGE SCHEDULE Whisky

S–W

OXIDIZING GASES

General comments		Areas containing leakages or spillages should be evacuated downwind immediately. These gases may ignite combustible material and enhance fire. Take care: Flames may be invisible. Leaking gas may be extremely cold. Measures should be taken to prevent leaking gases from penetrating into any other part of the ship. Ensure that there is no smoking or any other open fire on board unless the leak has been closed and all spaces have been ventilated. Particular attention should be taken in order to prevent gases drifting into occupied areas of the vessel, e.g. living quarters, machinery spaces, working areas. Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools, friction). Wear non-sparking footwear. Even short inhalation of small quantities of gas can cause breathing difficulties. Keep clear of evolving gases. Avoid all skin contact. Let *spilt liquefied gas* evaporate. When in contact with cold liquefied gases, most materials become brittle and are likely to break without warning. Avoid all contact, even when wearing protective clothing. If practicable, protect ship's superstructure with copious quantities of water. Do not direct water jet onto the spill.
Spillage on deck	Packages (small spillage)	Let gas evaporate. Keep clear.
	Cargo transport units (large spillage)	Let gas evaporate. Keep bridge and living quarters upwind. Otherwise, protect crew and living quarters against flammable or toxic gases by using water spray to drive gases away (water curtain). *Spilt liquefied gas:* Use water jets from as far as practicable to accelerate evaporation, not directing them straight onto the spill.
Spillage under deck	Packages (small spillage)	Do not enter space. Provide adequate ventilation. Where a ventilation system is used, particular attention should be observed in order to prevent gases penetrating into other areas of the ship. Let gas evaporate. Keep clear. Radio for expert ADVICE. Check atmosphere before entering space (toxicity and explosion hazard). Do not enter space without self-contained breathing apparatus.
	Cargo transport units (large spillage)	Do not enter space. Provide adequate ventilation. Where a ventilation system is used, particular attention should be observed in order to prevent gases drifting into other areas of the ship. Keep bridge and living quarters upwind. Otherwise, protect crew and living quarters against gases by using water spray to drive gases away (water curtain). If practicable, use water spray to avoid ignition of gases in the space. Radio for expert ADVICE.
Special cases: UN 1072, UN 1073		This is concentrated oxygen. No inhalation hazard after a short distance from a leak. No skin irritation hazard.

SPILLAGE SCHEDULE X-Ray

S–X

EXPLOSIVE ITEMS AND ARTICLES

General comments		Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools). *Electrostatic hazard:* Electric charge may ignite ammunition. Keep spilled material away from generators of static electricity (e.g. mobile phones, friction of synthetic polymers like PVC gloves). Wear non-sparking footwear.
Spillage on deck	Packages (small spillage)	*Articles:* Sweep or pick up articles. If the articles remain intact but appear damaged, separate out and radio for expert ADVICE. *Spilled substance:* Keep wet. Wash spillage overboard with copious quantities of water.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	*Articles:* Sweep or pick up articles. If the articles remain intact but appear damaged, separate and radio for expert ADVICE. *Spilled substance:* Keep wet. Collect spillage where practicable. Dispose of overboard.
	Cargo transport units (large spillage)	
Special cases: None.		

SPILLAGE SCHEDULE Yankee

S–Y

EXPLOSIVE CHEMICALS

<table>
<tr><td colspan="2">General comments</td><td>Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools). Stop leak if practicable.
Electrostatic hazard: Electric charge may ignite ammunition. Keep spilled material away from generators of static electricity (e.g. mobile phones, friction of synthetic polymers like PVC gloves). Wear non-sparking footwear.
Some explosive mixtures are stabilized in such a way that water will separate explosives from the stabilizer, thus creating a higher risk. The explosive component becomes very sensitive to shock and heat.
Radio for expert ADVICE.</td></tr>
<tr><td rowspan="2">Spillage on deck</td><td>Packages (small spillage)</td><td rowspan="2">Articles: Sweep or pick up articles. If the articles remain intact but appear damaged, separate out and ask for expert ADVICE. Wetted articles should be jettisoned.
Spilled substance: Keep it under water. Wash spillages overboard with copious quantities of water.</td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td rowspan="2">Spillage under deck</td><td>Packages (small spillage)</td><td rowspan="2">Articles: Sweep or pick up articles. If the articles remain intact but appear damaged, separate out and radio for expert ADVICE. Wetted articles should be jettisoned.
Spilled substance: Keep it under water. Collect spillages where practicable. Dispose of overboard.</td></tr>
<tr><td>Cargo transport units (large spillage)</td></tr>
<tr><td colspan="3">Special cases: None.</td></tr>
</table>

SPILLAGE SCHEDULE Zulu

S–Z

TOXIC EXPLOSIVES

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Even short inhalation of small quantities of gas can cause breathing difficulties or lead to severe poisoning. Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric handtools). *Electrostatic hazard:* Electric charge may ignite ammunition. Keep spilled material away from generators of static electricity (e.g. mobile phones, friction of synthetic polymers like PVC gloves). Wear non-sparking footwear. Particular attention should be taken in order to prevent developing gases drifting into occupied areas of the ship, e.g. living quarters, machinery, working areas. Keep bridge and living quarters upwind. Otherwise, protect crew and living quarters against gases by using water spray to drive gases away (water curtain). Radio for expert ADVICE.
Spillage on deck	Packages (small spillage)	Let vapours dissipate, keep clear. *Articles:* Sweep or pick up articles. If the articles remain intact but appear damaged, separate out and ask for expert ADVICE. *Spilled substance:* Keep wet. Wash spillage overboard with copious quantities of water. Keep clear of effluent.
	Cargo transport units (large spillage)	
Spillage under deck	Packages (small spillage)	Do not enter space without self-contained breathing apparatus. Check atmosphere before entering. Let vapours dissipate, keep clear. *Articles:* Sweep or pick up articles. If the articles remain intact but appear damaged, separate out and ask for expert ADVICE. *Spilled substance:* Keep wet. Collect spillages where practicable. Dispose of overboard.
	Cargo transport units (large spillage)	
Special cases: None.		

Index

Each current UN substance identification number (UN number) is allocated to EmS Fire and Spillage schedules as shown below. Underlined EmS codes (special cases) indicate a substance, material or article for which additional advice is given in the emergency response procedures.

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
0004	F-B	S-Y	0066	F-B	S-X	0135	F-B	S-Y
0005	F-B	S-X	0070	F-B	S-X	0136	F-B	S-X
0006	F-B	S-X	0072	F-B	S-Y	0137	F-B	S-X
0007	F-B	S-X	0073	F-B	S-X	0138	F-B	S-X
0009	F-B	S-X	0074	F-B	S-Y	0143	F-B	S-Z
0010	F-B	S-X	0075	F-B	S-Y	0144	F-B	S-Y
0012	F-B	S-X	0076	F-B	S-Z	0146	F-B	S-Y
0014	F-B	S-X	0077	F-B	S-Z	0147	F-B	S-Y
0015	F-B	S-X	0078	F-B	S-Y	0150	F-B	S-Y
0016	F-B	S-X	0079	F-B	S-Y	0151	F-B	S-Y
0018	F-B	S-Z	0081	F-B	S-Y	0153	F-B	S-Y
0019	F-B	S-Z	0082	F-B	S-Y	0154	F-B	S-Y
0020	F-B	S-Z	0083	F-B	S-Y	0155	F-B	S-Y
0021	F-B	S-Z	0084	F-B	S-Y	0159	F-B	S-Y
0027	F-B	S-Y	0092	F-B	S-X	0160	F-B	S-Y
0028	F-B	S-Y	0093	F-B	S-X	0161	F-B	S-Y
0029	F-B	S-X	0094	F-B	S-Y	0167	F-B	S-X
0030	F-B	S-X	0099	F-B	S-X	0168	F-B	S-X
0033	F-B	S-X	0101	F-B	S-X	0169	F-B	S-X
0034	F-B	S-X	0102	F-B	S-X	0171	F-B	S-X
0035	F-B	S-X	0103	F-B	S-X	0173	F-B	S-X
0037	F-B	S-X	0104	F-B	S-X	0174	F-B	S-X
0038	F-B	S-X	0105	F-B	S-X	0180	F-B	S-X
0039	F-B	S-X	0106	F-B	S-X	0181	F-B	S-X
0042	F-B	S-X	0107	F-B	S-X	0182	F-B	S-X
0043	F-B	S-X	0110	F-B	S-X	0183	F-B	S-X
0044	F-B	S-X	0113	F-B	S-Y	0186	F-B	S-X
0048	F-B	S-X	0114	F-B	S-Y	0190	F-B	S-X
0049	F-B	S-X	0118	F-B	S-Y	0191	F-B	S-X
0050	F-B	S-X	0121	F-B	S-X	0192	F-B	S-X
0054	F-B	S-X	0124	F-B	S-X	0193	F-B	S-X
0055	F-B	S-X	0129	F-B	S-Y	0194	F-B	S-X
0056	F-B	S-X	0130	F-B	S-Y	0195	F-B	S-X
0059	F-B	S-X	0131	F-B	S-X	0196	F-B	S-X
0060	F-B	S-X	0132	F-B	S-Y	0197	F-B	S-X
0065	F-B	S-X	0133	F-B	S-Y	0204	F-B	S-X

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
0207	F-B	S-Y	0280	F-B	S-X	0334	F-B	S-X
0208	F-B	S-Y	0281	F-B	S-X	0335	F-B	S-X
0209	F-B	S-Y	0282	F-B	S-Y	0336	F-B	S-X
0212	F-B	S-X	0283	F-B	S-X	0337	F-B	S-X
0213	F-B	S-Y	0284	F-B	S-X	0338	F-B	S-X
0214	F-B	S-Y	0285	F-B	S-X	0339	F-B	S-X
0215	F-B	S-Y	0286	F-B	S-X	0340	F-B	S-Y
0216	F-B	S-Y	0287	F-B	S-X	0341	F-B	S-Y
0217	F-B	S-Y	0288	F-B	S-X	0342	F-B	S-Y
0218	F-B	S-Y	0289	F-B	S-X	0343	F-B	S-Y
0219	F-B	S-Y	0290	F-B	S-X	0344	F-B	S-X
0220	F-B	S-Y	0291	F-B	S-X	0345	F-B	S-X
0221	F-B	S-X	0292	F-B	S-X	0346	F-B	S-X
0222	F-B	S-Y	0293	F-B	S-X	0347	F-B	S-X
0224	F-B	S-Z	0294	F-B	S-X	0348	F-B	S-X
0225	F-B	S-X	0295	F-B	S-X	0349	F-B	S-X
0226	F-B	S-Y	0296	F-B	S-X	0350	F-B	S-X
0234	F-B	S-Z	0297	F-B	S-X	0351	F-B	S-X
0235	F-B	S-Y	0299	F-B	S-X	0352	F-B	S-X
0236	F-B	S-Y	0300	F-B	S-X	0353	F-B	S-X
0237	F-B	S-X	0301	F-B	S-Z	0354	F-B	S-X
0238	F-B	S-X	0303	F-B	S-X	0355	F-B	S-X
0240	F-B	S-X	0305	F-B	S-Y	0356	F-B	S-X
0241	F-B	S-X	0306	F-B	S-X	0357	F-B	S-Y
0242	F-B	S-X	0312	F-B	S-X	0358	F-B	S-Y
0243	F-B	S-X	0313	F-B	S-X	0359	F-B	S-Y
0244	F-B	S-X	0314	F-B	S-X	0360	F-B	S-X
0245	F-B	S-X	0315	F-B	S-X	0361	F-B	S-X
0246	F-B	S-X	0316	F-B	S-X	0362	F-B	S-X
0247	F-B	S-X	0317	F-B	S-X	0363	F-B	S-X
0248	F-B	S-Y	0318	F-B	S-X	0364	F-B	S-X
0249	F-B	S-Y	0319	F-B	S-X	0365	F-B	S-X
0250	F-B	S-X	0320	F-B	S-X	0366	F-B	S-X
0254	F-B	S-X	0321	F-B	S-X	0367	F-B	S-X
0255	F-B	S-X	0322	F-B	S-X	0368	F-B	S-X
0257	F-B	S-X	0323	F-B	S-X	0369	F-B	S-X
0266	F-B	S-Y	0324	F-B	S-X	0370	F-B	S-X
0267	F-B	S-X	0325	F-B	S-X	0371	F-B	S-X
0268	F-B	S-X	0326	F-B	S-X	0372	F-B	S-X
0271	F-B	S-X	0327	F-B	S-X	0373	F-B	S-X
0272	F-B	S-X	0328	F-B	S-X	0374	F-B	S-X
0275	F-B	S-X	0329	F-B	S-X	0375	F-B	S-X
0276	F-B	S-X	0330	F-B	S-X	0376	F-B	S-X
0277	F-B	S-X	0331	F-B	S-Y	0377	F-B	S-X
0278	F-B	S-X	0332	F-B	S-Y	0378	F-B	S-X
0279	F-B	S-X	0333	F-B	S-X	0379	F-B	S-X

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
0380	F-B	S-X	0429	F-B	S-X	0475	F-B	S-Y
0381	F-B	S-X	0430	F-B	S-X	0476	F-B	S-Y
0382	F-B	S-X	0431	F-B	S-X	0477	F-B	S-Y
0383	F-B	S-X	0432	F-B	S-X	0478	F-B	S-Y
0384	F-B	S-X	0433	F-B	S-Y	0479	F-B	S-Y
0385	F-B	S-Y	0434	F-B	S-X	0480	F-B	S-Y
0386	F-B	S-Y	0435	F-B	S-X	0481	F-B	S-Y
0387	F-B	S-Y	0436	F-B	S-X	0482	F-B	S-Y
0388	F-B	S-Y	0437	F-B	S-X	0483	F-B	S-Y
0389	F-B	S-Y	0438	F-B	S-X	0484	F-B	S-Y
0390	F-B	S-Y	0439	F-B	S-X	0485	F-B	S-Y
0391	F-B	S-Y	0440	F-B	S-X	0486	F-B	S-X
0392	F-B	S-Y	0441	F-B	S-X	0487	F-B	S-X
0393	F-B	S-Y	0442	F-B	S-X	0488	F-B	S-X
0394	F-B	S-Y	0443	F-B	S-X	0489	F-B	S-Y
0395	F-B	S-X	0444	F-B	S-X	0490	F-B	S-Y
0396	F-B	S-X	0445	F-B	S-X	0491	F-B	S-X
0397	F-B	S-X	0446	F-B	S-X	0492	F-B	S-X
0398	F-B	S-X	0447	F-B	S-X	0493	F-B	S-X
0399	F-B	S-X	0448	F-B	S-Y	0494	F-B	S-X
0400	F-B	S-X	0449	F-B	S-X	0495	F-B	S-Y
0401	F-B	S-Y	0450	F-B	S-X	0496	F-B	S-Y
0402	F-B	S-Y	0451	F-B	S-X	0497	F-B	S-Y
0403	F-B	S-X	0452	F-B	S-X	0498	F-B	S-Y
0404	F-B	S-X	0453	F-B	S-X	0499	F-B	S-Y
0405	F-B	S-X	0454	F-B	S-X	0500	F-B	S-X
0406	F-B	S-Y	0455	F-B	S-X	0501	F-B	S-Y
0407	F-B	S-Y	0456	F-B	S-X	0502	F-B	S-X
0408	F-B	S-X	0457	F-B	S-X	0503	F-B	S-X
0409	F-B	S-X	0458	F-B	S-X	0504	F-B	S-Y
0410	F-B	S-X	0459	F-B	S-X	0505	F-B	S-X
0411	F-B	S-Y	0460	F-B	S-X	0506	F-B	S-X
0412	F-B	S-X	0461	F-B	S-X	0507	F-B	S-X
0413	F-B	S-X	0462	F-B	S-X	0508	F-B	S-Y
0414	F-B	S-X	0463	F-B	S-X	0509	F-B	S-Y
0415	F-B	S-X	0464	F-B	S-X	0510	F-B	S-X
0417	F-B	S-X	0465	F-B	S-X	0511	F-B	S-X
0418	F-B	S-X	0466	F-B	S-X	0512	F-B	S-X
0419	F-B	S-X	0467	F-B	S-X	0513	F-B	S-X
0420	F-B	S-X	0468	F-B	S-X	1001	F-D	S-U
0421	F-B	S-X	0469	F-B	S-X	1002	F-C	S-V
0424	F-B	S-X	0470	F-B	S-X	1003	F-C	S-W
0425	F-B	S-X	0471	F-B	S-X	1005	F-C	S-U
0426	F-B	S-X	0472	F-B	S-X	1006	F-C	S-V
0427	F-B	S-X	0473	F-B	S-Y	1008	F-C	S-U
0428	F-B	S-X	0474	F-B	S-Y	1009	F-C	S-V

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
1010	F-D	S-U	1067	F-C	S-W	1131	F-E	S-D
1011	F-D	S-U	1069	F-C	S-U	1133	F-E	S-D
1012	F-D	S-U	1070	F-C	S-W	1134	F-E	S-D
1013	F-C	S-V	1071	F-D	S-U	1135	F-E	S-D
1016	F-D	S-U	1072	F-C	S-W	1136	F-E	S-E
1017	F-C	S-U	1073	F-C	S-W	1139	F-E	S-E
1018	F-C	S-V	1075	F-D	S-U	1143	F-E	S-D
1020	F-C	S-V	1076	F-C	S-U	1144	F-E	S-D
1021	F-C	S-V	1077	F-D	S-U	1145	F-E	S-D
1022	F-C	S-V	1078	F-C	S-V	1146	F-E	S-D
1023	F-D	S-U	1079	F-C	S-U	1147	F-E	S-D
1026	F-D	S-U	1080	F-C	S-V	1148	F-E	S-D
1027	F-D	S-U	1081	F-D	S-U	1149	F-E	S-D
1028	F-C	S-V	1082	F-D	S-U	1150	F-E	S-D
1029	F-C	S-V	1083	F-D	S-U	1152	F-E	S-D
1030	F-D	S-U	1085	F-D	S-U	1153	F-E	S-D
1032	F-D	S-U	1086	F-D	S-U	1154	F-E	S-C
1033	F-D	S-U	1087	F-D	S-U	1155	F-E	S-D
1035	F-D	S-U	1088	F-E	S-D	1156	F-E	S-D
1036	F-D	S-U	1089	F-E	S-D	1157	F-E	S-D
1037	F-D	S-U	1090	F-E	S-D	1158	F-E	S-C
1038	F-D	S-U	1091	F-E	S-D	1159	F-E	S-D
1039	F-D	S-U	1092	F-E	S-D	1160	F-E	S-C
1040	F-D	S-U	1093	F-E	S-D	1161	F-E	S-D
1041	F-D	S-U	1098	F-E	S-D	1162	F-E	S-C
1043	F-C	S-V	1099	F-E	S-D	1163	F-E	S-C
1044	F-C	S-V	1100	F-E	S-D	1164	F-E	S-D
1045	F-C	S-W	1104	F-E	S-D	1165	F-E	S-D
1046	F-C	S-V	1105	F-E	S-D	1166	F-E	S-D
1048	F-C	S-U	1106	F-E	S-C	1167	F-E	S-D
1049	F-D	S-U	1107	F-E	S-D	1169	F-E	S-D
1050	F-C	S-U	1108	F-E	S-D	1170	F-E	S-D
1051	F-E	S-D	1109	F-E	S-D	1171	F-E	S-D
1052	F-C	S-U	1110	F-E	S-D	1172	F-E	S-D
1053	F-D	S-U	1111	F-E	S-D	1173	F-E	S-D
1055	F-D	S-U	1112	F-E	S-D	1175	F-E	S-D
1056	F-C	S-V	1113	F-E	S-D	1176	F-E	S-D
1057	F-D	S-U	1114	F-E	S-D	1177	F-E	S-D
1058	F-C	S-V	1120	F-E	S-D	1178	F-E	S-D
1060	F-D	S-U	1123	F-E	S-D	1179	F-E	S-D
1061	F-D	S-U	1125	F-E	S-C	1180	F-E	S-D
1062	F-C	S-U	1126	F-E	S-D	1181	F-E	S-D
1063	F-D	S-U	1127	F-E	S-D	1182	F-E	S-C
1064	F-D	S-U	1128	F-E	S-D	1183	F-G	S-O
1065	F-C	S-V	1129	F-E	S-D	1184	F-E	S-D
1066	F-C	S-V	1130	F-E	S-E	1185	F-E	S-D

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
1188	F-E	S-D	1247	F-E	S-D	1310	F-B	S-J
1189	F-E	S-D	1248	F-E	S-D	1312	F-A	S-I
1190	F-E	S-D	1249	F-E	S-D	1313	F-A	S-I
1191	F-E	S-D	1250	F-E	S-C	1314	F-A	S-I
1192	F-E	S-D	1251	F-E	S-C	1318	F-A	S-I
1193	F-E	S-D	1259	F-E	S-D	1320	F-B	S-J
1194	F-E	S-D	1261	F-E	S-D	1321	F-B	S-J
1195	F-E	S-D	1262	F-E	S-E	1322	F-B	S-J
1196	F-E	S-C	1263	F-E	S-E	1323	F-G	S-G
1197	F-E	S-D	1264	F-E	S-D	1324	F-A	S-I
1198	F-E	S-C	1265	F-E	S-D	1325	F-A	S-G
1199	F-E	S-D	1266	F-E	S-D	1326	F-A	S-J
1201	F-E	S-D	1267	F-E	S-E	1327	F-A	S-I
1202	F-E	S-E	1268	F-E	S-E	1328	F-A	S-G
1203	F-E	S-E	1272	F-E	S-E	1330	F-A	S-I
1204	F-E	S-D	1274	F-E	S-D	1331	F-A	S-I
1206	F-E	S-D	1275	F-E	S-D	1332	F-A	S-G
1207	F-E	S-D	1276	F-E	S-D	1333	F-G	S-P
1208	F-E	S-D	1277	F-E	S-C	1334	F-A	S-G
1210	F-E	S-D	1278	F-E	S-D	1336	F-B	S-J
1212	F-E	S-D	1279	F-E	S-D	1337	F-B	S-J
1213	F-E	S-D	1280	F-E	S-D	1338	F-A	S-G
1214	F-E	S-C	1281	F-E	S-D	1339	F-G	S-G
1216	F-E	S-D	1282	F-E	S-D	1340	F-G	S-N
1218	F-E	S-D	1286	F-E	S-E	1341	F-A	S-G
1219	F-E	S-D	1287	F-E	S-D	1343	F-G	S-G
1220	F-E	S-D	1288	F-E	S-E	1344	F-B	S-J
1221	F-E	S-C	1289	F-E	S-C	1345	F-A	S-I
1222	F-E	S-D	1292	F-E	S-D	1346	F-A	S-G
1223	F-E	S-E	1293	F-E	S-D	1347	F-B	S-J
1224	F-E	S-D	1294	F-E	S-D	1348	F-B	S-J
1228	F-E	S-D	1295	F-G	S-O	1349	F-B	S-J
1229	F-E	S-D	1296	F-E	S-C	1350	F-A	S-G
1230	F-E	S-D	1297	F-E	S-C	1352	F-A	S-J
1231	F-E	S-D	1298	F-E	S-C	1353	F-A	S-I
1233	F-E	S-D	1299	F-E	S-E	1354	F-B	S-J
1234	F-E	S-D	1300	F-E	S-E	1355	F-B	S-J
1235	F-E	S-C	1301	F-E	S-D	1356	F-B	S-J
1237	F-E	S-D	1302	F-E	S-D	1357	F-B	S-J
1238	F-E	S-C	1303	F-E	S-D	1358	F-G	S-J
1239	F-E	S-D	1304	F-E	S-D	1360	F-G	S-N
1242	F-G	S-O	1305	F-E	S-C	1361	F-A	S-J
1243	F-E	S-D	1306	F-E	S-D	1362	F-A	S-J
1244	F-E	S-C	1307	F-E	S-D	1363	F-A	S-J
1245	F-E	S-D	1308	F-E	S-D	1364	F-A	S-J
1246	F-E	S-D	1309	F-G	S-G	1365	F-A	S-J

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
1369	F-A	S-J	1420	F-G	S-L	1475	F-H	S-Q
1372	F-A	S-J	1421	F-G	S-L	1476	F-G	S-Q
1373	F-A	S-J	1422	F-G	S-L	1477	F-A	S-Q
1374	F-A	S-J	1423	F-G	S-N	1479	F-A	S-Q
1376	F-G	S-P	1426	F-G	S-O	1481	F-H	S-Q
1378	F-H	S-M	1427	F-G	S-O	1482	F-H	S-Q
1379	F-A	S-J	1428	F-G	S-N	1483	F-G	S-Q
1380	F-G	S-L	1431	F-A	S-L	1484	F-H	S-Q
1381	F-A	S-J	1432	F-G	S-N	1485	F-H	S-Q
1382	F-A	S-J	1433	F-G	S-N	1486	F-A	S-Q
1383	F-G	S-M	1435	F-G	S-O	1487	F-A	S-Q
1384	F-A	S-J	1436 I	F-G	S-O	1488	F-A	S-Q
1385	F-A	S-J	1436 II	F-G	S-O	1489	F-H	S-Q
1386	F-A	S-J	1436 III	F-G	S-O	1490	F-H	S-Q
1387	F-A	S-J	1437	F-A	S-G	1491	F-G	S-Q
1389	F-G	S-N	1438	F-A	S-Q	1492	F-A	S-Q
1390	F-G	S-O	1439	F-H	S-Q	1493	F-A	S-Q
1391	F-G	S-N	1442	F-H	S-Q	1494	F-H	S-Q
1392	F-G	S-N	1444	F-A	S-Q	1495	F-H	S-Q
1393	F-G	S-N	1445	F-H	S-Q	1496	F-H	S-Q
1394	F-G	S-N	1446	F-A	S-Q	1498	F-A	S-Q
1395	F-G	S-N	1447	F-H	S-Q	1499	F-A	S-Q
1396	F-G	S-O	1448	F-H	S-Q	1500	F-A	S-Q
1397	F-G	S-N	1449	F-G	S-Q	1502	F-H	S-Q
1398	F-G	S-N	1450	F-H	S-Q	1503	F-H	S-Q
1400	F-G	S-O	1451	F-A	S-Q	1504	F-G	S-Q
1401	F-G	S-O	1452	F-H	S-Q	1505	F-A	S-Q
1402 I	F-G	S-N	1453	F-H	S-Q	1506	F-H	S-Q
1402 II	F-G	S-N	1454	F-A	S-Q	1507	F-A	S-Q
1403	F-G	S-N	1455	F-H	S-Q	1508	F-H	S-Q
1404	F-G	S-O	1456	F-H	S-Q	1509	F-G	S-Q
1405	F-G	S-N	1457	F-G	S-Q	1510	F-H	S-Q
1407	F-G	S-N	1458	F-H	S-Q	1511	F-A	S-Q
1408	F-G	S-N	1459	F-H	S-Q	1513	F-H	S-Q
1409 I	F-G	S-L	1461	F-H	S-Q	1514	F-H	S-Q
1409 II	F-G	S-L	1462	F-H	S-Q	1515	F-H	S-Q
1410	F-G	S-M	1463	F-A	S-Q	1516	F-G	S-Q
1411	F-G	S-M	1465	F-A	S-Q	1517	F-B	S-J
1413	F-G	S-O	1466	F-A	S-Q	1541	F-A	S-A
1414	F-G	S-N	1467	F-A	S-Q	1544	F-A	S-A
1415	F-G	S-N	1469	F-A	S-Q	1545	F-E	S-D
1417	F-G	S-N	1470	F-H	S-Q	1546	F-A	S-A
1418 I	F-G	S-O	1471	F-H	S-Q	1547	F-A	S-A
1418 II	F-G	S-O	1472	F-G	S-Q	1548	F-A	S-A
1418 III	F-G	S-O	1473	F-H	S-Q	1549	F-A	S-A
1419	F-G	S-N	1474	F-A	S-Q	1550	F-A	S-A

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
1551	F-A	S-A	1601	F-A	S-A	1655	F-A	S-A
1553	F-A	S-A	1602	F-A	S-A	1656	F-A	S-A
1554	F-A	S-A	1603	F-E	S-D	1657	F-A	S-A
1555	F-A	S-A	1604	F-E	S-C	1658	F-A	S-A
1556	F-A	S-A	1605	F-A	S-A	1659	F-A	S-A
1557	F-A	S-A	1606	F-A	S-A	1660	F-C	S-W
1558	F-A	S-A	1607	F-A	S-A	1661	F-A	S-A
1559	F-A	S-A	1608	F-A	S-A	1662	F-A	S-A
1560	F-A	S-A	1611	F-A	S-A	1663	F-A	S-A
1561	F-A	S-A	1612	F-C	S-U	1664	F-A	S-A
1562	F-A	S-A	1613	F-A	S-A	1665	F-A	S-A
1564	F-A	S-A	1614	F-A	S-U	1669	F-A	S-A
1565	F-A	S-A	1616	F-A	S-A	1670	F-A	S-A
1566	F-A	S-A	1617	F-A	S-A	1671	F-A	S-A
1567	F-G	S-G	1618	F-A	S-A	1672	F-A	S-A
1569	F-E	S-D	1620	F-A	S-A	1673	F-A	S-A
1570	F-A	S-A	1621	F-A	S-A	1674	F-A	S-A
1571	F-B	S-J	1622	F-A	S-A	1677	F-A	S-A
1572	F-A	S-A	1623	F-A	S-A	1678	F-A	S-A
1573	F-A	S-A	1624	F-A	S-A	1679	F-A	S-A
1574	F-A	S-A	1625	F-A	S-A	1680	F-A	S-A
1575	F-A	S-A	1626	F-A	S-A	1683	F-A	S-A
1577	F-A	S-A	1627	F-A	S-A	1684	F-A	S-A
1578	F-A	S-A	1629	F-A	S-A	1685	F-A	S-A
1579	F-A	S-A	1630	F-A	S-A	1686	F-A	S-A
1580	F-A	S-A	1631	F-A	S-A	1687	F-A	S-A
1581	F-C	S-U	1634	F-A	S-A	1688	F-A	S-A
1582	F-C	S-U	1636	F-A	S-A	1689	F-A	S-A
1583	F-A	S-A	1637	F-A	S-A	1690	F-A	S-A
1585	F-A	S-A	1638	F-A	S-A	1691	F-A	S-A
1586	F-A	S-A	1639	F-A	S-A	1692	F-A	S-A
1587	F-A	S-A	1640	F-A	S-A	1693	F-A	S-A
1588 I	F-A	S-A	1641	F-A	S-A	1694	F-A	S-A
1588 II	F-A	S-A	1642	F-A	S-A	1695	F-E	S-C
1588 III	F-A	S-A	1643	F-A	S-A	1697	F-A	S-A
1589	F-C	S-U	1644	F-A	S-A	1698	F-A	S-A
1590	F-A	S-A	1645	F-A	S-A	1699	F-A	S-A
1591	F-A	S-A	1646	F-A	S-A	1700	F-A	S-G
1593	F-A	S-A	1647	F-A	S-A	1701	F-A	S-A
1594	F-A	S-A	1648	F-E	S-D	1702	F-A	S-A
1595	F-A	S-B	1649	F-A	S-A	1704	F-A	S-A
1596	F-A	S-A	1650	F-A	S-A	1707	F-A	S-A
1597	F-A	S-A	1651	F-A	S-A	1708	F-A	S-A
1598	F-A	S-A	1652	F-A	S-A	1709	F-A	S-A
1599	F-A	S-A	1653	F-A	S-A	1710	F-A	S-A
1600	F-A	S-A	1654	F-A	S-A	1711	F-A	S-A

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
1712	F-A	S-A	1761 II	F-A	S-B	1807	F-A	S-B
1713	F-A	S-A	1761 III	F-A	S-B	1808	F-A	S-B
1714	F-G	S-N	1762	F-A	S-B	1809	F-A	S-B
1715	F-E	S-C	1763	F-A	S-B	1810	F-A	S-B
1716	F-A	S-B	1764	F-A	S-B	1811	F-A	S-B
1717	F-E	S-C	1765	F-A	S-B	1812	F-A	S-A
1718	F-A	S-B	1766	F-A	S-B	1813	F-A	S-B
1719	F-A	S-B	1767	F-E	S-C	1814	F-A	S-B
1722	F-E	S-C	1768	F-A	S-B	1815	F-E	S-C
1723	F-E	S-C	1769	F-A	S-B	1816	F-E	S-C
1724	F-E	S-C	1770	F-A	S-B	1817	F-A	S-B
1725	F-A	S-B	1771	F-A	S-B	1818	F-A	S-B
1726	F-A	S-B	1773	F-A	S-B	1819	F-A	S-B
1727	F-A	S-B	1774	F-A	S-B	1823	F-A	S-B
1728	F-A	S-B	1775	F-A	S-B	1824	F-A	S-B
1729	F-A	S-B	1776	F-A	S-B	1825	F-A	S-B
1730	F-A	S-B	1777	F-A	S-B	1826 I	F-A	S-Q
1731	F-A	S-B	1778	F-A	S-B	1826 II	F-A	S-B
1732	F-A	S-B	1779	F-E	S-C	1827	F-A	S-B
1733	F-A	S-B	1780	F-A	S-B	1828	F-A	S-B
1736	F-A	S-B	1781	F-A	S-B	1829	F-A	S-B
1737	F-A	S-B	1782	F-A	S-B	1830	F-A	S-B
1738	F-A	S-B	1783	F-A	S-B	1831	F-A	S-B
1739	F-A	S-B	1784	F-A	S-B	1832	F-A	S-B
1740	F-A	S-B	1786	F-A	S-B	1833	F-A	S-B
1741	F-C	S-U	1787	F-A	S-B	1834	F-A	S-B
1742	F-A	S-B	1788	F-A	S-B	1835	F-A	S-B
1743	F-A	S-B	1789	F-A	S-B	1836	F-A	S-B
1744	F-A	S-B	1790	F-A	S-B	1837	F-A	S-B
1745	F-A	S-B	1791 I	F-A	S-B	1838	F-A	S-B
1746	F-A	S-B	1791 II	F-A	S-B	1839	F-A	S-B
1747	F-E	S-C	1791 III	F-A	S-B	1840	F-A	S-B
1748	F-H	S-Q	1792	F-A	S-B	1841	F-A	S-B
1749	F-C	S-W	1793	F-A	S-B	1843	F-A	S-A
1750	F-A	S-B	1794	F-A	S-B	1845	F-C	S-V
1751	F-A	S-B	1796 I	F-A	S-Q	1846	F-A	S-A
1752	F-A	S-B	1796 II	F-A	S-B	1847	F-A	S-B
1753	F-A	S-B	1798	F-A	S-B	1848	F-A	S-B
1754	F-A	S-B	1799	F-A	S-B	1849	F-A	S-B
1755	F-A	S-B	1800	F-A	S-B	1851	F-A	S-A
1756	F-A	S-B	1801	F-A	S-B	1854	F-G	S-M
1757	F-A	S-B	1802	F-H	S-Q	1855	F-G	S-M
1758	F-A	S-B	1803	F-A	S-B	1856	F-A	S-J
1759	F-A	S-B	1804	F-A	S-B	1857	F-A	S-J
1760	F-A	S-B	1805	F-A	S-B	1858	F-C	S-V
			1806	F-A	S-B	1859	F-C	S-U

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
1860	F-D	S-U	1931	F-A	S-J	1987	F-E	S-D
1862	F-E	S-D	1932	F-G	S-L	1988	F-E	S-D
1863	F-E	S-E	1935 I	F-A	S-A	1989	F-E	S-D
1865	F-E	S-D	1935 II	F-A	S-A	1990	F-A	S-A
1866	F-E	S-E	1935 III	F-A	S-A	1991	F-E	S-D
1868	F-A	S-G	1938	F-A	S-B	1992	F-E	S-D
1869	F-G	S-G	1939	F-A	S-B	1993	F-E	S-E
1870	F-G	S-O	1940	F-A	S-B	1994	F-E	S-D
1871	F-A	S-G	1941	F-A	S-A	1999	F-E	S-E
1872	F-A	S-Q	1942	F-H	S-Q	2000	F-A	S-I
1873	F-A	S-Q	1944	F-A	S-I	2001	F-A	S-I
1884	F-A	S-A	1945	F-A	S-I	2002	F-A	S-J
1885	F-A	S-A	1950	F-D	S-U	2004	F-G	S-M
1886	F-A	S-A	1951	F-C	S-V	2006	F-A	S-G
1887	F-A	S-A	1952	F-C	S-V	2008	F-G	S-M
1888	F-A	S-A	1953	F-D	S-U	2009	F-G	S-M
1889	F-A	S-B	1954	F-D	S-U	2010	F-G	S-O
1891	F-E	S-D	1955	F-C	S-U	2011	F-G	S-N
1892	F-A	S-A	1956	F-C	S-V	2012	F-G	S-N
1894	F-A	S-A	1957	F-D	S-U	2013	F-G	S-N
1895	F-A	S-A	1958	F-C	S-V	2014	F-H	S-Q
1897	F-A	S-A	1959	F-D	S-U	2015	F-H	S-Q
1898	F-A	S-B	1961	F-D	S-U	2016	F-A	S-A
1902	F-A	S-B	1962	F-D	S-U	2017	F-A	S-B
1903	F-A	S-B	1963	F-C	S-V	2018	F-A	S-A
1905	F-A	S-B	1964	F-D	S-U	2019	F-A	S-A
1906	F-A	S-B	1965	F-D	S-U	2020	F-A	S-A
1907	F-A	S-B	1966	F-D	S-U	2021	F-A	S-A
1908	F-A	S-B	1967	F-C	S-U	2022	F-A	S-B
1911	F-D	S-U	1968	F-C	S-V	2023	F-E	S-D
1912	F-D	S-U	1969	F-D	S-U	2024 I	F-A	S-A
1913	F-C	S-V	1970	F-C	S-V	2024 II	F-A	S-A
1914	F-E	S-D	1971	F-D	S-U	2024 III	F-A	S-A
1915	F-E	S-D	1972	F-D	S-U	2025 I	F-A	S-A
1916	F-E	S-D	1973	F-C	S-V	2025 II	F-A	S-A
1917	F-E	S-D	1974	F-C	S-V	2025 III	F-A	S-A
1918	F-E	S-E	1975	F-C	S-W	2026 I	F-A	S-A
1919	F-E	S-D	1976	F-C	S-V	2026 II	F-A	S-A
1920	F-E	S-E	1977	F-C	S-V	2026 III	F-A	S-A
1921	F-E	S-D	1978	F-D	S-U	2027	F-A	S-A
1922	F-E	S-C	1982	F-C	S-V	2028	F-A	S-B
1923	F-A	S-J	1983	F-C	S-V	2029	F-E	S-C
1928	F-G	S-L	1984	F-C	S-V	2030	F-A	S-B
1929	F-A	S-J	1986	F-E	S-D	2031 I	F-A	S-Q

* Applies to NITRIC ACID other than red fuming, with at least 65% but with not more than 70% nitric acid.

† Applies to NITRIC ACID other than red fuming, with less than 65% nitric acid.

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
2031 II*	F-A	S-Q	2197	F-C	S-U	2251	F-E	S-D
2031 II†	F-A	S-B	2198	F-C	S-U	2252	F-E	S-D
2032	F-A	S-Q	2199	F-D	S-U	2253	F-A	S-A
2033	F-A	S-B	2200	F-D	S-U	2254	F-A	S-I
2034	F-D	S-U	2201	F-C	S-W	2256	F-E	S-D
2035	F-D	S-U	2202	F-D	S-U	2257	F-G	S-N
2036	F-C	S-V	2203	F-D	S-U	2258	F-E	S-C
2037	F-D	S-U	2204	F-D	S-U	2259	F-A	S-B
2038	F-A	S-A	2205	F-A	S-A	2260	F-E	S-C
2044	F-D	S-U	2206	F-A	S-A	2261	F-A	S-A
2045	F-E	S-D	2208	F-H	S-Q	2262	F-A	S-B
2046	F-E	S-D	2209	F-A	S-B	2263	F-E	S-D
2047	F-E	S-D	2210	F-G	S-L	2264	F-E	S-C
2048	F-E	S-D	2211	F-A	S-I	2265	F-E	S-D
2049	F-E	S-D	2212	F-A	S-A	2266	F-E	S-C
2050	F-E	S-D	2213	F-A	S-G	2267	F-A	S-B
2051	F-E	S-C	2214	F-A	S-B	2269	F-A	S-B
2052	F-E	S-E	2215	F-A	S-B	2270	F-E	S-C
2053	F-E	S-D	2216	F-A	S-J	2271	F-E	S-D
2054	F-E	S-C	2217	F-A	S-J	2272	F-A	S-A
2055	F-E	S-D	2218	F-E	S-C	2273	F-A	S-A
2056	F-E	S-D	2219	F-E	S-D	2274	F-A	S-A
2057 II	F-E	S-D	2222	F-E	S-D	2275	F-E	S-D
2057 III	F-E	S-D	2224	F-A	S-A	2276	F-E	S-C
2058	F-E	S-D	2225	F-A	S-B	2277	F-E	S-D
2059	F-E	S-D	2226	F-A	S-B	2278	F-E	S-D
2067	F-H	S-Q	2227	F-E	S-D	2279	F-A	S-A
2071	F-H	S-Q	2232	F-A	S-A	2280	F-A	S-B
2073	F-C	S-U	2233	F-A	S-A	2281	F-A	S-A
2074	F-A	S-A	2234	F-E	S-D	2282	F-E	S-D
2075	F-A	S-A	2235	F-A	S-A	2283	F-E	S-D
2076	F-A	S-B	2236	F-A	S-A	2284	F-E	S-D
2077	F-A	S-A	2237	F-A	S-A	2285	F-E	S-D
2078	F-A	S-A	2238	F-E	S-D	2286	F-E	S-D
2079	F-A	S-B	2239	F-A	S-A	2287	F-E	S-D
2187	F-C	S-V	2240	F-A	S-B	2288	F-E	S-D
2188	F-D	S-U	2241	F-E	S-D	2289	F-A	S-B
2189	F-D	S-U	2242	F-E	S-D	2290	F-A	S-A
2190	F-C	S-W	2243	F-E	S-D	2291	F-A	S-A
2191	F-C	S-U	2244	F-E	S-D	2293	F-E	S-D
2192	F-D	S-U	2245	F-E	S-D	2294	F-A	S-A
2193	F-C	S-V	2246	F-E	S-D	2295	F-E	S-D
2194	F-C	S-U	2247	F-E	S-E	2296	F-E	S-D
2195	F-C	S-U	2248	F-E	S-C	2297	F-E	S-D
2196	F-C	S-U	2249	F-E	S-D	2298	F-E	S-D
			2250	F-A	S-A	2299	F-A	S-A

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
2300	F-A	S-A	2347	F-E	S-D	2397	F-E	S-D
2301	F-E	S-D	2348	F-E	S-D	2398	F-E	S-D
2302	F-E	S-D	2350	F-E	S-D	2399	F-E	S-C
2303	F-E	S-D	2351	F-E	S-D	2400	F-E	S-D
2304	F-A	S-H	2352	F-E	S-D	2401	F-E	S-C
2305	F-A	S-B	2353	F-E	S-C	2402	F-E	S-D
2306	F-A	S-A	2354	F-E	S-D	2403	F-E	S-D
2307	F-A	S-A	2356	F-E	S-D	2404	F-E	S-D
2308	F-A	S-B	2357	F-E	S-C	2405	F-E	S-D
2309	F-E	S-D	2358	F-E	S-D	2406	F-E	S-D
2310	F-E	S-D	2359	F-E	S-C	2407	F-E	S-C
2311	F-A	S-A	2360	F-E	S-D	2409	F-E	S-D
2312	F-A	S-A	2361	F-E	S-C	2410	F-E	S-D
2313	F-E	S-D	2362	F-E	S-D	2411	F-E	S-D
2315	F-A	S-A	2363	F-E	S-D	2412	F-E	S-D
2316	F-A	S-A	2364	F-E	S-D	2413	F-E	S-D
2317	F-A	S-A	2366	F-E	S-D	2414	F-E	S-D
2318	F-A	S-J	2367	F-E	S-D	2416	F-E	S-D
2319	F-E	S-D	2368	F-E	S-E	2417	F-C	S-U
2320	F-A	S-B	2370	F-E	S-D	2418	F-C	S-U
2321	F-A	S-A	2371	F-E	S-D	2419	F-D	S-U
2322	F-A	S-A	2372	F-E	S-D	2420	F-C	S-U
2323	F-E	S-D	2373	F-E	S-D	2421	F-C	S-W
2324	F-E	S-D	2374	F-E	S-D	2422	F-C	S-V
2325	F-E	S-D	2375	F-E	S-D	2424	F-C	S-V
2326	F-A	S-B	2376	F-E	S-D	2426	F-H	S-Q
2327	F-A	S-B	2377	F-E	S-D	2427	F-H	S-Q
2328	F-A	S-A	2378	F-E	S-D	2428	F-H	S-Q
2329	F-E	S-D	2379	F-E	S-C	2429	F-H	S-Q
2330	F-E	S-E	2380	F-E	S-D	2430	F-A	S-B
2331	F-A	S-B	2381	F-E	S-D	2431	F-A	S-A
2332	F-E	S-D	2382	F-E	S-D	2432	F-A	S-A
2333	F-E	S-D	2383	F-E	S-C	2433	F-A	S-A
2334	F-E	S-D	2384	F-E	S-D	2434	F-A	S-B
2335	F-E	S-D	2385	F-E	S-D	2435	F-A	S-B
2336	F-E	S-D	2386	F-E	S-C	2436	F-E	S-D
2337	F-E	S-D	2387	F-E	S-D	2437	F-A	S-B
2338	F-E	S-D	2388	F-E	S-D	2438	F-E	S-C
2339	F-E	S-D	2389	F-E	S-D	2439	F-A	S-B
2340	F-E	S-D	2390	F-E	S-D	2440	F-A	S-B
2341	F-E	S-D	2391	F-E	S-D	2441	F-G	S-M
2342	F-E	S-D	2392	F-E	S-D	2442	F-A	S-B
2343	F-E	S-D	2393	F-E	S-D	2443	F-A	S-B
2344	F-E	S-D	2394	F-E	S-D	2444	F-A	S-B
2345	F-E	S-D	2395	F-E	S-C	2446	F-A	S-A
2346	F-E	S-D	2396	F-E	S-D	2447	F-A	S-M

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
2448	F-A	S-H	2508	F-A	S-B	2574	F-A	S-A
2451	F-C	S-W	2509	F-A	S-B	2576	F-A	S-B
2452	F-D	S-U	2511	F-A	S-B	2577	F-A	S-B
2453	F-D	S-U	2512	F-A	S-A	2578	F-A	S-B
2454	F-D	S-U	2513	F-A	S-B	2579	F-A	S-B
2456	F-E	S-D	2514	F-E	S-D	2580	F-A	S-B
2457	F-E	S-D	2515	F-A	S-A	2581	F-A	S-B
2458	F-E	S-D	2516	F-A	S-A	2582	F-A	S-B
2459	F-E	S-D	2517	F-D	S-U	2583	F-A	S-B
2460	F-E	S-D	2518	F-A	S-A	2584	F-A	S-B
2461	F-E	S-D	2520	F-E	S-D	2585	F-A	S-B
2463	F-G	S-O	2521	F-E	S-D	2586	F-A	S-B
2464	F-A	S-Q	2522	F-A	S-A	2587	F-A	S-A
2465	F-A	S-Q	2524	F-E	S-D	2588	F-A	S-A
2466	F-G	S-Q	2525	F-A	S-A	2589	F-E	S-D
2468	F-A	S-Q	2526	F-E	S-C	2590	F-A	S-A
2469	F-H	S-Q	2527	F-E	S-D	2591	F-C	S-V
2470	F-A	S-A	2528	F-E	S-D	2599	F-C	S-V
2471	F-A	S-A	2529	F-E	S-C	2601	F-D	S-U
2473	F-A	S-A	2531	F-A	S-B	2602	F-C	S-V
2474	F-A	S-A	2533	F-A	S-A	2603	F-E	S-D
2475	F-A	S-B	2534	F-D	S-U	2604	F-E	S-C
2477	F-E	S-D	2535	F-E	S-C	2605	F-E	S-D
2478	F-E	S-D	2536	F-E	S-D	2606	F-E	S-D
2480	F-E	S-D	2538	F-A	S-G	2607	F-E	S-D
2481	F-E	S-D	2541	F-E	S-E	2608	F-E	S-D
2482	F-E	S-D	2542	F-A	S-A	2609	F-A	S-A
2483	F-E	S-D	2545	F-G	S-M	2610	F-E	S-C
2484	F-E	S-D	2546	F-G	S-M	2611	F-E	S-D
2485	F-E	S-D	2547	F-G	S-Q	2612	F-E	S-D
2486	F-E	S-D	2548	F-C	S-W	2614	F-E	S-D
2487	F-E	S-D	2552	F-A	S-A	2615	F-E	S-D
2488	F-E	S-D	2554	F-E	S-D	2616	F-E	S-D
2490	F-A	S-A	2555	F-B	S-J	2617	F-E	S-D
2491	F-A	S-B	2556	F-B	S-J	2618	F-E	S-D
2493	F-E	S-C	2557	F-B	S-J	2619	F-E	S-C
2495	F-A	S-Q	2558	F-E	S-D	2620	F-E	S-D
2496	F-A	S-B	2560	F-E	S-D	2621	F-E	S-D
2498	F-E	S-D	2561	F-E	S-D	2622	F-E	S-D
2501	F-A	S-A	2564	F-A	S-B	2623	F-A	S-I
2502	F-E	S-C	2565	F-A	S-B	2624	F-G	S-O
2503	F-A	S-B	2567	F-A	S-A	2626	F-A	S-Q
2504	F-A	S-A	2570	F-A	S-A	2627	F-A	S-Q
2505	F-A	S-A	2571	F-A	S-B	2628	F-A	S-A
2506	F-A	S-B	2572	F-A	S-A	2629	F-A	S-A
2507	F-A	S-B	2573	F-H	S-Q	2630	F-A	S-A

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
2642	F-A	S-A	2705	F-A	S-B	2761	F-A	S-A
2643	F-A	S-A	2707	F-E	S-D	2762	F-E	S-D
2644	F-A	S-A	2709	F-E	S-D	2763	F-A	S-A
2645	F-A	S-A	2710	F-E	S-D	2764	F-E	S-D
2646	F-A	S-A	2713	F-A	S-A	2771	F-A	S-A
2647	F-A	S-A	2714	F-A	S-I	2772	F-E	S-D
2648	F-A	S-A	2715	F-A	S-I	2775	F-A	S-A
2649	F-A	S-A	2716	F-A	S-A	2776	F-E	S-D
2650	F-A	S-A	2717	F-A	S-I	2777 I	F-A	S-A
2651	F-A	S-A	2719	F-H	S-Q	2777 II	F-A	S-A
2653	F-A	S-A	2720	F-A	S-Q	2777 III	F-A	S-A
2655	F-A	S-A	2721	F-H	S-Q	2778 I	F-E	S-D
2656	F-A	S-A	2722	F-A	S-Q	2778 II	F-E	S-D
2657	F-A	S-A	2723	F-H	S-Q	2779	F-A	S-A
2659	F-A	S-A	2724	F-A	S-Q	2780	F-E	S-D
2660	F-A	S-A	2725	F-A	S-Q	2781	F-A	S-A
2661	F-A	S-A	2726	F-A	S-Q	2782	F-E	S-D
2664	F-A	S-A	2727	F-A	S-Q	2783	F-A	S-A
2667	F-A	S-A	2728	F-A	S-Q	2784	F-E	S-D
2668	F-A	S-A	2729	F-A	S-A	2785	F-A	S-A
2669	F-A	S-A	2730	F-A	S-A	2786 I	F-A	S-A
2670	F-A	S-B	2732	F-A	S-A	2786 II	F-A	S-A
2671	F-A	S-A	2733	F-E	S-C	2786 III	F-A	S-A
2672	F-A	S-B	2734	F-E	S-C	2787 I	F-E	S-D
2673	F-A	S-A	2735	F-A	S-B	2787 II	F-E	S-D
2674	F-A	S-A	2738	F-A	S-A	2788 I	F-A	S-A
2676	F-D	S-U	2739	F-A	S-B	2788 II	F-A	S-A
2677	F-A	S-B	2740	F-E	S-C	2788 III	F-A	S-A
2678	F-A	S-B	2741	F-H	S-Q	2789	F-E	S-C
2679	F-A	S-B	2742	F-E	S-C	2790	F-A	S-B
2680	F-A	S-B	2743	F-E	S-C	2793	F-G	S-J
2681	F-A	S-B	2744	F-E	S-C	2794	F-A	S-B
2682	F-A	S-B	2745	F-A	S-B	2795	F-A	S-B
2683	F-E	S-C	2746	F-A	S-B	2796	F-A	S-B
2684	F-E	S-C	2747	F-A	S-A	2797	F-A	S-B
2685	F-E	S-C	2748	F-A	S-B	2798	F-A	S-B
2686	F-E	S-C	2749	F-E	S-D	2799	F-A	S-B
2687	F-A	S-G	2750	F-A	S-A	2800	F-A	S-B
2688	F-A	S-A	2751	F-A	S-B	2801	F-A	S-B
2689	F-A	S-A	2752	F-E	S-D	2802	F-A	S-B
2690	F-A	S-A	2753	F-A	S-A	2803	F-A	S-B
2691	F-A	S-B	2754	F-A	S-A	2805	F-G	S-N
2692	F-A	S-B	2757	F-A	S-A	2806	F-A	S-O
2693	F-A	S-B	2758	F-E	S-D	2809	F-A	S-B
2698	F-A	S-B	2759	F-A	S-A			
2699	F-A	S-B	2760	F-E	S-D			

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
2810	F-A	S-A	2870	F-G	S-M	2941	F-A	S-A
2811	F-A	S-A	2871	F-A	S-A	2942	F-A	S-A
2813 I	F-G	S-N	2872	F-A	S-A	2943	F-E	S-D
2813 II	F-G	S-N	2873	F-A	S-A	2945	F-E	S-C
2813 III	F-G	S-N	2874	F-A	S-A	2946	F-A	S-A
2814	F-A	S-T	2875	F-A	S-A	2947	F-E	S-D
2815	F-A	S-B	2876	F-A	S-A	2948	F-A	S-A
2817	F-A	S-B	2878	F-G	S-G	2949	F-A	S-B
2818	F-A	S-B	2879	F-A	S-B	2950	F-G	S-O
2819	F-A	S-B	2880	F-H	S-Q	2956	F-B	S-G
2820	F-A	S-B	2881	F-G	S-M	2965	F-G	S-O
2821	F-A	S-A	2900	F-A	S-T	2966	F-A	S-A
2822	F-A	S-A	2901	F-C	S-W	2967	F-A	S-B
2823	F-A	S-B	2902	F-A	S-A	2968	F-G	S-L
2826	F-E	S-C	2903	F-E	S-D	2969	F-A	S-A
2829	F-A	S-B	2904	F-A	S-B	2977	F-I	S-S
2830	F-G	S-N	2905	F-A	S-B	2978	F-I	S-S
2831	F-A	S-A	2907	F-A	S-J	2983	F-E	S-D
2834	F-A	S-B	2908	F-I	S-S	2984	F-H	S-Q
2835	F-G	S-O	2909	F-I	S-S	2985	F-E	S-C
2837	F-A	S-B	2910	F-I	S-S	2986	F-E	S-C
2838	F-E	S-D	2911	F-I	S-S	2987	F-A	S-B
2839	F-A	S-A	2912	F-I	S-S	2988	F-G	S-N
2840	F-E	S-D	2913	F-I	S-S	2989	F-A	S-G
2841	F-E	S-D	2915	F-I	S-S	2990	F-A	S-V
2842	F-E	S-D	2916	F-I	S-S	2991	F-E	S-D
2844	F-G	S-N	2917	F-I	S-S	2992	F-A	S-A
2845	F-G	S-M	2919	F-I	S-S	2993	F-E	S-D
2846	F-G	S-M	2920	F-E	S-C	2994	F-A	S-A
2849	F-A	S-A	2921	F-A	S-G	2995	F-E	S-D
2850	F-E	S-E	2922	F-A	S-B	2996	F-A	S-A
2851	F-A	S-B	2923	F-A	S-B	2997	F-E	S-D
2852	F-B	S-J	2924	F-E	S-C	2998	F-A	S-A
2853	F-A	S-A	2925	F-A	S-G	3005	F-E	S-D
2854	F-A	S-A	2926	F-A	S-G	3006	F-A	S-A
2855	F-A	S-A	2927	F-A	S-B	3009	F-E	S-D
2856	F-A	S-A	2928	F-A	S-B	3010	F-A	S-A
2857	F-C	S-V	2929	F-E	S-D	3011 I	F-E	S-D
2858	F-G	S-G	2930	F-A	S-G	3011 II	F-E	S-D
2859	F-A	S-A	2931	F-A	S-A	3011 III	F-E	S-D
2861	F-A	S-A	2933	F-E	S-D	3012 I	F-A	S-A
2862	F-A	S-A	2934	F-E	S-D	3012 II	F-A	S-A
2863	F-A	S-A	2935	F-E	S-D	3012 III	F-A	S-A
2864	F-A	S-A	2936	F-A	S-A	3013	F-E	S-D
2865	F-A	S-B	2937	F-A	S-A	3014	F-A	S-A
2869	F-A	S-B	2940	F-A	S-J	3015	F-E	S-D

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
3016	F-A	S-A	3095	F-A	S-N	3133	F-G	S-L
3017	F-E	S-D	3096	F-G	S-L	3134 I	F-G	S-N
3018	F-A	S-A	3097	F-A	S-Q	3134 II	F-G	S-N
3019 I	F-E	S-D	3098	F-A	S-Q	3134 III	F-G	S-N
3019 II	F-E	S-D	3099	F-A	S-Q	3135 I	F-G	S-N
3019 III	F-E	S-D	3100	F-A	S-Q	3135 II	F-G	S-N
3020 I	F-A	S-A	3101	F-J	S-R	3135 III	F-G	S-N
3020 II	F-A	S-A	3102	F-J	S-R	3136	F-C	S-V
3020 III	F-A	S-A	3103	F-J	S-R	3137	F-G	S-Q
3021	F-E	S-D	3104	F-J	S-R	3138	F-D	S-U
3022	F-E	S-D	3105	F-J	S-R	3139	F-A	S-Q
3023	F-E	S-D	3106	F-J	S-R	3140	F-A	S-A
3024	F-E	S-D	3107	F-J	S-R	3141	F-A	S-A
3025	F-E	S-D	3108	F-J	S-R	3142	F-A	S-A
3026	F-A	S-A	3109	F-J	S-R	3143	F-A	S-A
3027	F-A	S-A	3110	F-J	S-R	3144	F-A	S-A
3028	F-A	S-B	3111	F-F	S-R	3145	F-A	S-B
3048	F-A	S-A	3112	F-F	S-R	3146 I	F-A	S-A
3054	F-E	S-D	3113	F-F	S-R	3146 II	F-A	S-A
3055	F-A	S-B	3114	F-F	S-R	3146 III	F-A	S-A
3056	F-E	S-D	3115	F-F	S-R	3147	F-A	S-B
3057	F-C	S-U	3116	F-F	S-R	3148 I	F-G	S-N
3064	F-E	S-D	3117	F-F	S-R	3148 II	F-G	S-N
3065	F-E	S-D	3118	F-F	S-R	3148 III	F-G	S-N
3066	F-A	S-B	3119	F-F	S-R	3149	F-H	S-Q
3070	F-C	S-V	3120	F-F	S-R	3150	F-D	S-U
3071	F-E	S-D	3121	F-G	S-L	3151	F-A	S-A
3072	F-A	S-V	3122	F-A	S-Q	3152	F-A	S-A
3073	F-E	S-C	3123	F-G	S-N	3153	F-D	S-U
3077	F-A	S-F	3124	F-A	S-J	3154	F-D	S-U
3078	F-G	S-O	3125	F-G	S-N	3155	F-A	S-A
3079	F-E	S-D	3126	F-A	S-J	3156	F-C	S-W
3080	F-E	S-D	3127	F-A	S-J	3157	F-C	S-W
3082	F-A	S-F	3128	F-A	S-J	3158	F-C	S-V
3083	F-C	S-W	3129 I	F-G	S-N	3159	F-C	S-V
3084	F-A	S-Q	3129 II	F-G	S-N	3160	F-D	S-U
3085	F-A	S-Q	3129 III	F-G	S-N	3161	F-D	S-U
3086	F-A	S-Q	3130 I	F-G	S-N	3162	F-C	S-U
3087	F-A	S-Q	3130 II	F-G	S-N	3163	F-C	S-V
3088	F-A	S-J	3130 III	F-G	S-N	3164	F-C	S-V
3089	F-G	S-G	3131 I	F-G	S-L	3165	F-E	S-C
3090	F-A	S-I	3131 II	F-G	S-L	3166		
3091	F-A	S-I	3131 III	F-G	S-L	(for gases)	F-D	S-U
3092	F-E	S-D	3132 I	F-G	S-N	3166		
3093	F-A	S-Q	3132 II	F-G	S-N	(for liquids)	F-E	S-E
3094	F-G	S-L	3132 III	F-G	S-N	3167	F-D	S-U

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
3168	F-D	S-U	3224	F-J	S-G	3270	F-A	S-I
3169	F-C	S-U	3225	F-J	S-G	3271	F-E	S-D
3170	F-G	S-P	3226	F-J	S-G	3272	F-E	S-D
3171	F-A	S-I	3227	F-J	S-G	3273	F-E	S-D
3172	F-A	S-A	3228	F-J	S-G	3274	F-E	S-C
3174	F-A	S-J	3229	F-J	S-G	3275	F-E	S-D
3175	F-A	S-I	3230	F-J	S-G	3276	F-A	S-A
3176	F-A	S-H	3231	F-F	S-K	3277	F-A	S-B
3178	F-A	S-G	3232	F-F	S-K	3278	F-A	S-A
3179	F-A	S-G	3233	F-F	S-K	3279	F-E	S-D
3180	F-A	S-G	3234	F-F	S-K	3280	F-A	S-A
3181	F-A	S-I	3235	F-F	S-K	3281	F-A	S-A
3182	F-A	S-G	3236	F-F	S-K	3282	F-A	S-A
3183	F-A	S-J	3237	F-F	S-K	3283	F-A	S-A
3184	F-A	S-J	3238	F-F	S-K	3284	F-A	S-A
3185	F-A	S-J	3239	F-F	S-K	3285	F-A	S-A
3186	F-A	S-J	3240	F-F	S-K	3286	F-E	S-C
3187	F-A	S-J	3241	F-J	S-G	3287	F-A	S-A
3188	F-A	S-J	3242	F-J	S-G	3288	F-A	S-A
3189	F-G	S-J	3243	F-A	S-A	3289	F-A	S-B
3190	F-A	S-J	3244	F-A	S-B	3290	F-A	S-B
3191	F-A	S-J	3245	F-A	S-T	3291	F-A	S-T
3192	F-A	S-J	3246	F-A	S-B	3292	F-G	S-P
3194	F-G	S-M	3247	F-A	S-Q	3293	F-A	S-A
3200	F-G	S-M	3248	F-E	S-D	3294	F-E	S-D
3205	F-A	S-J	3249	F-A	S-A	3295	F-E	S-D
3206	F-A	S-J	3250	F-A	S-B	3296	F-C	S-V
3208 I	F-G	S-N	3251	F-F	S-G	3297	F-C	S-V
3208 II	F-G	S-N	3252	F-D	S-U	3298	F-C	S-V
3208 III	F-G	S-N	3253	F-A	S-B	3299	F-C	S-V
3209 I	F-G	S-N	3254	F-A	S-M	3300	F-D	S-U
3209 II	F-G	S-N	3255	F-A	S-M	3301	F-A	S-J
3209 III	F-G	S-N	3256	F-E	S-D	3302	F-A	S-A
3210	F-H	S-Q	3257	F-A	S-P	3303	F-C	S-W
3211	F-H	S-Q	3258	F-A	S-P	3304	F-C	S-U
3212	F-H	S-Q	3259	F-A	S-B	3305	F-D	S-U
3213	F-H	S-Q	3260	F-A	S-B	3306	F-C	S-W
3214	F-H	S-Q	3261	F-A	S-B	3307	F-C	S-W
3215	F-A	S-Q	3262	F-A	S-B	3308	F-C	S-U
3216	F-A	S-Q	3263	F-A	S-B	3309	F-D	S-U
3218	F-A	S-Q	3264	F-A	S-B	3310	F-C	S-W
3219	F-A	S-Q	3265	F-A	S-B	3311	F-C	S-W
3220	F-C	S-V	3266	F-A	S-B	3312	F-D	S-U
3221	F-J	S-G	3267	F-A	S-B	3313	F-A	S-J
3222	F-J	S-G	3268	F-B	S-X	3314	F-A	S-I
3223	F-J	S-G	3269	F-E	S-D	3315	F-A	S-A

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
3316	F-A	S-P	3365	F-B	S-J	3402	F-G	S-N
3317	F-B	S-J	3366	F-B	S-J	3403	F-G	S-L
3318	F-C	S-U	3367	F-B	S-J	3404	F-G	S-L
3319	F-B	S-J	3368	F-B	S-J	3405	F-H	S-Q
3320	F-A	S-B	3369	F-B	S-J	3406	F-H	S-Q
3321	F-I	S-S	3370	F-B	S-J	3407	F-H	S-Q
3322	F-I	S-S	3371	F-E	S-D	3408	F-H	S-Q
3323	F-I	S-S	3373	F-A	S-T	3409	F-A	S-A
3324	F-I	S-S	3374	F-D	S-U	3410	F-A	S-A
3325	F-I	S-S	3375	F-H	S-Q	3411	F-A	S-A
3326	F-I	S-S	3376	F-B	S-J	3412	F-A	S-B
3327	F-I	S-S	3377	F-A	S-Q	3413 I	F-A	S-A
3328	F-I	S-S	3378	F-A	S-Q	3413 II	F-A	S-A
3329	F-I	S-S	3379	F-E	S-Y	3413 III	F-A	S-A
3330	F-I	S-S	3380	F-B	S-J	3414 I	F-A	S-A
3331	F-I	S-S	3381	F-A	S-A	3414 II	F-A	S-A
3332	F-I	S-S	3382	F-A	S-A	3414 III	F-A	S-A
3333	F-I	S-S	3383	F-E	S-D	3415	F-A	S-A
3336	F-E	S-D	3384	F-E	S-D	3416	F-A	S-A
3337	F-C	S-V	3385	F-G	S-N	3417	F-A	S-G
3338	F-C	S-V	3386	F-G	S-N	3418	F-A	S-A
3339	F-C	S-V	3387	F-A	S-Q	3419	F-A	S-B
3340	F-C	S-V	3388	F-A	S-Q	3420	F-A	S-B
3341	F-A	S-J	3389	F-A	S-B	3421	F-A	S-B
3342	F-A	S-J	3390	F-A	S-B	3422	F-A	S-A
3343	F-E	S-Y	3391	F-G	S-M	3423	F-A	S-B
3344	F-B	S-J	3392	F-G	S-M	3424 II	F-A	S-A
3345	F-A	S-A	3393	F-G	S-M	3424 III	F-A	S-A
3346	F-E	S-D	3394	F-G	S-M	3425	F-A	S-B
3347	F-E	S-D	3395 I	F-G	S-N	3426	F-A	S-A
3348	F-A	S-A	3395 II	F-G	S-N	3427	F-A	S-A
3349	F-A	S-A	3395 III	F-G	S-N	3428	F-A	S-A
3350	F-E	S-D	3396 I	F-G	S-N	3429	F-A	S-A
3351	F-E	S-D	3396 II	F-G	S-N	3430	F-A	S-A
3352	F-A	S-A	3396 III	F-G	S-N	3431	F-A	S-A
3354	F-D	S-U	3397 I	F-G	S-N	3432	F-A	S-A
3355	F-D	S-U	3397 II	F-G	S-N	3434	F-A	S-A
3356	F-H	S-Q	3397 III	F-G	S-N	3436	F-A	S-A
3357	F-E	S-Y	3398 I	F-G	S-N	3437	F-A	S-A
3358	F-D	S-U	3398 II	F-G	S-N	3438	F-A	S-A
3359	F-A	S-D	3398 III	F-G	S-N	3439	F-A	S-A
3360	F-A	S-I	3399 I	F-G	S-N	3440	F-A	S-A
3361	F-A	S-B	3399 II	F-G	S-N	3441	F-A	S-A
3362	F-E	S-C	3399 III	F-G	S-N	3442	F-A	S-A
3363	F-A	S-P	3400	F-A	S-J	3443	F-A	S-A
3364	F-B	S-J	3401	F-G	S-N			

UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill	UN No.	EmS Fire	EmS Spill
3444	F-A	S-A	3488	F-E	S-D	3534	F-F	S-K
3445	F-A	S-A	3489	F-E	S-D	3535	F-A	S-G
3446	F-A	S-A	3490	F-G	S-N	3536	F-A	S-I
3447	F-A	S-A	3491	F-G	S-N	3537	F-D	S-U
3448	F-A	S-A	3494	F-E	S-E	3538	F-C	S-V
3449	F-A	S-A	3495	F-A	S-B	3539	F-C	S-U
3450	F-A	S-A	3496	F-A	S-I	3540	F-E	S-D
3451	F-A	S-A	3497	F-A	S-J	3541	F-A	S-G
3452	F-A	S-A	3498	F-A	S-B	3542		
3453	F-A	S-B	3499	F-A	S-I	3543	F-G	S-N
3454	F-A	S-A	3500	F-C	S-V	3544	F-A	S-Q
3455	F-A	S-B	3501	F-D	S-U	3545	F-J	S-R
3456	F-A	S-B	3502	F-C	S-V	3546	F-A	S-A
3457	F-A	S-A	3503	F-C	S-V	3547	F-A	S-B
3458	F-A	S-A	3504	F-D	S-U	3548	F-A	S-P
3459	F-A	S-A	3505	F-D	S-U	3549	F-A	S-T
3460	F-A	S-A	3506	F-A	S-B	3550	F-A	S-A
3462	F-A	S-A	3507	F-I	S-S			
3463	F-E	S-C	3508	F-A	S-I			
3464	F-A	S-A	3510	F-D	S-U			
3465	F-A	S-A	3511	F-C	S-V			
3466	F-A	S-A	3512	F-C	S-U			
3467	F-A	S-A	3513	F-C	S-W			
3468	F-D	S-U	3514	F-D	S-U			
3469	F-E	S-C	3515	F-C	S-W			
3470	F-E	S-C	3516	F-C	S-U			
3471	F-A	S-B	3517	F-D	S-U			
3472	F-A	S-B	3518	F-C	S-W			
3473	F-E	S-D	3519	F-C	S-U			
3474	F-B	S-J	3520	F-C	S-W			
3475	F-E	S-E	3521	F-C	S-U			
3476	F-G	S-P	3522	F-D	S-U			
3477	F-A	S-B	3523	F-D	S-U			
3478	F-D	S-U	3524	F-C	S-U			
3479	F-D	S-U	3525	F-D	S-U			
3480	F-A	S-I	3526	F-D	S-U			
3481	F-A	S-I	3527	F-A	S-G			
3482	F-G	S-N	3528	F-E	S-E			
3483	F-E	S-D	3529	F-D	S-U			
3484	F-E	S-C	3530	F-A	S-F			
3485	F-H	S-Q	3531	F-J	S-G			
3486	F-H	S-Q	3532	F-J	S-G			
3487	F-H	S-Q	3533	F-F	S-K			

* F-G, S-M for pyrophoric substances, F-A, S-J for self-heating substances.