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## MEASURES TO STRENGTHEN INTERNATIONAL CO-OPERATION IN MATTERS RELATING TO NUCLEAR SAFETY AND RADIOLOGICAL PROTECTION

### CODE FOR THE SAFE CARRIAGE OF IRRADIATED NUCLEAR FUEL, PLUTONIUM, AND HIGH-LEVEL RADIOACTIVE WASTES IN FLASKS ON BOARD SHIPS

#### Note by the Director General

1. At its February 1993 session, the Board of Governors had before it document GOV/INF/681 entitled "Co-operation between the IAEA and the International Maritime Organization (IMO)". The document gave a brief account of the first meeting of a Joint IAEA/IMO Working Group on the Safe Carriage of Irradiated Nuclear Fuel by Sea.<sup>\*/</sup>
2. At its June 1993 session, the Board had before it document GOV/INF/695 entitled "The maritime transport of irradiated nuclear fuel", which stated that the Joint Working Group had agreed to recommend to IMO's Maritime Safety Committee that it endorse a draft Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium, and High-Level Radioactive Wastes in Flasks on Board Ships that the Group had prepared.
3. On 21 September 1993, the Board, which had the draft Code before it in document GOV/INF/709, took note of it and authorized the Director General to transmit it to the General Conference.
4. The draft Code, in the Attachment to the present document, is being submitted for adoption to IMO's Assembly, which is meeting from 25 October to 5 November 1993.

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<sup>\*/</sup> The Joint Working Group's name has meanwhile become "Joint IAEA/IMO/UNEP Working Group on the Safe Carriage of Irradiated Nuclear Fuel and Other Nuclear Materials by Sea".



[DRAFT] CODE FOR THE SAFE CARRIAGE OF IRRADIATED  
NUCLEAR FUEL, PLUTONIUM AND HIGH LEVEL RADIOACTIVE WASTES  
IN FLASKS ON BOARD SHIPS

1 GENERAL

1.1 This Code applies to new and existing ships regardless of size, including cargo ships of less than 500 tons gross tonnage, engaged in the carriage of irradiated nuclear fuel, plutonium and high level radioactive wastes in flasks approved in accordance with the applicable Regulations for the Safe Transport of Radioactive Material adopted by the International Atomic Energy Agency and carried in accordance with class 7 of the International Maritime Dangerous Goods (IMDG) Code, schedules 10, 11, 12 or 13.

1.2 For the purposes of this Code:

- .1 Irradiated nuclear fuel means material containing uranium, thorium and/or plutonium isotopes which has been used to maintain a self-sustaining nuclear chain reaction.
- .2 Plutonium means the resultant mixture of isotopes of that material extracted from irradiated nuclear fuel from reprocessing.
- .3 High level radioactive wastes means liquid wastes resulting from the operation of the first stage extraction system of the concentrated wastes from subsequent extraction stages, in a facility for reprocessing irradiated nuclear fuel, or solids into which such liquid wastes have been converted.

1.3 For the purposes of this Code, ships carrying materials covered by this Code in flasks have been assigned to three classes, depending on the total radioactive quantity which may be carried on board:

Class INF 1 - Ships carrying such materials with an aggregate radioactivity less than 4,000 TBq.

Class INF 2 - Ships carrying irradiated nuclear fuel or high level radioactive wastes with an aggregate radioactivity less than  $2 \times 10^6$  TBq and ships carrying Plutonium with an aggregate radioactivity less than  $2 \times 10^5$  TBq.

Class INF 3 - Ships carrying irradiated nuclear fuel or high level radioactive wastes and ships carrying Plutonium with no restriction on the aggregate radioactivity of the materials.

1.4 All ships, regardless of size, carrying materials covered by this Code should comply with the requirements of SOLAS 1974, as amended, and in addition with the requirements as prescribed in table 1 and sections 2 to 9, concerning damage stability, fire protection, temperature control of cargo spaces, structural considerations, cargo securing arrangements, electrical supplies, radiological protection equipment and management, training and shipboard emergency plan.

1.5 In addition to the requirements of this Code, the provisions of the IMDG Code also apply.

1.6 The Administration should provide the ship with an appropriate document as evidence of compliance of construction and equipment with the requirements of this Code.

Table 1: Requirements for ships carrying irradiated nuclear fuel, plutonium and high level radioactive wastes in flasks on board ships

Ship's class	Damage stability		Fire protection		Temperature control of cargo spaces	Structural considerations	Cargo securing arrangements	Electrical supplies	Radiological protection equipment	Management, training and shipboard emergency plan
	Passenger ships*	Cargo ships	Passenger ships*	Cargo ships						
INF 1	2.1	2.1	3.1	3.1	4	5	6	7.1	8	9
INF 2	2.2	2.3	3.3	3.3	4	5	6	7.2 + 7.3	8	9
INF 3	N/A	2.4	N/A	3.2 + 3.3	4	5	6	7.2 + 7.3 + 7.4	8	9

N/A: INF 3 not allowed on passenger ships

\* As defined in SOLAS 74, chapter I, part A, regulation 2(f)

## 2 DAMAGE STABILITY

2.1 To the satisfaction of the Administration concerned.

2.2 Part B, chapter II-1, of the 1974 SOLAS Convention, as amended by MSC resolution 12(56), or resolution A.265(VIII).

2.3 Part B-1, chapter II-1 of the 1974 SOLAS Convention (resolution MSC.19(58)), regardless of ship length.

2.4 Type 1 ships survival capability and location of cargo spaces in chapter 2 of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) or, regardless of ship length, requirements in part B-1, chapter II-1 of the 1974 SOLAS Convention (resolution MSC.19(58)) with subdivision index  $R_{INF}$  as given below:

$$R_{INF} = R + 0.2(1 - R)$$

## 3 FIRE PROTECTION

3.1 To the satisfaction of the Administration concerned.

3.2 Accommodation spaces, service spaces, control stations and machinery spaces of category A, as defined in regulation II-2/3.19 of SOLAS 74, as amended, should be fitted either forward or aft of the cargo spaces, due regard being paid to the overall safety of the ship.

3.3 The ship should be fitted with the following systems and equipment, irrespective of its gross tonnage, i.e. also for cargo ships of less than 500 tons gross tonnage:

- .1 a water fire-extinguishing system complying with the requirements of regulation II-2/4 of SOLAS 74, as amended;
- .2 a fixed fire-extinguishing system in machinery spaces (defined as above) complying with the requirements of regulation II-2/7 of SOLAS 74, as amended;
- .3 fixed cargo space cooling arrangements, complying with the requirements of regulation II-2/54.2.1.3 of SOLAS 74, as amended; and
- .4 a fixed fire-detection and fire-alarm system, protecting the machinery spaces, accommodation and service spaces, complying with the requirements of regulation II-2/13 of SOLAS 74, as amended.

## 4 TEMPERATURE CONTROL OF CARGO SPACES

4.1 Adequate ventilation or refrigeration of enclosed cargo spaces should be provided so that the average ambient temperature within such spaces does not exceed 55°C at any time.

4.2 Ventilation or refrigeration systems serving cargo spaces intended for the transport of materials covered by this Code should be independent of those serving other spaces.

4.3 Those items essential to operation, e.g., fans, compressors, heat exchangers, cooling water supply, etc., should be provided in duplicate for each cargo space and spare parts should be available, to the satisfaction of the Administration concerned.

## 5 STRUCTURAL CONSIDERATIONS

The structural strength of deck areas and support arrangements should be designed, taking into account the high loading which is to be sustained. In existing ships the structural strength should be evaluated with a view to limit the locations where flasks may be stowed.

## 6 CARGO SECURING ARRANGEMENTS

6.1 Adequate permanent securing devices should be provided to prevent movement of the flasks within the cargo spaces. In designing permanent devices, due consideration should be given to the orientation of the flasks and the following ship acceleration levels should be taken into account:

- 1.5 g longitudinally;
- 1.5 g transversely;
- 1.0 g vertically up;
- 2.0 g vertically down;

or alternatively,

where flasks are carried on the open deck or a vehicle deck they should be secured in accordance with the principles of safe stowage and securing of heavy, unitized and wheel-based (rolling) cargoes contained in Assembly resolution A.714(17) of 6 November 1991, on the Code of Safe Practice for Cargo Stowage and Securing, taking into account Assembly resolution A.581(14) of 20 November 1985, on Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships and MSC/Circ.385 of 8 January 1985, on Provisions to be included in the Cargo Securing Manual to be carried on board ships.

6.2 Where collision chocks are used, these should be so arranged that they will not interfere or prevent cooling air flow which may be necessary (see section 4).

## 7 ELECTRICAL SUPPLIES

7.1 To the satisfaction of the Administration concerned.

7.2 An alternative source of electrical power, complying with the requirements of the International Electrotechnical Commission (IEC) should be provided so that damage involving the main supply would not also affect the alternative source.

7.3 The power available from the alternative source should be sufficient to supply the following services for at least 36 hours:

- .1 the equipment provided for the flooding and cooling arrangements referred to in 3.3.3 and 4; and
- .2 all emergency services required by SOLAS 74, as amended.

7.4 The alternative source referred to in 7.2 should be located outside the extent of any damage envisaged in section 2.

#### 8 RADIOLOGICAL PROTECTION EQUIPMENT

Depending upon the degree of activity of the materials covered by this Code which are being carried, the ship's design may need to provide for additional arrangements or equipment for radiological protection to the satisfaction of the Administration concerned.

#### 9 MANAGEMENT, TRAINING AND SHIPBOARD EMERGENCY PLAN

The management, training and shipboard emergency plan for a ship should take account of developments within the Organization to the satisfaction of the Administration concerned.

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