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No. 11-NT(83)/2012 **Dated: 07.02.2013**

Casualty Circular No. 01of 2013

Subject: Fire in containers.

1. What happened ?

1.1 A container ship 'X', of about 2800 TEU, had arrived from Khor Fakkan UAE. The vessel was loaded with containers, of which, 63 containers (all 20 ft) were initially loaded on board another vessel at Dar-e-Salam Tanzania, thereafter transshipped to the container vessel 'X' at Khor Fakkan for onward shipment to Nhava Sheva, Mumbai. 63 containers were stowed at various locations on board under deck and on deck at holds 2, 3, 4, 5 and 6.

1.2 While the vessel was waiting at Mumbai anchorage, smoke was observed coming out from one of the 63 containers which was at position 070282 (on deck above Hold No. 2). Ship's crew fought the fire by injecting water into the container and also started boundary cooling. The fire was extinguished.

1.3 After 4 days, while the vessel was proceeding towards the pilot station, smoke was observed to be coming out from another of the 63 containers in position 330184 (on deck above Hold No. 5). Similar action by the ship's crew resulted in extinguishing the fire.

2. How it happened ?

2.1 On examination of the contents of the containers, it was noted that all both the containers had 'sunflower cake' as cargo, which has oil content of 14% - 16% and the moisture content of 4% - 6%. Fire occurred after about 5 – 6 weeks of loading these 63 containers at Dar-E-Salam.

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2.2 Oil seeds cake is susceptible to self-heating due to oxidation of residual oil in the cake. The oil seeds have a shell that protects the oil from reacting with oxygen in the air. However, once the seeds are crushed that protection is lost. The oxidation of residual oil in the cake releases heat, and the rate of oxidation is higher at higher temperature. Oxygen can still diffuse into the cake and the oxidation can continue, unless the cake is in hermetically sealed packing. If the cake is accumulated in a stack or stow, the heat generated in the center cannot be lost easily to the surroundings so that the internal temperature rises, which can make the oxidation faster. In some case the heating can cause the cake or its packaging to ignite. Self-heating can take many hours, days or weeks to happen. Considering the timing in this case, the only likely cause of these fires is self-heating of the seed-cakes.

3. Why it happened?

3.1 The oil content of the seed cake indicates that this cargo should have been declared as IMDG cargo, UN No. 1386 (a) Class 4.2 which applies to substances having oil content of 10% or more. The main stowage requirement for this cargo that apply to container cargoes are, "away from sources of heat" and that the cargo must be properly aged before shipping. Ageing allows a lot of the oxidation reaction to occur safely before the cargo is accumulated into a stow, thus avoiding the self-heating.

3.2 The ship also was not provided with consignment details of all the 63 containers till the 1st incident of fire occurred.

4. Lessons to be learned

4.1 The primary cause of the fire was because of the self-heating of the residual oil in the sunflower seeds. The cargo should have been declared as IMDG cargo under Class 4.2 and properly stowed.

4.2 The shipping company should ensure that the details of cargo are made available to the Master of the vessel so that the appropriate stowage can be determined to ensure that such containers are quickly accessed and hazards associated with the cargo are effectively dealt in good time.

4.3 Relevant precautions, as stated in the IMDG Code for shipping seed cake (UN No. 1386), are enclosed for ready reference.

(Capt. Harish Khatri)
Dy. Director General of Shipping (Tech)

UN No.	Proper Shipping Name (PSN)	Class or division	Subsidiary risk(s)	Packing group	Special provisions	Limited and excepted quantity provisions		Packing		IBC	
						Limited quantities	Excepted quantities	Instructions	Provisions	Instructions	Provisions
(1)	(2) 3.1.2	(3) 2.0	(4) 2.0	(5) 2.0.1.3	(6) 3.3	(7a) 3.4	(7b) 3.5	(8) 4.1.4	(9) 4.1.4	(10) 4.1.4	(11) 4.1.4
1379	PAPER, UNSATURATED OIL TREATED incompletely dried (including carbon paper)	4.2	–	III	–	0	E1	P410	PP31	IBC08	B3
1380	PENTABORANE	4.2	6.1	I	–	0	E0	P601	–	–	–
1381	PHOSPHORUS, WHITE or YELLOW, DRY or UNDER WATER or IN SOLUTION	4.2	6.1 P	I	–	0	E0	P405	PP31	–	–
1382	POTASSIUM SULPHIDE, ANHYDROUS or POTASSIUM SULPHIDE with less than 30% water of crystallization	4.2	–	II	–	0	E2	P410	PP31 PP40	IBC06	B2
1383	PYROPHORIC METAL, N.O.S. or PYROPHORIC ALLOY, N.O.S.	4.2	–	I	274	0	E0	P404	PP31	–	–
1384	SODIUM DITHIONITE (SODIUM HYDROSULPHITE)	4.2	–	II	–	0	E2	P410	PP31	IBC06	B2
1385	SODIUM SULPHIDE, ANHYDROUS or SODIUM SULPHIDE with less than 30% water of crystallization	4.2	–	II	–	0	E2	P410	PP31	IBC06	B2
1386	SEED CAKE, containing vegetable oil (a) mechanically expelled seeds, containing more than 10% oil or more than 20% oil and moisture combined	4.2	–	III	29 929	0	E1	P003 LP02	PP20	IBC08	B3 B6
1386	SEED CAKE, containing vegetable oil (b) solvent extractions and expelled seeds, containing not more than 10% of oil and when the amount of moisture is higher than 10%, not more than 20% of oil and moisture combined	4.2	–	III	29 929	0	E1	P003 LP02	PP20	IBC08	B3 B6
1387	WOOL WASTE, WET	4.2	–	III	117	0	E1	P410	–	–	–
1389	ALKALI METAL AMALGAM, LIQUID	4.3	–	I	182	0	E0	P402	PP31	–	–
1390	ALKALI METAL AMIDE	4.3	–	II	182	500 g	E2	P410	PP31 PP40	IBC07	B2

Portable tanks and bulk containers			EmS	Stowage and segregation	Properties and observations	UN No.
(12)	Tank instructions (13) 4.2.5 4.3	Provisions (14) 4.2.5	(15) 5.4.3.2 7.3	(16) 7.1 7.2	(17)	(18)
–	–	–	F-A, S-J	Category A.	Liable to ignite spontaneously. The provisions of this Code should not apply to manufactured articles properly aged.	1379
–	–	–	F-G, S-L	Category D.	Colourless liquid. Boiling point range: 48°C to 63°C. Ignites spontaneously in air. Decomposes in contact with water, evolving hydrogen, a flammable gas. Toxic if swallowed, by skin contact or by inhalation.	1380
–	T9	TP3 TP31	F-A, S-J	Category E.	Ignites spontaneously in air. Melting point: 44°C. Toxic if swallowed, by skin contact or by inhalation. Receptacles are usually filled with substance in the liquid state which subsequently solidifies. A sufficient ullage should be allowed.	1381
–	T3	TP33	F-A, S-J	Category A. "Separated from" acids.	Black solid, absorbs moisture to become crystalline. Liable to ignite spontaneously. In contact with acids, evolves hydrogen sulphide, a toxic and flammable gas. Reacts violently with acids.	1382
–	T21	TP7 TP33	F-G, S-M	Category D.	Liable to ignite spontaneously in air. If shaken, may produce sparks. In contact with water, evolves hydrogen, a flammable gas.	1383
–	T3	TP33	F-A, S-J	Category E. Keep as dry as reasonably practicable.	White or grey crystalline powder. Liable to heat and ignite spontaneously in air and to evolve sulphur dioxide, an irritating gas.	1384
–	T3	TP33	F-A, S-J	Category A. "Separated from" acids.	Black solid, absorbs moisture to become crystalline. Liable to ignite spontaneously. In contact with acids, evolves hydrogen sulphide, a toxic and flammable gas. Reacts violently with acids.	1385
–	BK2	–	F-A, S-J	Category E. Keep dry. "Away from" all sources of heat. For special stowage provisions, see 7.1.10.4.1.	Residue remaining after oil has been expelled mechanically from oil-bearing seeds. Used mainly as animal feed or fertilizer. The most common seed cakes include those derived from coconut (copra), cottonseed, groundnut (peanut), linseed, maize (hominy chop), niger seed, palm kernel, rape seed, rice bran, soya bean and sunflower seed and they may be shipped in the form of cake, flakes, pellets, meal, etc. May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. Before shipment, this cargo should be properly aged The duration of ageing varies with the oil content. Smoking and the use of naked lights should be prohibited during loading and unloading and on entry to the cargo space(s) at any time.	1386
–	BK2	–	F-A, S-J	Category A. Keep dry. "Away from" all sources of heat. For special stowage provisions, see 7.1.10.4.2.	Residue remaining after oil has been extracted by a solvent process or expelled mechanically from oil-bearing seeds. Used mainly as animal feed or fertilizer. The most common seed cakes include those derived from coconut (copra), cottonseed, groundnut (peanut), linseed, maize (hominy chop), niger seed, palm kernel, rape seed, rice bran, soya bean and sunflower seed and they may be shipped in the form of cake, flakes, pellets, meal, etc. May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. The seed cake should be substantially free from flammable solvent. Before shipment, this cargo should be properly aged. The duration of ageing varies with the oil content. Smoking and the use of naked lights should be prohibited during loading and unloading and on entry to the cargo space(s) at any other time.	1386
–	–	–	F-A, S-J	Category A.	Liable to ignite spontaneously in air according to moisture content.	1387
–	–	–	F-G, S-N	Category D. "Separated from" acids.	Silvery liquid, consisting of metal alloyed with mercury. Reacts with moisture, water or acids, evolving hydrogen, a flammable gas. When heated, evolves toxic vapours.	1389
–	T3	TP33	F-G, S-O	Category E. Clear of living quarters. "Separated from" acids.	Small crystals. Decomposes in contact with water or acids, evolving ammonia vapour and producing highly caustic alkaline solutions.	1390

.3 bags should always be stowed in double strip, as shown in 7.1.10.3.3 of this Code for fishmeal, unstabilized; and

.4 regular temperature readings should be taken at varying depths in the cargo space and recorded. If the temperature of the cargo exceeds 55°C and continues to increase, ventilation to the cargo spaces should be restricted. If self-heating continues, then carbon dioxide or inert gas should be introduced.

7.1.10.4.2 Stowage precautions for SEED CAKE, containing vegetable oil (b) solvent extractions and expelled seeds containing not more than 10% of oil and, when the amount of moisture is higher than 10%, not more than 20% of oil and moisture combined:

.1 surface ventilation is required to assist in removing any residual solvent vapour;

.2 if bags are stowed without provision for ventilation to circulate throughout the stow and the voyage exceeds 5 days, regular temperature readings should be taken at varying depths in the hold and recorded; and

.3 if the voyage exceeds 5 days, the vessel should be equipped with facilities for introducing carbon dioxide or inert gas in to the cargo spaces.

7.1.11 Stowage of goods of class 5.1

7.1.11.1 Except for cargo spaces in cargo transport units, cargo spaces should be cleaned before oxidizing substances are loaded into them. Attention should be paid to the removal of all combustible materials which are not necessary for the stowage of such cargoes.

7.1.11.2 As far as reasonably practicable, non-combustible securing and protecting materials and only a minimum of clean dry wooden dunnage should be used.

7.1.11.3 Precautions should be taken to avoid the penetration of oxidizing substances into other cargo spaces, bilges, etc., which may contain combustible material.

7.1.11.4 After discharge, cargo spaces used for the transport of oxidizing substances should be inspected for contamination. A space that has been contaminated should be properly cleaned and examined before being used for other cargoes, especially foodstuffs.

7.1.11.5 **Stowage precautions for AMMONIUM NITRATE, UN 1942 and AMMONIUM NITRATE FERTILIZERS, UN Nos. 2067, 2068, 2069, 2070, 2072**

7.1.11.5.1 Ammonium nitrate, UN 1942 and ammonium nitrate fertilizers, UN Nos. 2067, 2068, 2069, 2070, 2072 should be stowed in a clean cargo space capable of being opened up in an emergency. In the case of bagged fertilizer or fertilizer in closed cargo transport units, it is sufficient if, in the case of an emergency, the cargo is accessible through free approaches (hatch entries), and mechanical ventilation enables the master to exhaust any gases or fumes resulting from decomposition. The possible need to open hatches in case of fire to provide maximum ventilation and to apply water in an emergency and the consequent risk to the stability of the ship through flooding of the cargo space should be considered before loading.

7.1.11.5.2 The compatibility of non-hazardous ammonium nitrate mixtures with other materials, which may be stowed in the same cargo space should be considered before loading.

7.1.12 Stowage of goods of class 5.2

7.1.12.1 Organic peroxides should be stowed in accordance with stowage category D, as specified in 7.1.1.2.

7.1.12.2 When organic peroxides are transported on roll-on/roll-off ships, see the relevant provisions of chapter 7.4.

7.1.12.3 Organic peroxides should be stowed "away from" living quarters or access to them.

7.1.12.4 Organic peroxides should be stowed "away from" all sources of heat. Packages containing organic peroxides should be protected from direct sunshine and stowed in a cool, well-ventilated place.

7.1.12.5 When stowage arrangements are made, it should be borne in mind that it may become necessary to take the appropriate emergency action, such as jettisoning.

7.1.13 Stowage of goods of class 6.1

7.1.13.1 **General stowage precautions for goods of class 6.1**

7.1.13.1.1 After discharge, spaces used for the transport of substances of this class should be inspected for contamination. A space which has been contaminated should be properly cleaned and examined before being used for other cargoes, especially foodstuffs.

7.1.10.3.2 *Containers*

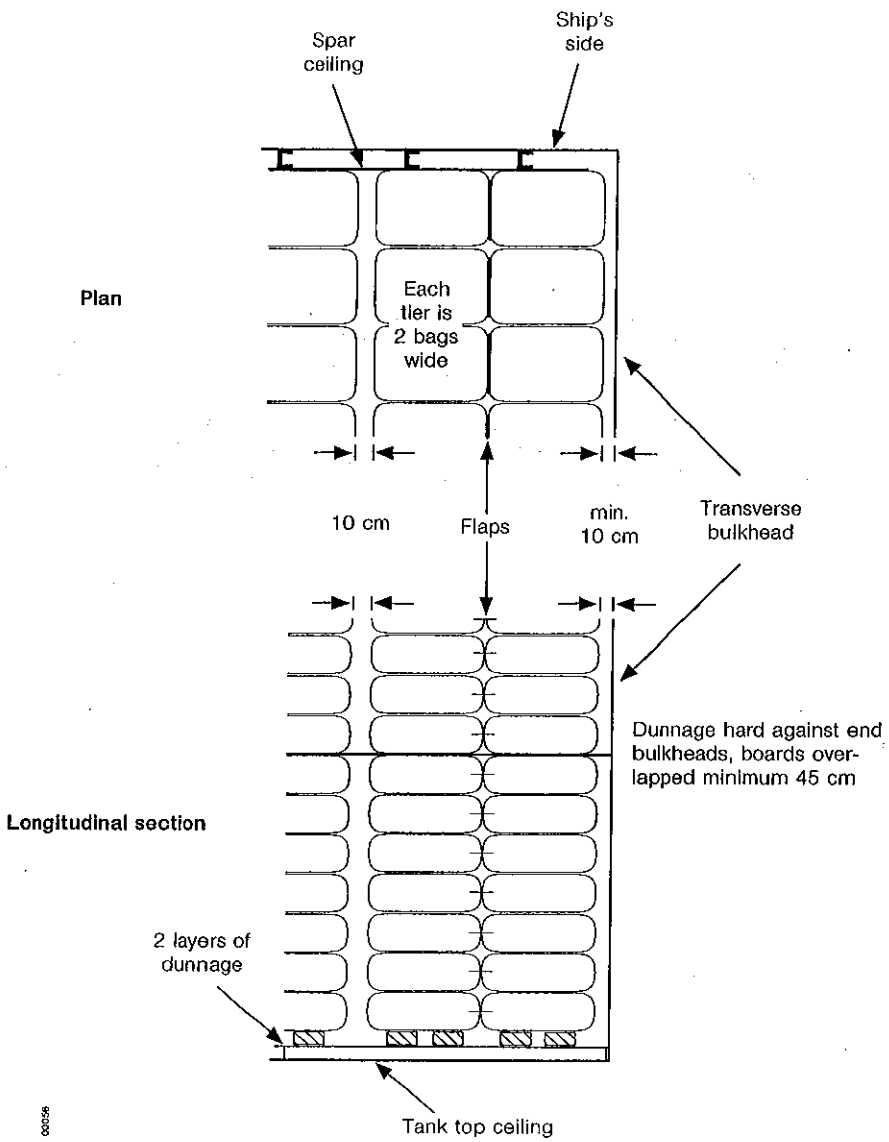
.1 After packing, the doors and other openings should be sealed to prevent the penetration of air into the unit.

.2 Temperature readings in the hold should be taken once a day early in the morning during the voyage and recorded.

.3 If the temperature of the hold rises excessively above ambient and continues to increase, the possible need to apply copious quantities of water in an emergency and the consequent risk to the stability of the ship should be considered.

.4 The cargo must be stowed well clear of pipes and bulkheads which are liable to become heated (such as engine-room bulkheads).

7.1.10.3.3 **Double strip stowage**



7.1.10.4. **Stowage precautions for SEED CAKE (UN 1386)**

7.1.10.4.1 Stowage precautions for SEED CAKE, containing vegetable oil (a) mechanically expelled seeds, containing more than 10% of oil or more than 20% of oil and moisture combined:

.1 through and surface ventilation is required;

.2 if the voyage exceeds 5 days, the ship should be equipped with facilities for introducing carbon dioxide or inert gas into the cargo spaces;