COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS AND ON THE GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS

Sub-Committee of Experts on the
Transport of Dangerous Goods

Thirty-second session
Geneva, 3-7 December 2007
Item 11 of the provisional agenda

OTHER BUSINESS

Fire protection of cargo in container transportation

Transmitted by the International Dangerous Goods and Containers Association (IDGCA)

1. International standards and rules which regulate transport of dangerous goods and containers do not establish any requirements to the equipping of containers with supplementary individual fire extinguishing means. The question of fire safety of goods usually comes under the competence of different specialists and sometimes is just passing over.

2. Hundreds of thousands of containers are carried by road and sea daily. Container is a transport appliance intended to facilitate carriage of cargo involving one or more modes of transport without its intermediate trans-shipment. It ensures cargo integrity and security in adverse climate conditions and prevents unauthorised access to the cargo by way of sealing its doors. Fire safety of the cargo carried inside a closed container has not so far received proper attention. Depending on the type of cargo, fire may cause serious consequences, especially so as far as dangerous goods are concerned. Cargo ignition may be caused by two main factors.

3. The first of them is incident of the vehicle (motor car, rolling stock, ship, etc.) caused by inadequate driving, improper use of the equipment, technical failures and external factors relating to weather conditions. In case of an incident a standard container cannot stand fire impact for a long time protecting the cargo inside. There is an exception, though, of special transport packaging units capable of withstanding fire for a long period of time and intended, for instance, for carriage of radioactive materials. All the existing standards and regulations provide for fire extinguishing means to be available on any vehicle, but it is quite often that there is no chance to apply them in the crucial moment, consequently the fire starting at the vehicle may eventually move to the container body and affect the cargo inside the container.

4. A serious incident involving container transport was the fire starting on 19 March 2006 on board ocean containership Hyundai Fortune going from Asia to Rotterdam via the Gulf of Aden. Over 500 of 5551 containers were destroyed by fire (TEU equivalent). Insurance compensations exceeded USD 300 mln, with only USD 70 mln being paid for the ship hull, other payments were made against insurance events. According to statistics, an average cost of a loaded standard

20-foot container, cargo included, is USD 30 thousand, it may, though, reach up to a hundred thousand in case of expensive electronic devices being carried. Hyundai accident is not the first fire on board a containership: the same destiny was in stock for MOL Renaissance and Hanjin Pennsylvania. It is quite difficult to identify the cause of fire, and experts investigating Hyundai accident (and others as well) have not reached the uniform conclusion on the point, whether it was the fire onboard or the fire of the cargo inside containers. We do not have much left for us, though, but only to rely on specialists' expertise investigating cause-and-effect relation of the accident, and consider whether we can do anything to the effect of improving the above statistics.

5. The second fire raising factor is the property of self-ignition of certain chemicals when exposed to open air. Under ADR, container transport of some chemicals, e.g. class 4.1, is either prohibited or requires extra preventive measures. Special containers are needed for carriage of such cargoes. Cargo ignition is more likely to occur in container in case of wrong stowage of dangerous goods or non-compliance with transportation requirements.

6. The cargo loaded into a container experiences acceleration in loading/unloading, vibration on roads and railways, rolling and pitching during sea voyage, it is subject to considerable temperature variations when carried in different climate conditions. Vibration and stresses can cause cargo ignition if it is stowed improperly and its parts rub against each other or against container walls. Solar radiation is one of the most dangerous cargo "enemies", fire probability increases in higher ambient air temperatures.

7. To provide cargo safety, to prevent fire and enhance fire safety during container cargo transportation, as well as to mitigate accident consequences, IDGCA suggests the following technical solution.

8. An autonomous fire extinguishing unit (FEU) filled with gas fire extinction compound shall be fixed in a container. A cylinder filled with gaseous fire extinct chemical fixed with a sensor tube forms a part of the FEU. The sensor tube is 10-25 m long, for bigger cylinders (25, 50 and 100 litres), however, a number of tubes may be fixed to the locking device, or FEU may be used with the sensor tube being part of the locking device opening control unit. The FEU is placed inside the container, which makes it inaccessible for unauthorised use after the container doors have been closed. To exclude FEU free moving inside the container, the cylinder must be fixed either to the cargo, where this is allowable, or to the inside container surface, where it is least likely to be damaged or moved during loading. Where the cargo is intended to occupy the whole of the container, the sensor tube shall be fixed on any internal container surface. In case the cargo volume is considerably less than that of the container, the sensor tube shall be fixed on the cargo surface, in places of potential ignition. After the fire extinguishing unit has been fixed and the cargo has been stowed (or the other way round) the container doors shall be closed and sealed. The container is ready for transportation and storage in trans-shipment locations. The autonomous fire extinguishing unit is inside the container during transportation, after unloading it may be either removed or left in place. When FEU is fixed inside the container, this must be identified on the outside of its door, so as this container shall be used only for particular types of cargoes characterised with self-ignitability. This information may be identified, say, on a metal plate attached to the container. The fire extinguishing unit is autonomous, does not require power supply, is simple to assemble and operate. The pressure indicator fixed in the locking device

allows for regular visual monitoring of the gaseous fire extinction compound inside the cylinder. Halon may be used as the gaseous fire extinct chemical. The unit does not require special fire sensors to be fixed inside the container, as the sensor tube attached to the cylinder locking device performs the functions of both fire detection and fire extinct delivery to the ignition hazard. When container is heated by an external source or when fire starts inside the container for any other reasons, the sensor tube is locally heated up to the temperature of 110-120° C, when its wall is softened and broken. The fire extinct chemical gets to the ignition through this opening. The sensor tube is located as close to the ignition hazard as possible thus providing maximum efficiency of the autonomous fire extinguishing unit. When fire extinct substance leaves the cylinder, the oxygen content in the ignition zone is going down, and the fire stops. Further on, when all the fire extinct substance leaves the cylinder, it mixes with the ambient air and the oxygen content diminishes in the whole of the container. When the FEU activates in the container, the latter is a closed capacity filled with the mixture of air and halon. When the fire extinct substance gets into the container, the oxygen concentration in it is significantly lower. Ignition resistance of all the cargo inside the container is increased, while the external source of heat is still active. The loaded container is capable of longer withstanding the impact of the external fire.

9. Container tightness is important for providing and preserving the required chemical composition of the gas mixture, which, in particular, depends on the materials used for sealing of doors. Only the relevant tests, however, can provide the exact time related resistance values of different sealing materials against fire.

10. For the cargo fire protection (and providing the above processes) it is recommended to fix a container with FEU based on the ratio: 1 litre of fire extinction chemical protects 1 m^3 of the container capacity, so that after FEU activating the fire extinct gas would fill the whole capacity of the empty container. ISO 668:1995 standard specify the container capacity between 14 and 74 m^3. Depending on the container size, FEU may be used with cylinder capacity of 8, 20, 30, 50, 100 litres.

11. Time of gas fire extinct chemical release from the cylinder through the small diameter sensor tube is crucial for fire protection of cargo in high capacity containers. It is recommended to apply FEU with the sensor tube performing the functions of the locking device through which the fire extinguisher can fill the container within less than 10 seconds. Cargo decreases the free volume of the container, and when FEU has been activated, there is a certain excessive pressure of the gaseous medium in the relevantly tight container. Chemical changes of the gaseous mixture (decrease of oxygen content) caused by FEU activation, will provide for fire safety inside the container within 5 to 7 hours depending on the cargo volume.

12. The properties and quality of the door sealing material will determine the fire resistance of the container. The longer fire resistant medium can be kept inside the container, the longer cargo carried may withstand the impact of fire. For efficient use of FEU, the existing requirements for sealing materials shall be reviewed and new ones shall be introduced relating to resistance against high temperatures. Sealing material is the weakest point in providing container tightness,

and the longer the sealing material is capable of withstanding high temperatures, the longer the cargo will preserve fire resistance. Bearing in mind that the temperature value of sensor tube pores opening is a criterion of the suggested method (110-120) °C, this method will provide fire protection of flammable and low-flammable chemicals and materials.

13. FEU application in commercial container transport influences the interests of many parties concerned, i.e. consignor, consignee, carrier, logistics specialists, customs officials, underwriters, etc. All the parties concerned are invited to join their efforts in developing relevant regulatory basis, technical specifications and operation requirements. The first step may be done through elaborating the concept of fire fighting means application in freight container of various types, outlining the ways to put FEU into operation, relations and mutual obligations of the participants, etc. We invite all the interested parties to review and participate in the proposal.

_____