

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

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PERFORMANCE OF PACKAGINGS, INCLUDING IBCs

Permeation through the walls of plastics packagings, including IBCs, building up the hazard of an explosive atmosphere in freight containers

Transmitted by the expert from Germany

1. Background

The results of the research project “Permeation during transport of dangerous goods in containers – determination of potentially explosive mixtures during transport of dangerous goods in containers under normal conditions of carriage” by order of the German Federal Ministry of Transport, Building and Urban Affairs led to the development of this informal document. Intending to submit a formal proposal for the July 2008 session the German expert herewith wishes to inform the Sub-Committee for further consideration and guidance on this proposal.

2. Introduction

The UN-Recommendations on the Transport of Dangerous Goods provide general design requirements, specifications, testing and certification rules for packagings. The main principles of the UN-Recommendations are performance orientated design requirements, which have replaced the concept of described packaging. The transport of dangerous goods is associated with specific hazards due to the properties of the dangerous substances. The packagings have an extremely important function in relation to minimizing risks. Plastics packagings and plastics IBCs as well as combination packagings with plastics inner packagings are frequently used for the transport of flammable and combustible liquids. In the regulations special attention is drawn to the weakening effects on plastics material by liquids providing specific test requirements for the proof of the chemical compatibility. However, additional hazards can arise from considerable concentrations of flammable vapors permeated out of plastics packagings into the surrounding atmosphere. This permeation hazard is dealt only as a general requirement of the UN Model Regulations for the specification of plastics IBCs and large packagings: “Any permeation of the substance contained shall not constitute a danger under normal conditions of transport.” (see 6.5.5.3.2, 6.5.5.4.6, 6.6.4.3.1). An analogous

requirement for plastics packagings is missing in the UN Model Regulations but can be found in the ICAO-TI (see 6.3.1.7.1.) ADR/RID is dealing the permeation hazard of plastics packagings in 6.1.4.8.1 with the following additional requirement: “Any permeation of the substance contained in the package, or recycled plastics material used to produce new packaging, shall not constitute a danger under normal conditions of carriage.”

3. Results of the research project

In general, the development of an explosive atmosphere in freight containers due to permeation of flammable and combustible liquids out of packagings is not well regulated and investigated. This was the main reason to carry out the research project mentioned above. Experiment-based calculations of solvent concentrations in the freight containers have shown that the lower explosive limit (as an example for toluene) can be easily reached within a few hours. Furthermore, the measured air exchange rates of a ventilated 22G1-freight container were not sufficient to prevent the build-up of an explosive atmosphere.

Further measurements of the permeation rate for different plastics materials revealed that permeation can be minimized by using packagings with permeation barriers (e.g. EVOH barrier layer) or packagings with fluorinated internal and external layers (SMP process). These permeation barriers reduce the rate of permeation by more than a decimal power so that the hazard of the development of an explosive atmosphere during the transport of liquids like toluene in those packagings is significantly reduced under normal conditions of transport (40 °C).

In order to find out what are normal conditions of transport a freight container was shipped to Singapore and Australia loaded with drums and IBCs filled with water and equipped with temperature sensors. The measured maximum air temperature in the container was 48 °C as well as the maximum temperature in the inner vapor space of the packaging 40 °C.

4. Draft proposal for amended provisions of the UN Model Regulations on the Transport of Dangerous Goods

Based on the results of the German research project and dependent on the outcome of the discussion in the Sub-Committee the German expert would be ready to submit a proposal at the July meeting with following elements:

- (a) Adding special provisions concerning documentation and identification of transport units with explosion hazard caused by permeation in order to apply measures of ventilation to remove any potentially explosive atmosphere prior to unloading the transport unit.
 - (b) Adding an analogous permeation requirement in chapter 6.1 (plastics drums, plastics jerricans, specific composite packagings (plastics material) and combination packagings with plastics inner packagings) as set out in 6.5.5.3.2, 6.5.5.4.6 and 6.6.4.3.1.
 - (c) Adding provisions that the permeation requirements can be covered, if appropriate means are applied to all concerned packagings and IBCs to reduce the rate of permeation or to be transported in containers with ventilation.
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