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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 **14 June 2011**

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Item 2 (f) of the provisional agenda
Explosives and relates matters: miscellaneous

Difficulties in carrying out TDG classification tests

Transmitted by the expert from Canada

Introduction

1. The Manual of Tests and Criteria [1] is widely accepted around the world as a standard for classifying dangerous goods for transport. In order to standardize the tests, it was necessary to specify materials used in the tests fairly precisely. Unfortunately, the precise specification of materials in the tests related to energetic materials has created difficulties in obtaining the materials in some cases. As a result, it can be difficult to carry out some of the tests in exactly the manner specified in the Manual, leading to uncertainty about the validity of test results in some cases. Although it is stated in the General Introduction to the Manual that "The competent authority has discretion to dispense with certain tests, to vary the details of tests, and to require additional tests when this is justified to obtain a reliable and realistic assessment of the hazard of a product", the Manual can be interpreted as a rigorous standard, especially if the competent authority does not have access to expert technical assistance.

2. IGUS is the International Group of Experts on the Explosion Risks of Unstable Substances [2]. It brings together from all over the world independent experts on the risks of dangerous substances. Full IGUS members are from government and independent research organizations; individuals from industry can and do attend meetings by invitation. The aim of IGUS is to exchange information on the behaviour of unstable substances, with respect to production, handling, storage and transport. IGUS works in support of the international bodies dealing with dangerous goods regulations and TDG issues are a regular focus of the annual meetings of the two IGUS sub-groups: Explosives, Propellants and Pyrotechnics (IGUS-EPP) and Energetic and Oxidizing Substances (IGUS-EOS).

3. It was agreed at a meeting of the IGUS-EPP group in Osaka, Japan in 2009 that IGUS would survey its stakeholders to establish the scope of the problem of obtaining materials for TDG testing and to begin to address it. This INF paper summarizes the results of the survey.

Methodology

4. A survey was sent out on 24 October 2010 to the IGUS-EPP and IGUS-EOS groups. The two groups comprise around 170 members. The members were asked to circulate further to interested stakeholders in government and industry. A compilation of replies and key results was recirculated on 22 February 2011. The results of the survey were presented

at meetings of the IGUS-EPP and IGUS-EOS groups April and May, 2011 [3, 4]. At the meetings, it was agreed that the expert from Canada would produce an INF paper for consideration by the Explosives Working Group at the June, 2011 meeting of the Sub-Committee of Experts on the Transport of Dangerous Goods.

Results of the Survey

5. Fifty-two comments were received related to the materials used for tests, from 12 organizations, representing both government and industry. The comments were broken down as follows:

- UN and ANE Gap Test – 15 comments
- Time/pressure Test and HSL Flash Test – 8 comments
- DDT Test – 4 comments
- External Fire Tests – 5(c) and 6(c) – 5 comments
- Koenen Tests (Series 1, 2 and 8) – 1 comment
- 8(a) Thermal Stability – 1 comment
- 8(d) Mod. Vented Pipe – 1 comment
- Dutch Pressure Vessel Test – 1 comment
- F.1 Ballistic Mortar – 1 comment
- O.1 Oxidizing Solids – 1 comment
- O.2 Oxidizing Liquids – 1 comment

6. In terms of the number of comments, the top five difficulties related to materials were:

- Steel tubes for gap tests (6).
- Primed cambric for time/pressure tests (6)
- Donor charges for gap tests (5)
- Wood for external fire tests (4)
- Shock attenuators for gap tests (3)

7. In order to illustrate the types of comments received we will focus here on the materials for the Gap and Time/pressure Tests. Apart from the External Fire Test, the Gap and Time/pressure Tests were of most concern.

1. Gap Tests

Steel tubes

Test Series 1 and Test Series 2 Gap Tests

Specifications: cold-drawn, seamless, carbon steel tube, OD 48 ± 2 mm, wall thickness 4.0 ± 0.1 mm.

Questions: the manual specifies cold drawn; is this necessary? Is the narrow specification on the tube thickness really necessary in view of the comparatively loose OD specification?

Test Series 8 Gap Test (ANE)

Specifications: 95 mm outer diameter, 11.1 mm wall thickness ± 10% variations. Material properties: tensile strength = 420 MPa (± 20% variation); elongation (%) = 22 (± 20% variation); Brinell hardness = 125 (± 20% variation).

Questions: Specifying multiple parameters increases the difficulty of finding a matching material. Is it necessary to specify three parameters, especially as these are not specified for the Test Series 1 and Test Series 2 gap tests?

Donor charges

Test Series 1 and Test Series 2 Gap Tests

Specifications: 160 g RDX/wax (95/5) or PETN/TNT (50/50), 50 ± 1 mm in diameter with a density of 1 600 ± 50 kg/m^3 and length of about 50 mm.

Questions: Is it reasonable to substitute plastic explosives (in view of the fact that RDX/wax and PETN/TNT have different explosive properties?

Test Series 8 Gap Test (ANE)

Specifications: 95 mm diameter by 95 mm long, pressed 50/50 PETN/TNT (Pentolite) or 95/5 RDX/wax, density 1 600 kg/ m^3 ± 50 kg/m^3.

Questions: Is it reasonable to substitute cast Pentolite for pressed Pentolite, as the difference between cast and pressed Pentolite is less significant than between Pentolite and RDX/wax, and pressed Pentolite is difficult to source? Similarly, is it reasonable to substitute a plastic explosive such as C-4, for similar reasons?

Attenuators

Test Series 2 Gap Test

Specifications: polymethyl methacrylate (PMMA), diameter 50 ± 1 mm and length 50 ± 1 mm

Test Series 8 Gap Test (ANE)

Specifications: cast polymethyl methacrylate (PMMA) rod, of 95 mm diameter by 70 mm long.

Questions: Cast PMMA rod is difficult to obtain and is not specified for Test Series 2. For the purposes of this test, would extruded PMMA not be acceptable?

2. Time/pressure Test

Primed cambric

Primed cambric is not readily available. Some laboratories have stocks, but it is difficult to obtain new supplies, particularly as the detailed specification for primed cambric is not published.

Electric igniters

Specifications: an electric fusehead of the type commonly used in low-tension detonators.

Questions: the specification is not very clear. For example, what is a low-tension detonator?

Unfortunately, readily available electric igniters vary greatly in strength.

Proposal

8. The above examples clearly demonstrate that there are a number of significant difficulties in sourcing certain materials exactly as specified for the tests in the Manual of Tests and Criteria.

9. It is proposed that the Explosives Working Group be given the task of reviewing in detail the specifications in the Manual of Tests and Criteria for materials used to carry out the different tests relevant to Class 1 materials. The group may also wish to review the tests for materials of Divisions 4.1, 5.1 and 5.2. Where possible, the specifications should include a performance standard (e.g., a minimum shock pressure for a gap test), as well as examples of suitable (and generally available) materials. It is important that any changes to the specifications be based on sound science.

References

[1] Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Fifth Revised Edition, United Nations, New York and Geneva, 2009.

[2] http://www.oecdigus.org/

[3] “Difficulties with TDG Tests” P. Lightfoot and R. Bowes, Presentation at IGUS-EPP Meeting, Salt Lake City, Utah, USA, May 3-5, 2011.

[4] “Difficulties with TDG Tests” R. Bowes and P. Lightfoot, Presentation at IGUS-EOS Meeting, Washington, DC, USA, April 27-29, 2011.