
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

Twenty-seventh session
Geneva, 3-7 July 2006
Item 2 of the agenda

TRANSPORT OF EXPLOSIVES

Report of the Working Group on Explosives

Transmitted by the chairman of working group

- 1 The Working Group on explosives met from 3 to 7 July 2006, in a parallel session with the Sub-Committee of Experts on the Transport of Dangerous Goods to have technical discussions on the official documents scheduled under agenda item 2 and 12 in INF.2 of the 29th session of the UN/SCETDG under the Chairmanship of Mr. A. Johansen (Norway).
2. Experts from Belgium, Canada, China, Finland, France, Germany, Japan, the Netherlands, Norway, Spain, Sweden, United Kingdom and United States of America participated, as well as representatives from CLEPA, DGAC, EFMA, ICCA and SAAMI.
3. The Sub-Committee tasked the Working Group to discuss the following official and related documents:

4. Agenda item 2:

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| UNSCETDG/27/INF.39 (Chairman) | Report of the Working Group |
| ST/SG/AC.10/C.3/2005/11 (Spain) | Procedure and criterion for the Modified Vented Pipe Test |
| UNSCETDG/27/INF.7 (Sweden) | Comments on ST/SG/AC.10/C.3/2005/11 |
| ST/SG/AC.10/C.3/2006/7 (Norway) | Mixed transport of goods of Class 1 with dangerous goods of other classes – Mixed transport of explosives and nitrates |
| ST/SG/AC.10/C.3/2006/29 (United Kingdom) | Carriage of signals and flares in Divisions 1.4G and 1.4S |
| ST/SG/AC.10/C.3/2005/26 (Germany) | Classification of HOBt |
| UNSCETDG/29/INF.22 (Germany) | Classification of HOBt |
| ST/SG/AC.10/C.3/2006/62 (Canada) | Additional test for determining 1.4S classification |
| UNSCETDG/29/INF.29 (USA) | Comments to ST/SG/AC.10/C.3/2006/62 |

Agenda item 12:

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|-----------------------------------|--|
| ST/SG/AC.10/C.3/2006/27 (Germany) | Physical hazards due to explosive properties |
| ST/SG/AC.10/C.3/2006/61 (SAAMI) | Proposal of amendment to Chapter 2.1 of the GHS (Explosives) |

If time allowed the following informal documents might be considered by the Working Group:

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|-------------------------------------|---|
| UNSCETDG/29/INF.23 (Germany) | Amendments to the Manual of Test and Criteria |
| UNSCETDG/27/INF.4 (Germany) | Amendments to the Manual of Test and Criteria |
| UNSCETDG/29/INF.32 (United Kingdom) | Test Series 8 – Results from Modified Test 8(b) |
| UNSCETDG/29/INF.51 (Australia) | Test Series 8 – Classification of UN 3375 |
| UNSCETDG/29/INF.33 (United Kingdom) | Note to 2.1.3.5.5 |
| UNSCETDG/29/INF.41 (Germany) | Proposal of amendments to the procedure for classification of ammonium nitrate emulsions, suspensions and gels (Figure 2.1.4 in Chapter 2.1 of the GHS) |

5 **Modified Vented Pipe Test (test 8(d))**

Spain and Sweden briefly introduced their background documents .../2005/11 and .../27/INF.7. The expert from Spain stressed that the vent size of 85 mm was deliberately placed between square brackets, awaiting other suggestions. The expert from Norway explained that several existing products would fail the 85 mm vent size criterion but have been shipped without problems. Because of a lack of resources it was not possible to perform tests to justify a revised vent size that would accommodate existing products.

Several experts stated that the Modified Vented Pipe Test is better specified than the original 8(d) test, but that both tests are still not suitable to address the hazards in a tank fire. In most of the tests the hazards from the last remaining 5 – 10% of the emulsions or suspensions are assessed and the applicability to a real tank fire was questioned.

It was recognised that there are no better tests at the moment, apart from real-scale tests on tanks. It is therefore proposed to include the Modified Vented Pipe Test as an alternative test in Test 8 (d) with a vent size of 85 mm in square brackets pending new proposals for a different vent size. If no new proposals are submitted for the 30th session the square brackets are to be removed from the current text.

The expert from DGAC had identified some flaws in the test description of the current Test 8(d). The measures in section (a) of paragraph 18.7.1.2 were a mixture of millimetres and centimetres, while the UN system uses millimetres. The same is true for the dimensions in Figure 18.7.1.1, they should all be in millimetres and a caption below the figure should be included stating: “All measurements are in millimetres.” The thickness of the plates is quoted wrongly in Figure 18.7.1.1, it is listed as 1.2 cm while it should be 10 mm.

6 **Mixed transport of explosives and nitrates**

There was a proposal not to include the UN numbers and thus to allow all inorganic nitrates, however, this would allow nitrates of the transitional elements. Some of those elements (e.g. chromium) are known to be incompatible with ammonium nitrate. It was therefore decided to only allow nitrates of alkali metals and alkaline earth metals from Division 5.1 to be shipped with blasting explosives (except UN0083). This would cover the practical needs of the industry concerned.

7 **Carriage of signals and flares in Divisions 1.4G and 1.4S**

The Working Group agreed that it is possible to have marine distress signals and smoke signals in Hazard Divisions 1.4G and 1.4S, also taking the definitions of these products into account and supported the proposal from the United Kingdom to include three new entries in Class 1 for these articles.

8 **Classification of HOBt**

Germany briefly introduced the papers. The expert from the United States remarked that this product is frequently used in the pharmaceutical industry and is shipped in increasing quantities. In the near future the product will typically be shipped in 100 kg bags.

The proposal now includes

- the anhydrous HOBt (proposed as 1.3C);
- the anhydrous HOBt wetted with water (proposed as 4.1); and
- the monohydrate HOBt (proposed as 4.1).

The crystal water in the monohydrate corresponds to approximately 12% water and would be released at a temperature of about 80° C. The wetted anhydrous version would not easily convert into the monohydrate molecule, so both variations need to be mentioned.

Some experts remarked that no thermal stability test according to test 3(c) has been performed and suggested that the deflagration incident mentioned in INF.22 may be (partly) attributed to thermal instability.

Other experts asked for clarification on the 6(c) test performed with the wetted anhydrous version, especially when comparing the Koenen test results with the 6(c) test.

The Working Group supported the proposal to include:

- 1-hydroxybenzotriazole, anhydrous into Hazard Division 1.3C; and
- 1-hydroxybenzotriazole, with not less than 20% water, by mass into Hazard Division 4.1 as a desensitised explosive

More details, especially on the details of the 6(c) test, for 1-hydroxybenzotriazole, monohydrate needs to be supplied to the Sub-Committee to justify an entry in Division 4.1.

9 **Additional test for determining 1.4S classification**

The expert from Canada briefly introduced the paper which is meant to assess a property in the definition of 1.4S currently not addressed in the test scheme. He also stated that, where it came to shaped charges, Australia reclassifies shaped charges with an explosive content of 39 g and less as 1.4D and shaped charges with more than 39 g as 1.1D (see bulletin WH 04.01.04 on worksafe.nt.gov.au) .

Several experts expressed their sympathy for the proposal, a special concern is the air transport of shaped charges. The effects shown in the Canadian proposal could impose severe damage to an aircraft.

Other experts were of the opinion that the results of the 6(a) test could be used to assess the effects on the package and that a separate test was not necessary.

DGAC pointed out that the proposal contained no method to differentiate between the effects of the “means of initiation” versus the effects of the tested devices which could lead to misinterpretation of the test results. DGAC requested that the proposal be amended to include a method to make such a differentiation.

Canada will prepare a new proposal including text to be inserted in the Manual of Tests and Criteria.

10 Proposal for amendment to Chapter 2.1 of the GHS (Explosives)

SAAMI introduced its paper. Sporting ammunition is typically sold in the USA in retail shops where they are outside the transport packaging. An exploding bomb symbol on these packages could send the message that it is not appropriate to have these products in a store. The fire services might be confused and decide not to fight a fire whilst the current drill is that 1.4S products can be approached in case of a fire. There are also security issues with the exploding bomb symbol.

The experts from the USA and France had sympathy for the proposal and agreed that applying exploding bomb symbols to 1.4S products is not appropriate. They believed that a more general approach for 1.4S products should be used, not just only for sporting ammunition.

Other experts stressed that, once outside the packaging, some products might behave differently and show more hazardous effects. For several situations, like consumer use, it is important to communicate that the product contains materials with explosive properties.

It should be made clear, e.g. by training and information, that the exploding bomb symbol does not necessarily mean mass explosion hazard.

The attention was drawn to another proposal (ST/SG/AC.10/C.4/2006/11 by CEFIC) where the opposite is proposed: to assign the exploding bomb sign to Hazard Divisions 1.5 and 1.6. The majority of the Working Group was not in favour of removing the exploding bomb sign for certain 1.4S products. A new proposal from SAAMI, including a more specific description of the products concerned, will be prepared.

11 Physical hazards due to explosive properties

The four issues raised by Germany are dealt with in the sub-sections a) to d) below. It was acknowledged that the current Manual of Tests and Criteria was written for transport purposes. Furthermore, GHS does not address substances having more than one hazardous property. These shortcomings might be solved by introducing a new sub-paragraph in 1.3.2.4.5 of the GHS document.

a) *Ammonium nitrate*

The possibility raised by Germany to introduce a new sub-category for ammonium nitrate in the GHS was felt not appropriate by the majority of the Working Group. Germany's main concern was that certain types of ammonium nitrate classified as oxidizers may have an explosion hazard but a warning to that effect is missing in the current system. Since the GHS does not have Special Provisions, it was felt that a note to Table 2.14.1 was the best solution. This new note would be the Note 1, the existing note would become Note 2.

b) *Substances having explosive properties but not classified as explosives*

The group considered how the explosive properties of this category of substances were assessed. On the one hand, it would involve substances having explosive properties based on mechanical sensitivity (like friction and impact) and heating under confinement (Koenen test) as currently used in the EU. On the other hand, it also includes substances having explosive properties in Test Series 1 and 2 and which are, for transport, classified outside Class 1 based on the results of the 6(c) test. The group was not convinced that mechanical sensitivity alone would necessarily address all explosive properties since it only concerns initiation and not propagation.

Germany will provide additional information, including examples of substances and test data, in the next biennium. The expert from ICCA offered support in drafting the additional information.

c) *Explosive substances and articles not packaged for transport*

The group confirmed the need to give more guidance in the GHS document on how to deal with unpackaged and repackaged explosives, especially since the classification and related hazards are often dependent on the packaging. This could be solved by adding a note to Table 2.1.2 giving guidance on symbols, signal words and hazard statements to be used.

d) *Desensitized explosives*

In GHS, explosives wetted with water or alcohols, or diluted with other substances to suppress their explosive properties, are dealt with in the Chapter on explosives. It is recognised that they may be treated differently for some regulatory purposes, e.g. transport. However, the storage regulations for these substances in most of the countries represented in the Working Group treat them as flammable liquids or solids.

It was felt not appropriate to include these substances in the Chapters 2.6 or 2.7 of the GHS document since they may not have flammable properties. The group identified four possible solutions:

- make no changes, leave it to national legislation;
- continue to deliberately classify these substances inappropriately;
- create a new chapter in Part 2 of the GHS document, dealing with desensitized explosives; or
- create a new Division 1.7 for these substances.

Although the last option may have a large number of consequential amendments, text revisions and regulatory consequences, the group had a preference for the last option. The Sub-Committees on TDG and GHS are invited to decide on the four options.

To make the current situation more clear, a reference to the newly proposed text in paragraph 1.3.2.4.5 is to be added to Note 2 to Table 2.1.1 of the GHS document.

12 **Amendments to the Manual of Test and Criteria**

The proposals from Germany contained in 29/INF.23 and 27/INF.4 were discussed and accepted by the Working Group. The expert from France was concerned that these changes might lead to higher costs in performing the Koenen test.

13 **Test Series 8 – Results from Modified Test 8(b)**

The expert from the UK presented his informal paper containing information on Test Series 8(b). His experience was that there is no need to change test 8(b). The use of only aluminium tanks was considered a matter for national legislation.

14 **Test Series 8 – Classification of UN 3375**

Several experts stated that the proposals contained in INF.51 from Australia were submitted much too late in the process. The creation of UN3375 for ANEs in Division 5.1 was done to harmonize the classification and transport conditions worldwide, since these products were assigned to several different Classes and Divisions or treated as non dangerous.

Canada was in principle in favour of the proposal, as it reflected their national situation. It was suggested that the proposal could be altered to allow these substances in Division 5.1 in aluminium tanks only.

There was no support from the majority of the group for the proposal from Australia.

15 Note to 2.1.3.5.5

The expert from the UK had noted a shift in the recent fireworks formulations to circumvent the definition of flash composition given in note 2 to the default fireworks classification table. It was felt that a performance based approach was more appropriate than a description based on a chemical formulation. The Time/pressure test, as described in Series 1 and 2 Type (c), was used with 1 g of 13 different pyrotechnic compositions from various types of fireworks. The results show that several of the tested substances were equivalent to or exceeded the power of flash compositions conforming to Note 2. The expert from Japan had similar test results. His paper needed to be translated before it could be presented to the group.

The expert from the USA informed the group on tests currently being performed with the Cap test (Test 5(a)) with an electric match as an initiator. The main parameter in the tests is the particle size of the metal in flash compositions but the tests also include perchlorate/benzoate mixtures.

There was general support for the proposed performance based approach, pending further data. The UK expert announced that he would submit a proposal to amend Note 2 to paragraph 2.1.3.5.5 for the December 2006 meeting.

16 Proposal of amendments to the procedure for classification of ammonium nitrate emulsions, suspensions and gels (Figure 2.1.4 in Chapter 2.1 of the GHS)

The Working Group agreed that the proposal contained in INF.41 was only a consequential amendment and supported the proposed change.

CONSEQUENTIAL AMENDMENTS TO THE 14TH EDITION OF THE MODEL REGULATIONS, THE 1ST REVISED EDITION OF THE GHS DOCUMENT AND THE 4TH REVISED EDITION OF THE MANUAL OF TESTS AND CRITERIA

- 1 In the Manual of Tests and Criteria:
 - Renumber the current Test 8(d) in section 18.7.1 to Test 8(d)(i);
 - Insert a new section 18.7.2 for Test 8(d)(ii)
 - Use the text in the Annex to ST/SG/AC.10/C.2/2005/11, but renumber 18.7.1 to 18.7.2 in this text
 - Leave the square brackets around 85 mm in item (a) in the 18.7.1.2 in .../2005/11 awaiting new test data to justify a new vent size in December 2006
 - If no additional test data is received, the square brackets can be removed
 - Change the measurements in section (a) of paragraph 18.7.1.2. and Figure 18.7.1.1. to millimetres and insert a caption below the Figure reading: “All measurements are in mm.”
 - Correct the thickness of the plates from 1.2 cm to 10 mm

- 2 Change the text in 7.1.3.2.3 of the Model Regulations to: “Blasting explosives (except UN 0083 Explosive, blasting, type C) may be transported together with ammonium nitrate (UN 1942 and 2067) and alkali metal nitrates (e.g. UN 1486) and alkaline earth metal nitrates (e.g. UN 1454) of Class 5.1 provided the aggregate is treated as blasting explosives under Class 1 for the purposes of placarding, segregation, stowage and maximum permissible load.”
- 3 Include the following entries into the Dangerous Goods List, in Chapter 3.2 of the Model Regulations:

| UN No. | Name and description | Class or Division | | | | Limited quantities | Packing Instruction |
|--------|------------------------|-------------------|-----|-----|-----|--------------------|---------------------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 0xxx | SIGNALS DISTRESS, ship | 1.4G | | | | NONE | P135 |
| 0xxx | SIGNALS DISTRESS, ship | 1.4S | | | | NONE | P135 |
| 0xxx | SIGNALS, SMOKE | 1.4S | | | | NONE | P135 |

- 4 Include the following entries into the Dangerous Goods List, in Chapter 3.2 of the Model Regulations:

| UN No. | Name and description | Class or Division | | | | Limited quantities | Packing Instruction |
|--------|---|-------------------|-----|-----|-----|--------------------|---------------------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 0xxx | 1-HYDROXYBENZO-TRIAZOLE, ANHYDROUS, dry or wetted with less than 20% water, by mass | 1.3C | | | | NONE | P114(b) |
| xxxx | 1-HYDROXYBENZO-TRIAZOLE, ANHYDROUS, wetted with not less than 20% water, by mass | 4.1 | | I | 28 | NONE | P406 |

In Chapter 4

Add PP48 to Packing Instruction P114(b) and P406 reading: “For UN 0xxx and xxxx, metal packagings shall not be used.”

Amend PP50 in P114(b) to read: “For UN Nos. 0160, 0161 and 0xxx, inner packagings are not necessary when drums are used as the outer packaging.”

- 5 Include a new sub-section after the current text in paragraph 1.3.2.4.5 of the 1st revised Edition of the GHS document reading:
 “Certain physical hazards (e.g. due to explosive or oxidizing properties) may be altered by dilution, as is the case for desensitized explosives, by inclusion in a preparation or article, packaging or other factors. These hazards should be assessed for the actual situation (e.g. transport, storage, etc.). It should be noted that in chapters 2.1 to 2.16 classification procedures are mainly based upon transport regulations and that for other purposes, e.g. storage, those procedures should take experience and expertise into account.”
- 6 – Renumber the existing Note to Table 2.14.1 of the 1st revised Edition of the GHS document to Note 2
- Insert an new Note 1 to Table 2.14.1 reading:
 “Some oxidizing solids may also present explosion hazards under certain conditions (e.g. when stored in large quantities). For example, some types of ammonium nitrate may give rise to an explosion hazard under extreme conditions and the Resistance to Detonation Test (Reference: IMO BC Code 2005; Code of Practice for Solid Bulk Cargoes, Annex 3, Test 5) may be used to assess this hazard. Appropriate comments should be made in the Safety Data Sheet.”

- 7 Insert a note to Table 2.1.2 of the 1st revised Edition of the GHS document reading:
“**NOTE:** Unpackaged explosives or explosives repacked in packages other than the original or similar packages shall have:
- the exploding bomb symbol;
 - the signal word ‘danger’ and
 - the hazard statement ‘explosive, mass explosion hazard’
- unless the hazard is shown to correspond to one of the columns of this table, in which case the corresponding symbol, signal word and/ or the hazard statement shall be assigned.”
- 8 Insert the following text after ‘(e.g. transport)’ in Note 2 to Table 2.1.1 of the 1st Revised Edition of the GHS document: “, see 1.3.2.4.5.”
- 9 – In sections 11.5.1.2.1, 12.5.1.2.1, 18.6.1.2.1, and 25.4.1.2.1 of the 4th Revised Edition of the Manual replace the words "of suitable quality" in the second sentence with "with the specification DC04 (EN 10027-1, Europe), or equivalent A620 (AISI/SAE/ASTM, USA), or equivalent SPCEN (JIS G 3141, Japan).” and delete the third sentence.
- Insert the following text at the end of the mentioned sections: “For quality control of the steel tubes 1% of the tubes from each production lot shall be subjected to quality control and the following data shall be verified:
- (a) the mass of the tubes shall be 26.5 ± 1.5 g, tubes to be used in one test sequence shall not differ in weight by more than 1 g;
 - (b) the length of the tubes shall be 75 ± 0.5 mm;
 - (c) the wall thickness of the tubes measured 20 mm from the bottom of the tube shall be 0.5 ± 0.05 mm.
 - (d) the bursting pressure as determined by quasi-static load through an incompressible fluid shall be 30 ± 3 MPa.”
- 10 In Figure 2.1.4 of the 1st Revised Edition of the GHS document, change the text “Too unstable to be classified as an oxidizing liquid or an oxidizing solid. Go to Figure 2.1.2, Test Series 1” to: “Classify as unstable explosive”
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