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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

Twenty-seventh session, 4-8 July 2005  
Item 3 (b) of the provisional agenda

EXPLOSIVES, SELF-REACTIVE SUBSTANCES AND ORGANIC PEROXIDES

Miscellaneous proposals

Additional test for classifying determining 1.4 S classification  
Evaluation of properties in the definition not currently tested

Transmitted by the expert from Canada

**Introduction**

1. At present the classification of articles and substances into 1.4 Compatibility Group S relies on the results of solely the 6(c) Test. However, the definition for 1.4 S includes characteristics that are not determined by the 6(c) Test.
2. The definition for 1.4 S classification is as follows:

Paragraph 2.1.1.4 (d) of the Recommendations on the Transport of Dangerous Goods Model Regulations”, thirteenth revised edition:

“Division 1.4                      Substances and articles which present no significant hazard

This division comprises substances and articles which present only a small hazard in the event of ignition or initiation during transport. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire shall not cause virtually instantaneous explosion of almost the entire contents of the package.

***NOTE:** Substances and articles of this division are in Compatibility Group S if they are so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast and projection effects are limited to the extent that they do not significantly hinder fire-fighting or other emergency response efforts in the immediate vicinity of the package.”*

3. The Manual of Tests and Criteria provides various regimes for testing products as candidates for Class 1: Series 1 to 4 define acceptability into Class 1. Series 5 defines acceptability into 1.1 or 1.5. Series 6 defines acceptability into 1.1, 1.2, 1.3, 1.4 or 1.4 S. Series 7 and 8 cover 1.6 and ANE's.
4. The 6(a) and 6(b) tests look at accidental functioning. However, the criteria of mass explosion and communication leading to mass explosion are set for classification into 1.1. No criteria are given for the other divisions.
5. The 6(c) test classifies into 1.1, 1.2, 1.3, 1.4, and 1.4 S. However it does so by virtue of behaviour in a fire. That is, the test looks at behaviour of the substance or articles after the package has been degraded by fire.
6. The portion of the definition for 1.4 S, “any hazardous effects arising from accidental functioning are confined within the package”, this not addressed. The substance or the article is not initiated or ignited in a manner that could determine effects outside the package if the substance or article functioned as intended. There is a possibility that products classified as 1.4 S based on behaviour in a fire may produce a hazardous effect when functioned. Examples are small amounts of detonating explosive which will burn in a fire but would detonate if initiated and would possibly produce hazardous effects outside the package. There has been at least one incident on Canada where a cheaper design of shaped charge initiated when dropped onto the floor. Packaging might have cushioned the impact and prevented initiation but it might not have.
7. Initiation or ignition as a result of fire, after the package is degraded, may produce different results from functioning with the intended means of ignition or initiation. Knowledge of the behaviour of the article or substance in both cases is needed to allow proper classification.

### **Proposal**

8. The expert from Canada proposes that a new test, the 6(d), be added to determine those requirements for which there is no current test. The 6 (a) test can serve as a basis for this test to determine effects outside the package in the case of ignition during transport. The 6(a) test would be repeated but without any confinement. After completing the test series 6(a), 6(b) and 6(c), 6(d) would be conducted.
9. The product in question would be initiated in the same manner as prescribed in Test Series 6(a). Items provided with their own means of initiation would use those means unless it is impractical or unsafe to do so. For such a case a remote activating initiation system should be prepared to remove testing personnel from the vicinity of any effect. If the item did not include its own means of initiation, the intended means of initiation should be used.

**Effect**

10. The definition of a 1.4 S article or substance requires that any hazardous effects be *confined to inside* the package: the package cannot be perforated (projections are confined); the package must not allow flames to come through (thermal effects are confined to inside the package) and the package must remain intact (blast effects are confined to within the package). This can be evaluated visually after the event and with videos for the flames. The setting of these criteria is based on the definitions: the effects must be confined.

**Other considerations**

11. The proposed criteria for a 1.4 S, specifically that hazardous effects be confined to the package, may have some effect on classification because this characteristic was never evaluated. However, the expert from Canada wishes to point out that this proposal does not suggest that hazardous effects are to be eliminated but only that they be confined to the package. If articles or substances already classified fail to meet this proposed test, they also fail to meet the definitions for 1.4 S and are not properly classified. *The solution is not to change criteria to allow these substances or articles into this classification but to change the packaging so that they do meet the intentions of the definition.*
12. It must be pointed out that though such a test was never a requirement, Competent Authorities did have the option of using such a test in support of their decisions. The inclusion of such a test in the prescribed test regime will allow for more consistent uniformity in classification.
13. Canada has carried out such tests on shaped charges which had been previously classified as 1.4 S. Photographs of the material after the unconfined 6(a) are included in this paper at the end.
14. As a result of this testing, shaped charge previously classified as 1.4S have been, with few exception, reclassified in Canada as 1.4 D. 1.4 D was chosen because the results were not consistent with other possible classifications. However, it is recognized that some designs of shaped charges may behave as 1.2.
15. At this stage the expert from Canada does not propose additional testing for 1.4. The definition calls for “effects largely confined to the package and no projection of appreciable size or range is to be expected”.
16. The words “largely”, “appreciable sites or range” are subjective and need further development.
17. A possible approach would be to base the criteria on those same criteria either currently accepted for the 6(c) Test. That is:
  - 17.1 For projection criteria 1.4 energy level would be used with no fragments over 20 J. This is to be measured as in the 6(c) test by no perforation of the aluminum witness screens placed at 4 m from the package.
  - 17.2 The fragment distribution as currently set out in the Manual of Tests and Criteria would be used: not more than 10 metallic projection, each with a mass exceeding 25 g are thrown more than 50 m from the package; no metallic projection with a mass exceeding 150 g is thrown more than 15 m from the package.

17.3 For the other requirements the following criteria are offered for consideration:

- no fireball or jet of flame beyond 4 m;
- no fiery projection thrown further than 15 m
- a burning time of less than 33 second for 100 kg net explosives weight with the appropriate scaling and measurement factors.

Such criteria would be in line with current 1.4 other than Compatibility Group S classifications.

## Figures

Figure 1 - Before Firing

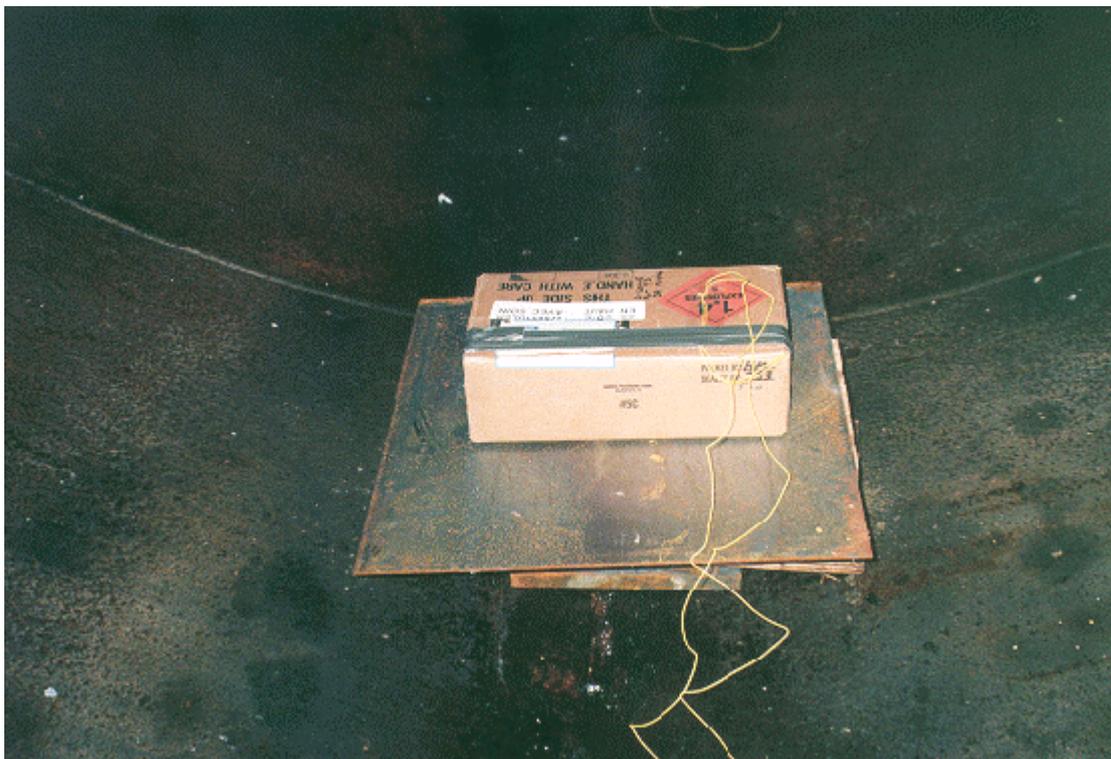


Figure 2 - Remnants after firing



Figure 3 - Remnants after firing



Figure 4 - Hole in steel witness plate.



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