

## 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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Explosives and related matters

### Addendum to ST/SG/AC.10/C.3/2010/18 (SAAMI) Division 1.4S Limited Quantities

Transmitted by the Sporting Arms & Ammunition Manufacturers'  
Institute (SAAMI)

#### Introduction

1. The Sporting Arms & Ammunition Manufacturers' Institute (SAAMI) has proposed allowing certain 1.4S explosives to be transported as Limited Quantities in ST/SG/AC.10/C.3/2010/18. As explained in Paragraph 4 of the proposal, the result is elimination of the transport document for land transport only, and eventual harmonization of the marine mode with existing segregation requirements for land. Marking is modified to conform with Limited Quantity requirements. Classification, testing and packaging are unaffected. Labeling and placarding are already not required and are unaffected ( Reference UNMR 5.2.2.2.1.4; 5.3.1.1.2(a), and corresponding IMDG requirements ).

2. Limited Quantities status is desired to ease transportation and address the concerns of authorities other than national competent authorities who do not differentiate between 1.4S and other explosives and ban all Class 1 in their systems (for example, ports). The goal of this proposal is to ensure that the assignment of these goods to Class 1 is manageable, so that industry does not believe that getting out of Class 1 is the only viable option. As explained in the Guiding Principles the numbering of classes does not indicate hazard precedence, however the logistical reality is that Class 1 is often banned and differentiations within this class are often ignored, as is exemplified by no Class 1 being eligible for Limited Quantities.

#### Discussion

3. In this informal paper, SAAMI is offering an additional test for Limited Quantities eligibility, equivalent to passenger aircraft criteria. In this paper SAAMI also comments on the technical aspects of the bonfire test criteria for 1.4S.

#### Additional Criterion

4. In the ICAO TI, Part 3, Paragraph 4.1.2 states "Only dangerous goods which are permitted on passenger aircraft and which meet the criteria of the following classes,

divisions and packing groups (if appropriate) may be carried under these provisions for dangerous goods in limited quantities.”

5. The 6(d) single package test is accepted by ICAO as an effective determinant allowing transport of Class 1 by passenger aircraft. SAAMI proposes that this criterion be used as a conservative basis to differentiate which 1.4S products are eligible for Limited Quantities in surface transport.

6. Although cartridges in UN 0012, UN 0014 and UN 0055 are not subject to the 6(d) test, testing was conducted on a broad range of sizes. This test requires that any hazardous effects arising from functioning of the articles are confined within the package. Notwithstanding that accidental ignition is difficult, cartridges consistently pass all the 6(d) criteria:

- (a) Denting or perforation of the witness plate beneath the package;
- (b) A flash or flame capable of igniting an adjacent material such as a sheet of  $80 \pm 3$  g/m<sup>2</sup> paper at a distance of 25 cm from the package;
- (c) Disruption of the package causing projection of the explosives contents; or
- (d) A projection which passes completely through the packaging (a projection or fragment retained or stuck in the wall of the packaging is considered as non hazardous).

7. Cartridges in UN 0012, UN 0014 and UN 0055 pass the test to the extent that it is often impossible to determine whether an ignition occurred until the package is opened.

8. Very small cartridges pass the test in the pasteboard inner package alone, without the benefit of an outer package. However, the outer package will be present as the proposal makes no change to packaging requirements.

9. The Sub-Committee may wish to consider how best to use the 6(d) test as a reliable criterion to determine which 1.4S explosives are eligible for Limited Quantities.

## Comments on Existing Criteria

10. As a result of SAAMI’s proposal, some concerns have been voiced about existing bonfire test results and whether cartridges in UN 0012, UN 0014 and UN 0055 meet all the test criteria, which are:

- (a) A fireball or jet of flame which extends more than 1 m from the flames of the fire;
- (b) A fiery projection emanating from the product is thrown more than 5 m from the edge of the packages or unpackaged articles;
- (c) An indentation in any of the witness screens of more than 4 mm;
- (d) A metallic projection with a kinetic energy exceeding 8 J as assessed by the distance - mass relation given in Figure 16.6.1.1;
- (e) A burning time of the product measured to be less than 330 seconds for 100 kg net explosive mass (see 16.6.1.4.8: Notes for scaling time measurements in evaluating thermal flux effects);

11. In particular, some cartridges in UN 0012, UN 0014 and UN 0055 may indent the screens more than 4mm. A review of the development of this criterion indicates that the criterion previously allowed no dent in the 2<sup>nd</sup> Edition of the UN Manual of Tests & Criteria.

12. In the mid-1990's an intercessional working group of explosives experts was convened to address the inclusion of explosives into 1.4S which could discharge projectiles at near super-sonic speeds. One result was that the no-dent criterion was modified to four millimetres. A review of contemporary working papers at the time shows that the four millimetre dent criterion is designed to be protective of bare skin at five metres. Dents were found to be an ambiguous (scientifically "indiscrete") measurement. As a result, more sophisticated witness stands were proposed, but these were rejected to maintain simplicity.

13. The usefulness of the dent criterion is caveated as redundant and conflictive to the other projectile hazard criterion - the 8 joule energy level, selected as safe for people without protective equipment in the immediate vicinity. As evidenced in test reports, projectiles equal to or less than the 8 joule mass-distance criterion routinely exceed the four millimetre dent criterion. Of the two projectile hazard metrics, the 8 joule mass-distance is based on research and experimentation of greater breadth and depth.

14. Thus it is necessary to bear in mind the guiding principles of the UN Manual of Tests & Criteria:

*"1.1.2 It should be noted that the Manual of Tests and Criteria is not a concise formulation of testing procedures that will unerringly lead to a proper classification of products. It therefore assumes competence on the part of the testing authority and leaves responsibility for classification with them. 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. In some cases, a small scale screening procedure may be used to decide whether or not it is necessary to perform larger scale classification tests. Suitable examples of procedures are given in the introductions to some test series and in Appendix 6."*

15. As further examples of the necessity to interpret test results, typical 1.4S explosives can be made to fail both the dent/perforation and mass-distance criteria with Division 1.2 results (e.g. bombs) by simply throwing them by hand. Unswerving adherence to these criteria deviates from the intent to protect against explosively propelled projectiles.

16. The goal of the 4 millimetre dent criterion, i.e. protecting bare skin at five metres from a fire is indicative of products of extremely low hazard, and is not a realistic criterion for the best possible explosive classification; especially considering that normally no product can drop out of Class 1, as is usual for other classes when a product does not meet Packing Group III criteria. We should bear in mind that other classes of dangerous goods often would not pass 1.4S bonfire criteria relative to fire ball (1 metre), fiery projections (5 metre) or hazardous projectiles (8 joule or 4 millimetre dent). Therefore some amount of hazard is accepted, and zero hazard tolerance contravenes the Committee's stated goal for a realistic assessment. Fire fighters in full gear may be at risk if operating 5 metres from a dangerous goods fire of any class, and preferentially would control a sporting cartridge fire from greater distances in as little as ten seconds, as shown in the SAAMI fire training video. Therefore it is unrealistic to expect that persons with no protective clothing, helmet or respiratory protection may reside unharmed at 5 metres from a fire of Division 1.4S products or other dangerous goods.

17. Accordingly, the dent criterion must be used with judgment as one component of a greater evaluation, and in light of overall data. In the bonfire test, cartridges in UN 0012, UN 0014 and UN 0055:

UN 0014 and UN 0055:

- (a) Do not contribute to heat flux to a measurable level above the bonfire itself
- (b) Have no measurable flame balls

- (c) Have no flaming projections
- (d) Produce projectiles not exceeding 8J in energy, the UN standard for persons without protective gear

## **Conclusion**

18. An evaluation of bonfire results according to the United Nations Manual of Tests and Criteria demonstrates that sporting cartridges are properly classified in Division 1.4S. The 6(d) test, which is indicative of passenger aircraft eligibility, has been identified as a logical metric to differentiate and restrict eligibility for Limited Quantities on a conservative basis to only the safest Division 1.4S products. Cartridges in UN 0012, UN 0014 and UN 0055 conform to 6(d) test criteria. The Limited Quantities methodology proposed in ST/SG/AC.10/C.3/2010/18, augmented with an additional requirement to pass the 6(d) test, is potentially inclusive of any Division 1.4S entry meeting the additional criteria, subject to thorough and individual consideration like that undergone by the cartridges proposed here.

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