

## 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, SELF-REACTIVE SUBSTANCES AND ORGANIC PEROXIDES

Ammonium nitrate emulsions, suspensions and gels

Test Series 8(d)

Comments on ST/SG/AC.10/C.3/2004/24

Transmitted by the Expert from Canada

#### Background

ST/SG/AC.10/3/2004/24 proposes a modified version of the Vented Pipe Test (MVPT) as the optional Test 8(d) in Series 8. The proposal is very similar to that put forward in the 2003 INF paper UN/SCETDG/24/INF.45 "A review of the modified vented pipe test". It proposes modifications to equipment and procedures, and more importantly to the criteria used to judge the outcome of the test. We have concerns with some of these proposals.

#### Comments

- (a) Most of the equipment and procedural changes suggested should improve the test, making it more reliable and reproducible. However one change, the suggestion to increase the vent size from 75mm to 87mm diameter, does not seem to be supported by any rationale, and presumably represents a significant decrease in the severity of the test.
- (b) It is proposed to use run-time criteria in the MVPT to establish whether a product that does not contain chemical sensitizers can be classified as Class 5.1 as opposed to Class 1.5. If a material does not vent completely or rupture the vessel within the "run time for rupture", then it can be classified as 5.1. The run time for rupture is defined as 2.8 times the period required to heat an equivalent volume of water to 100°C under the same conditions. The factor of 2.8 is not explained in ST/SG/AC.10/C.3/2004/24, but can be traced back to UN/SCETDG/24/INF.45. The factor of 2.8 comes from the time taken for a sample of ammonium nitrate prill to react completely in the MVPT. The inference is that ammonium nitrate falls into Class 5.1, so anything that reacts more slowly must be less dangerous and so must also fall outside of Class 1. We are not convinced this argument is supportable. To take the example of Test Substance 3 from ST/SG/AC.10/C.3/2004/24: the calculated "run time for rupture" is 80 minutes and 5 seconds and the material met the proposed criterion (would pass the test), even though it exploded and ruptured the vessel after 91 minutes and 19 seconds. The fundamental question we are trying to address with these tests is whether or not a

substance can undergo mass explosion in a fire and we believe it should not be possible to pass the test if the material explodes. There is not a good correlation between time to reaction and the severity of the reaction among the 87 MVPT trials reported in UN/SCETDG/24/INF.45, so we cannot accept time to reaction as a valid criterion. The physical configuration of materials during a fire is very difficult to predict, particularly in an accident scenario, and it is not advisable to assume a maximum duration for a fire. It is our belief that any test of this kind must be run to complete consumption of the material, particularly as explosion in MVPT tests almost always occurs near the end of the test when there is rapid venting occurring. Even though the value of 2.8 is in square brackets and subject to debate, we believe that the time-based approach is not supportable.

- (c) ST/SG/AC.10/C.3/2004/24 differs from UN/SCETDG/24/INF.45 in that it introduces an additional criterion for chemically sensitized materials. If the "run time for venting" is less than 1.4 times the period required to heat an equivalent volume of water to 100°C under the same conditions, then the material fails and cannot be classified as Class 5.1. There is no apparent justification for the value of 1.4 (which is admittedly in square brackets). As with the "run time for rupture", this approach does not address the fundamental question of whether or not the material is susceptible to mass explosion in a fire. Materials that simply vent quickly, but do not explode, fail the test. To take the example of Test Substance 5 from ST/SG/AC.10/C.3/2004/24: the calculated "run time for venting" is 33 minutes and 45 seconds, but the material fails the test, even though it did not explode, as it vented after 23 minutes and 59 seconds. The time to venting will depend very critically on the geometry of the test and cannot be used as an indication of the mass explosion hazard.

## Conclusion

If we are to continue to use the vented vessel test, we could adopt some of the experimental improvements outlined in ST/SG/AC.10/C.3/2004/24, such as the use of a standard heat source. However, the test should always be run to full consumption of the product and the time-based criteria proposed in ST/SG/AC.10/C.3/2004/24 should not be used. The pass-fail criterion for the test should be based on whether or not the material explodes, irrespective of the run time.

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