UN/SCETDG/21/INF.16

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-first session, 1-10 July 2002, agenda item 3 (b))

EXPLOSIVES, SELF-REACTIVE SUBSTANCES AND ORGANIC PEROXIDES

Classification of ammonium nitrate emulsions, suspensions and gels

Manual of Tests and Criteria – Test 8(d)

Transmitted by the experts from Norway and Sweden

Summary of ANE tests in Finland, Sweden and Norway

1. Background

Large quantities of Ammonium Nitrate Emulsion (ANE) matrixes are transported by road, rail and sea. Transportation regulations are very different in different countries, and the UN is working to come up with a new recommendation for the classification of ammonium nitrate emulsions, suspensions and gels. To support this work the explosives industries in the Nordic countries (Finland, Sweden and Norway) have assumed responsibility for carrying out USA Vented Pipe Tests (VPT) and full scale tests, and reporting back to the UN's Sub-Committee of Experts on the Transport of Dangerous Goods. This paper is a short summary of the work done up to now by Forcit OY, Kimit AB and Dyno Nobel Europe.

2. USA Vented Pipe Test (VPT)

32 USA Vented Pipe Tests have been conducted in Finland. Both standard and modified vented pipes were tested. Dry birch wood was used as a heat source in all the tests, except for one were oil was used. In all cases (except one) we used completely filled vessels, containing approximately 60 kg of ANE. The following variations were conducted.

- Vessel materials were made of steel and Aluminium, all with wall thickness of 10 mm.
- A wide range of ANE types were tested, from straight AN emulsion with 17% water up to 30% water. In addition, ANE's with up to 12% SN or 20% CN were tested.
- Nozzle opening ranged from 3" up to completely open.
- The length of the nozzle pipe was 150 mm and 0 mm.

The main conclusions from these tests are:

- The time lapse from ignition to explosion was between 30-50 minutes. (Only 18 min. for the oil fire)
- With a nozzle opening of 3" all ANEs seem to explode/detonate, while with larger openings none of the emulsions seem to explode/detonate.
- Kimit AB, Forcit OY and Dyno Nobel ASA cannot recommend the proposed classification method "Test 8(d): USA vented pipe test" as a way of classing ANE matrixes.

The experiments in Finland have resulted in 3 reports and 2 videos on CD.

The references to the reports are:

1) Evaluation of USA Vented Pipe Test; Written by Jan Vestre, Dyno Nobel; November 2000.
2) Further Characterisation and Development of the USA Vented Pipe Test; Written by Hans Karlström, Kimit AB; September 2001.
3) Further studies of the USA vented pipe test without the vent pipe and summary of all tests conducted in Keuruu 2000.2001; Written by Folke Nilimaa and Pekka Heino.

Attachment 1 gives an overview of the 32 VPT tests performed.

3. Full scale burning test

Two full-scale burning tests have been performed. The first one was conducted at Halkavarre, in northern Norway in September 1996. The second one was conducted at Kuosanen near Kiruna in northern Sweden in April 2002.

- Both tanks were constructed out of aluminium, in accordance with ADR regulations.
- 4 and 6 tonnes of emulsion matrix respectively were set on fire in the two experiments.
- In the Halkavarre experiment a special tank was used. It was heated by setting light to two truck tyres plus 20 litres of diesel and 10 litres of gasoline.
- In the Kuosanen experiment a discarded regular tanker was used. It was heated by setting light to a total of 8 truck tyres plus 400 litres of diesel.
- The second experiment progressed in an almost identical manner to the first experiment.

The main conclusions from these tests are:

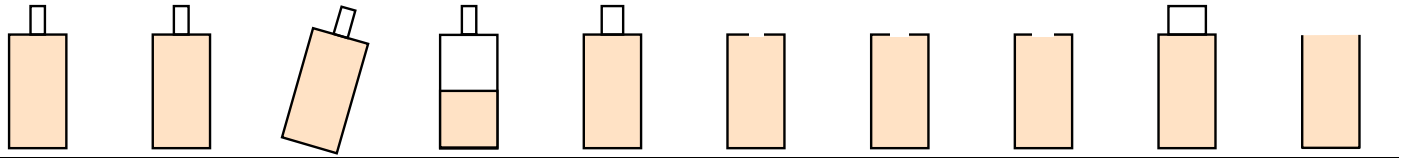
- In the first experiment the tank broke open 3 min and 50 sec. after the fire had started.
- In the second experiment the clamp holding a tight hatch gave way after 3 min, and combustion fumes vented through the top hatch. After 6 min and 50 sec. we could see black smoke changing to greyish/white indicating that emulsion matrix was burning.
- In both cases the tanks broke open relatively peacefully, and approximately 25 to 40% of the ANE remained unburned after the fire had died out.
- Forcit OY, Kimit AB and Dyno Nobel are of the opinion that it is very unlikely that an emulsion matrix in an aluminium tank would explode if exposed to an intense fire, since the aluminium softens and will not sustain confinement, which is necessary for an explosion to occur.

The full scale experiments in Norway and Sweden have resulted in 2 reports and 2 videos on CD.

The references to these two reports are:

1) A full scale ignition test of emulsion matrix in a 3 m^3 tank. Written by Jan Vestre, Dyno Nobel. September 1996

2) Full-scale burning test of a tank loaded with emulsion matrix. Written by Hans Karlström, Kimit AB; April 2002.



PRODUCTS	SV	SV Al	SV Al	SV 50%	4.5”	3”	3.5”	4”	8”	Open top
1. S.E. SMO/Pol.	2 tests									
2. SMO *AN + 12% SN, 15% H_20*										**
3. S.E. SMO/Pol. *30% H_20*										
4. SMO *AN + 6% SN, 15% H_20*	2 tests									
5. SMO *AN, 17% H_20*		*								
6. KIMIT MATRIX										
7. S.E. SMO										
8. SMO *AN + 20% CN, 15% H_20*										
9. VIHTAV. MATRIX										
10. AN-E										
11. INGREDIENTS										
12. OIL PHASE										
13. KIMULUX *Microspheres*										

LEGEND

= Vessel undamaged

= Vessel fragmenetd into large pices (explosion)

= Vessel fragmented (detonation)