

**Sub-Committee of Experts on the
Transport of Dangerous Goods**
(Nineteenth session,
2-6 July 2001, agenda item 8 (b))

EXPLOSIVES, SELF-REACTIVE SUBSTANCES AND ORGANIC PEROXIDES

Classification of ammonium nitrate emulsions, suspensions and gels

Preliminary Results from Proposed Test Series 8

Transmitted by the Experts from Canada, France, Germany and the United Kingdom

1. Background

During the twenty-first session of the Committee of Experts on the Transport of Dangerous Goods, December 2000, it was decided to create a new entry for Ammonium Nitrate Emulsions, suspensions or gels, intermediate for blasting explosives (ANEs), in 5.1 (UN No. 3375).

It was further decided to have a working group meeting during the spring of 2001 to discuss and give suggestions for suitable test methods to be used when assigning substances to this new entry (Test Series 8). During the meeting several members presented results obtained using the proposed tests, and it was agreed that these results would be presented to the Sub-Committee at its July 2001 meeting in a format which included some details of the formulations tested. The methodology for Tests 8(a), 8(b) and 8(c) was generally supported, and results of these tests are presented here. Work on Test 8(d) will be the subject of a separate presentation coordinated by Sweden.

2. Results

Test 8(a) : Thermal Stability Test

The results are presented in the attached Table. As expected, all the emulsions proved to be thermally stable, even at 20 °C above the maximum transport temperature.

Test 8(b) : ANE Gap Test

The results given in the Table show that the test is capable of distinguishing between sensitized and unsensitized products. At least some of these tests were carried out at room temperature, so at actual transport temperature it is possible that some of the negative results may become positive.

Test 8(c) : Koenen Test

The results given in the Table show that the test is capable of distinguishing between sensitized and unsensitized products.

Test 8(a): Thermal Stability Test

| Substance | Sample Mass (g) | Test T (°C) | Result | Comments |
|--|------------------------|--------------------|---------------|---|
| Ammonium Nitrate | 408 | 102 | "-" | slight discolouration, hardened into lump Weight loss 0.5% |
| ANE-1 Ammonium Nitrate 76 Water 17 Fuel/emulsifier 7 | 551 | 102 | "-" | separation of oil and crystallized salts. Weight loss 0.8% |
| ANE-2 (sensitized) Ammonium Nitrate 75 Water 17 Fuel/emulsifier 7 | 501 | 102 | "-" | Some discolouration Weight loss 0.8% |
| ANE-Y Ammonium Nitrate 77 Water 17 Fuel/emulsifier 7 | 500 | 85 | "-" | Weight loss 0.1% |
| ANE-Z Ammonium Nitrate 75 Water 20 Fuel/emulsifier 5 | 510 | 95 | "-" | Weight loss 0.2% |
| ANE-G1 Ammonium Nitrate 74 Sodium Nitrate 1 Water 16 Fuel/emulsifier 9 | 553 | 85 | "-" | no rise in temperature |
| ANE-G2 Ammonium Nitrate 74% Sodium Nitrate 3% Water 16% Fuel/emulsifier 7% | 540 | 85 | "-" | no rise in temperature |

Test 8(b): ANE GapTest

| Substances | Density g/cc | Gap mm | Result | Comments |
|---|-----------------|-----------|--------|--|
| Ammonium Nitrate (low density) | 0.85 | 35 | "-" | Tube fragmented (large fragments) Plate bent VOD 2.3-2.8 km/s |
| Ammonium Nitrate (low density) | 0.85 | 35 | "-" | Tube fragmented (large fragments) Plate fractured |
| ANE-FA Ammonium Nitrate 69, Sodium Nitrate 12, Water 10, Fuel/emulsifier 8 | 1.4 | 50 | "-" | Tube fragmented (large fragments) Plate not perforated |
| ANE-FA | 1.44 | 70 | "-" | Tube fragmented (large fragments) Plate not perforated |
| ANE-FB Ammonium Nitrate 70, Sodium Nitrate 11, Water 12, Fuel/emulsifier 7 | ca 1.40 | 70 | "-" | Tube fragmented (large fragments) Plate not perforated |
| ANE-FC (sensitized) Ammonium Nitrate 75, Water 13, Fuel/emulsifier 10 | 1.17 | 70 | "-" | Tube fragmented (fine fragments) Plate perforated |
| ANE-FD (sensitized) Ammonium Nitrate 76, Water 17, Fuel/emulsifier 7 | ca 1.22 | 70 | "-" | Tube fragmented (fine fragments) Plate perforated |
| ANE-1 Ammonium Nitrate 76, Water 17, Fuel/emulsifier 7 | 1.4 | 35 | "-" | Tube fragmented into large pieces. Plate dented VOD: 3.1 km/s |
| ANE-2 (sensitized) Ammonium Nitrate 76, Water 17, Fuel/emulsifier 7 | 1.3 | 35 | "-" | Tube fragmented into small pieces. Plate perforated. VOD: 6.7 km/s |
| ANE-2 (sensitized) Ammonium Nitrate 76, Water 17, Fuel/emulsifier 7 | 1.3 | 70 | "-" | Tube fragmented into small pieces. Plate perforated. VOD: 6.2 km/s |
| ANE-G1 Ammonium Nitrate 74 Sodium Nitrate 1 Water 16 Fuel/emulsifier 9 | 1.29 | 70 | "-" | Tube fragmented . Plate indented. VOD 1968m/s |
| ANE-G3 (sensitized by gassing) Ammonium Nitrate 74 Sodium Nitrate 1 Water 16 Fuel/emulsifier 9 | 1.17 | 70 | "-" | Tube fragmented Plate punctured. |
| ANE-G2 Ammonium Nitrate 74 Sodium Nitrate 3 Water 16 Fuel/emulsifier 7 | 1.32 | 70 | "-" | Tube fragmented Plate indented. |
| ANE-G4 (sensitized by microballoons) Ammonium Nitrate 74 Sodium Nitrate 3 Water 16 Fuel/emulsifier 7 | 1.23 | 70 | "-" | Tube fragmented Plate punctured. |

| | | | | |
|---|------|----|-----|---|
| ANE-G5 Ammonium Nitrate 70 Calcium Nitrate 8 Water 16 Fuel/emulsifier 7 | 1.41 | 70 | "-" | Tube fragmented Plate indented. VOD 2061m/s |
|---|------|----|-----|---|

Test 8(c): Koenen Test

| Substances | Result | Comments |
|---|--------|---------------------------|
| Ammonium Nitrate (low density) | "-" | Limiting diameter: <1 mm |
| ANE-F1 Ammonium Nitrate 71, Water 21, Fuel/emulsifier 7 | "-" | |
| ANE-F2 Ammonium Nitrate 77, Water 17, Fuel/emulsifier 7 | "-" | |
| ANE-F3 Ammonium Nitrate 70, Sodium Nitrate 11, Water 12, Fuel/emulsifier 7 | "-" | |
| ANE-F4 Ammonium Nitrate 42, Calcium Nitrate 35, Water 16, Fuel/emulsifier 7 | "-" | |
| ANE-F5 Ammonium Nitrate 69, Sodium Nitrate 13, Water 10, Fuel/emulsifier 8 | "-" | |
| ANE-F6 Ammonium Nitrate 72, Sodium Nitrate 11, Water 10, Fuel/emulsifier 6 | "-" | |
| ANE-F7 Ammonium Nitrate 76, Water 13, Fuel/emulsifier 10 | "-" | |
| ANE-F8 Ammonium Nitrate 77, Water 16, Fuel/emulsifier 6 | "-" | |
| ANE-1 Ammonium Nitrate 76 Water 17 Fuel/emulsifier 7 | "-" | Limiting diameter: 1.5 mm |
| ANE-2 (sensitized by microballoons) Ammonium Nitrate 75 Water 17 Fuel/emulsifier 7 | "+" | Limiting diameter: 2 mm |
| ANE-4 (sensitized by microballoons) Ammonium Nitrate 70, Sodium Nitrate 11, Water 9, Fuel/emulsifier 5.5 | "+" | Limiting diameter: 2 mm |
| ANE-G1 Ammonium Nitrate 74 Sodium Nitrate 1 Water 16 Fuel/emulsifier 9 | "-" | |
| ANE-G2 Ammonium Nitrate 74 Sodium Nitrate 3 Water 16 Fuel/emulsifier 7 | "-" | |