Logistics-Explosives-Safety

Rolf Oechslin
RUAG Munition

Jørgen Schneider
Dyno Nobel Danmark A/S
Cost, safety, and compliance with international regulations are among the most important factors with respect to shipping explosives. The following article gives detailed insight into the transport and storage of explosives necessary for destroying mines and UXO.

by Rolf Oechslin, RUAG Munition and Jorgen Schneider, Dyno Nobel

Introduction

The humanitarian disaster caused by landmines and UXO listed throughout more than 60 countries has created an active and growing response from the international community that could eventually lead to the elimination of the use of landmines. As mines can be very dangerous or impossible to render safe, they often must be destroyed in situ. Quality demolition products are essential for the safety of the mine clearance experts. Delivering materials for the demining teams can be solved with reasonable economic resources and within a relatively short time; however, problems associated with explosives must be solved first. For example:
- Can explosives suitable for demining be delivered locally?
- Can explosives be transported to the site and stored safely?
- Is it possible to get explosives from neighbouring countries?

Transport of Explosives

To understand the transport of explosives, a few things must be clear. First, explosives are classified as dangerous goods. The dangerous goods covered by the heading of a class are defined on the basis of their properties. The assignment of Class 1 explosive substances and articles must be assigned to a division and a compatibility group. The division is based on the results of the tests described in UN regulations. Listed below are the various divisions and compatibility groups into which Class 1 explosive substances and articles are subdivided.

Compatibility Groups

Compatibility groups inform you about how to stuff a container and how it can be transported as well. Definitions of compatibility groups of substances and articles for division 1 are listed in Table 1 on the top right.

When stuffing a container with explosives, you are allowed to use normal goods in the container as well, but under no circumstances can it contain other dangerous goods. Table 2 shows what is possible to mix when stuffing a container.

By putting division number and compatibility group together, it is possible to store and transport the explosives by sea or air in accordance with International Maritime Organization (IMO) regulations (transporting by ship) or in accordance with the International Air Transport Association (IATA) Dangerous Goods Regulations (transporting by air) as in Table 3.

Table 3 is rather theoretical and can be difficult to understand. All explosives will be listed as Class 1. In addition, they will have a division number, a compatibility number, a UN number and a proper shipping name. Typical explosives for demining can be at Table 4 depictions.
NOTES FROM THE FIELD

Logsistics-Explosives-Safety

Table 2: Mining of explosives when stowing (by compatibility group).

<table>
<thead>
<tr>
<th>B</th>
<th>D</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible</td>
<td>Forbidden</td>
<td>Possible</td>
</tr>
<tr>
<td>Possible</td>
<td>Forbidden</td>
<td>Possible</td>
</tr>
<tr>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

Table 3: Transportation of explosives.

<table>
<thead>
<tr>
<th>By ship</th>
<th>Passenger and Cargo Aircraft</th>
<th>Cargo Aircraft only</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4 D</td>
<td>Possible</td>
<td>Forbidden</td>
</tr>
<tr>
<td>1.4 B</td>
<td>Possible</td>
<td>Forbidden</td>
</tr>
<tr>
<td>1.4 D</td>
<td>Possible</td>
<td>Forbidden</td>
</tr>
<tr>
<td>1.4 S</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

Table 4: Classification of Typical Explosives for Demining.

<table>
<thead>
<tr>
<th>Classification</th>
<th>UN Number</th>
<th>Proper Shipping Name/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 D</td>
<td>UN No. 0105</td>
<td>Fuse, safety</td>
</tr>
<tr>
<td>1.1 D</td>
<td>UN No. 0054</td>
<td>Detonators, electric, for blasting</td>
</tr>
<tr>
<td>1.1 D</td>
<td>UN No. 0078</td>
<td>Detonators, electric, for blasting</td>
</tr>
<tr>
<td>1.1 D</td>
<td>UN No. 0077</td>
<td>Detonators, non-electric, for blasting</td>
</tr>
</tbody>
</table>

Table 6: Overview and Early Findings, continued from page 95:

<table>
<thead>
<tr>
<th>All graphics courtesy of the authors.</th>
</tr>
</thead>
</table>

Contact Information

Dyno Nobel Danmark A/S
PO. Box 1401
DK-2600 Glosstrup
Denmark
Tel: +45 43 45 15 38
Fax: +45 43 45 22 70
E-mail: jorgen.schneider@dynonobel.com
Website: www.dynonobel.dk

Fax: +33 3228 42 76
E-mail: rolf.oechslin@ruag.com
Website: www.ruag.com

Jorgen Schneider
Managing Director
Dyno Nobel Denmark A/S
Smelleland 7
PO. Box 1461
DK-2600 Glosstrup
Denmark
Tel: +45 43 43 15 38
Fax: +45 43 43 22 70
E-mail: jorgen.schneider@dynonobel.com
Website: www.dynonobel.dk

EDEM2: Overview and Early Findings continues from page 95.

Endnotes


Contact Information

Karin De Bruyn
Research Coordinator
Vrije Universiteit Brussel, ETRO Dept
VUB-ETRIP Heizland, 2
B-1050 Brussels
Belgium
Tel: +32-2-629-2930
Typical tender for explosives for demining is:

- Explosives (Classified 1.1 D, e.g., PE or similar) approximately 1–5 tons,
- Detonating cord (Classified 1.1 D, e.g., 10 g/m² approx. 1,000–10,000 m)
- Electric detonators (Classified 1.4 S) approx. 6–11,000 p.c.
- Safety fuse (Classified 1.4 S) approx. 5–8,000 m
- Detonators non-electric for blasting (Classified 1.1 B, detonator to be crimped on a safety fuse) approx. 500–1,000 p.c.

The explosives will be delivered as soon as possible.

For tenders explosives are very informative and for a limited project. Transportation must be by ship as explosives, detonating cords and non-electric detonators for blasting are classified 1.1 D and 1.1 B, and the goods must be stuffed in two containers.

One of the containers will have explosives and the detonating cord (approximately six tons in total or 10 pallets). The second container will have the electric detonators, the safety fuse and the non-electric detonators (approximately 600 kg on one pallet). The only reason for having two containers is because of the non-electric detonators for blasting. These detonators have an extremely low value as well, but must be stuffed separately from the explosives.

Finding a ship that will carry explosives becomes more and more difficult because the liners and insurance companies classify them as high-risk goods. Also, the liner will have restrictions as to which ports they can go into (a lot of harbours have very heavy restrictions as to what type of goods a ship must carry). When planning such a tender, a lot of money can be saved, but the tender must be changed to one of the two following alternatives.

**Alternative 1**
- Explosives (Classified 1.1 D, e.g., PE or similar) approx. 1–5 tons
- Detonating cord (Classified 1.1 D, e.g., 10 g/m² approx. 1,000–10,000 m)
- Electric detonators (Classified 1.4 S) approx. 6–11,000 p.c.
- Passenger or cargo aircraft can ship the goods. Extremely quick delivery is possible and you only pay the freight cost for the goods that you transport by aircraft. The deminers can do the same job as what the first tender asked for.

**Alternative 2**
- Charges, shaped (Classified 1.4 S) approx. 6–11,000 p.c.
- Electric detonators (Classified 1.4 S) approx. 6–11,000 p.c.
- Safety fuse, on a ship, approx. 500–1,000 p.c.
- Cruiser, charged, without detonator

The explosives will be delivered as soon as possible.

For tenders explosives are very informative and for a limited project. Transportation must be by ship as explosives, detonating cords and non-electric detonators for blasting are classified 1.1 D and 1.1 B, and the goods must be stuffed in two containers.

One of the containers will have explosives and the detonating cord (approximately six tons in total or 10 pallets). The second container will have the electric detonators, the safety fuse and the non-electric detonators (approximately 600 kg on one pallet). The only reason for having two containers is because of the non-electric detonators for blasting. These detonators have an extremely low value as well, but must be stuffed separately from the explosives.

Finding a ship that will carry explosives becomes more and more difficult because the liners and insurance companies classify them as high-risk goods. Also, the liner will have restrictions as to which ports they can go into (a lot of harbours have very heavy restrictions as to what type of goods a ship must carry). When planning such a tender, a lot of money can be saved, but the tender must be changed to one of the two following alternatives.

**Alternative 1**
- Explosives (Classified 1.1 D, e.g., PE or similar) approx. 1–5 tons
- Detonating cord (Classified 1.1 D, e.g., 10 g/m² approx. 1,000–10,000 m)
- Electric detonators (Classified 1.4 S) approx. 6–11,000 p.c.
- Passenger or cargo aircraft can ship the goods. Extremely quick delivery is possible and you only pay the freight cost for the goods that you transport by aircraft. The deminers can do the same job as what the first tender asked for.

**Alternative 2**
- Charges, shaped (Classified 1.4 S) approx. 6–11,000 p.c.
- Electric detonators (Classified 1.4 S) approx. 6–11,000 p.c.
- Safety fuse, on a ship, approx. 500–1,000 p.c.
- Cruiser, charged, without detonator

The explosives will be delivered as soon as possible.