Logistics-Explosives-Safety

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NOTES FROM THE FIELD

Logistics-Explosives-Safety

Cost, safety, and compliance with international regulations are among the most important factors with respect to shipping explosives. This article provides detailed insight into the transport and storage of explosives necessary for destroying mines and UXO.

by Rolf Oechslin, RUAG Munition and Jürg Schneider, Dyno Nobel Denmark A/S

Introduction

The humanitarian disaster caused by landmines and UXO is now being used as a means to gain active and growing political support from the international community that is committed to the elimination of the use of landmines. As mines can be very dangerous and 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 be transported safely?
• Can explosives be transported to the site and stored safely?
• Is it possible to get explosives to neighbouring countries?

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References

1. The full official title of the CWC is: the Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical and Bacteriological (And Related) Weapons Which May Be Duly to Be Excessively Injurious or to Have Indiscriminate Effects.


3. Ellis, p. 194.

4. Should a legally binding protocol be adopted it would become the fifth protocol of the CWC. For details of the other four protocols, see Ellis, op. cit.

5. Full details of the Draft Proposal and other papers presented in the meeting can be found on the UN Department of Disarmament Affairs website on the CWC at http:// disarmament.un.org/sc/scindex.html.


Class 1: Explosive Substances and Articles

Division numbers give information on how the explosives can be transported. Explosives typical for demining can be put into one of the following divisions:

• Division 1.1: Substances and articles that have a mass explosion hazard (a mass explosion is an explosion that affects almost the entire load instantaneously).

• Division 1.4: Substances and articles that present only a slight risk of explosion in the event of ignition or initiation during carriage. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire shall not cause an instantaneous explosion of the entire contents of the package.

Compatibility Groups

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

For shipping a container with explosives, you are allowed to have 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 shipping a container.

By doubling division number and compatibility group together, it is possible to store and transport the explosives by air or in accordance with the International Maritime Organization (IMO) regulations for transportation 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.
**Table 2:** Mining of explosives when stuffing, by comparison group

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

**Table 3:** Mining of explosives when stuffing, by comparison group

<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 B</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. 067</td>
<td>Explosives, blasting, Type D (e.g., Pl 6, C4 or similar high explosives)</td>
</tr>
<tr>
<td>1.1 D</td>
<td>UN No. 0677</td>
<td>Black powder granular, or in meal</td>
</tr>
<tr>
<td>1.1 D</td>
<td>UN No. 0659</td>
<td>Charges, shaped, without detonator</td>
</tr>
<tr>
<td>1.1 D</td>
<td>UN No. 0585</td>
<td>Detonating cord, non-electric, for blasting</td>
</tr>
<tr>
<td>1.4 S</td>
<td>UN No. 0105</td>
<td>Safety fuse, for blasting</td>
</tr>
<tr>
<td>1.1 B</td>
<td>UN No. 0279</td>
<td>Detonators, electric, for blasting</td>
</tr>
<tr>
<td>1.4 S</td>
<td>UN No. 0555</td>
<td>Detonators, electric, for blasting</td>
</tr>
<tr>
<td>1.4 S</td>
<td>UN No. 0560</td>
<td>Detonators, non-electric, for blasting</td>
</tr>
<tr>
<td>1.4 S</td>
<td>UN No. 0560</td>
<td>Detonators, non-electric, for blasting</td>
</tr>
<tr>
<td>1.4 S</td>
<td>UN No. 0441</td>
<td>Charges, shaped, without detonator</td>
</tr>
</tbody>
</table>

**Storage of Explosives**

Many regulations for storage of explosives exist. If explosives are classified 1.1 D and 1.1 B, there are very heavy restrictions on storage of these explosives because of the potentiality of fatality or fatality for the surrounding area if the explosives were to go off. Storage of explosives 1.4 S are not subject to fire regulations because if the storage caught on fire, the material would burn out without going into detonation, or in the worst case, only a very limited quantity of fragment will come out without causing serious harm to the firemen.

**Explosives for Demining**

Procedures for use of explosives for demining and destruction of UXO have traditionally been made by the armed forces. Reliable procedures have been developed. Explosives to be used are normally:

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

The explosives shall be delivered as soon as possible.

A tender for explosives is very important and for a limited project. Transportation may 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), and the second container will have the electric detonators, the safety fuse and the non-electric detonators (approximately 600 kg, on two pallets). 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 harbours 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/m) approx. 1,000-10,000 m
- Electric detonators (Classified 1.4 S) approx. 6-11,000 psc.

The goods must be forwarded by ship, but only one container is needed.

The deminers can do the same job as what the first tender asked for.

**Conclusion**

When taking into consideration the problems in transportation and secure storage of explosives classified 1.1 D and 1.1 B, it should be highly recommended to demand use of shaped charges and electric detonators classified 1.4 S. The prices for the shaped charges classified 1.4 S are higher than for explosives 1.1 D, but this is not of interest. The most important thing is the price when fired on the demolition site—what the cost has been for transportation of high explosives compared to the shaped charges, what the cost has been for storage and what the price is for improved safety for the shaped charges compared to high explosives. If the vendor includes all of those factors in the cost, the shaped charges will be competitive to be high explosives.

**References**

7. Cremer, J. "How to Measure the Impact of InternationalExplosives-Safety".

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NOTES FROM THE FIELD

Table 2. Maximum explosives when storing (by compatibility groups).

Table 3: Transportation of explosives.

Storage of Explosives

Many regulations for storage of explosives exist. If explosives are classified 1.1 D and 1.1 B, there are very heavy restrictions on storage of these explosives because of the potentially fatal consequences for the surrounding area if the explosives were to go off. Storage of explosives 1.4 S are not subjected to heavy restrictions but are subject to fire regulations because if the storage caught on fire, the material would burn out without going into detonation, or in the worst case, only a limited quantity of fragment will come out without causing serious harm to the firemen.

Explosives for Demining

Procedure for uses of explosives for demining and destruction of UXO have traditionally been made by the armed forces. Reliable procedures have been developed. Explosives to be used are normally:

- Explosives (Classified 1.1 D, e.g., PE4 or similar) approx. 1-5 tons
- Detonating cord (Classified 1.1 D, e.g., 10 g/m) approx. 1,000-10,000 m
- Electric detonators (Classified 1.4 S) approx. 6-11,000 pc.
- Detonating cord (Classified 1.1 B, e.g., 10 g/m) approx. 1,000-10,000 m
- Electric detonators (Classified 1.4 S) approx. 6-11,000 pc.

The goods must be forwarded by ship, but only one container is needed. The deminer can do the same job as what the first tender asked for.

Alternative 2

- Charges shaped (Classified 1.4 S) approx. 6-11,000 pc.
- Electric detonators (Classified 1.4 S) approx. 6-11,000 pc.
- Propellant and 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.

By ship

By air

Conclusion

When taking into consideration the problems in transportation and secure storage of explosives classified 1.1 D and 1.1 B, it should be highly recommended to demand use of shaped charges and electric detonators classified 1.4 S. The prices for the shaped charges classified 1.4 S are higher than for explosives 1.1 D, but this is not of interest. The most important thing is the price when found on the demoliions sites—what the cost has been for transportation of high explosives compared to the shaped charges, what the cost has been for storage and what the price is for improved safety for the shaped charges compared to high explosives. If the vendor includes all of those costs in the offer, the shaped charges will be competitive to high explosives.

The price for electric detonators classified 1.4 S is slightly higher compared to ordinary packed electric detonators, and adding the cost of transporting the electric detonators classified 1.4 S becomes much cheaper than the ordinary packed electric detonators. Giving up the detonator packaging and using prepacked charges in the pipes, fuse and detonators for the safety fuse and demanding shaped charges and electric detonators 1.4 S, it will be easier to have the necessary explosives in a short time and with the highest possible safety for the users and during transport and storage.

Table 4: Classification of Typical Explosives for Demining

**EUDEM2: Overview and Early Findings, continued from page 95**

*All graphics courtesy of the authors.

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Endnotes


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