STORAGE OF EXPLOSIVES IN GERMANY
2nd Provision to the German explosives act (2.SprengV),
Dr. Moana Nolde
MJV Tønsberg, Norge
Locations

- Branch Fabeckstraße
- Headquarters Lichterfelde
- Branch Adlershof
- BAM Test-site Technical Safety in Baruth/Mark
BAM is a senior scientific and technical Federal authority and research institute with responsibility to Federal Ministry of Economic Affairs and Energy.

We ensure ongoing safety in technology and chemistry through
– research and development
– testing, analysis, approval and certification
– consultation, information and advice.

We collaborate for global safety standards.
Division 2.3
Explosives (N.N.)

Areas of competence

• Blasting Explosives and Propellants (Dr. A. von Oertzen)
• Pyrotechnics (Dr. Chr. Lohrer)
• Safety Assessment Explosives (Dr. M. Nolde)
Blasting Explosives, Propellants

- EU-conformity assessment for explosives (CE-marking) according to Directive 2014/28/EU
- Approval of blasting accessories according to the Explosives Act
- Assignment of explosives to hazard divisions for transport and storage classes
- Responsible authority for issuing transfer approvals for explosives
- Contribution to the further development of national and international standards
- Contribution to the further development of laws and ordinances
Pyrotechnics

• EC type examination of pyrotechnic articles, pyrotechnic compositions and ignition devices, approval of pyrotechnic ammunition

• conformity assessment procedure – modules B, C, D, E, G and H – according to the Directive 2013/23/EC for pyrotechnic articles (including ignition devices)

• conformity assessment procedure – modules B, C, D, E, F and G – according the Directive 93/15/EEC for pyrotechnic compositions

• assignment to storage and compatibility groups for pyrotechnic articles, pyrotechnic compositions and pyrotechnic ammunition

• classification for pyrotechnic articles, pyrotechnic compositions and pyrotechnic ammunition.
Safety Assessment Explosives

- Risk assessment and survey of
  - warehouses for explosives and pyrotechnics
  - procedures for the production, treatment, disposal and storage of explosives and of articles containing explosives
- Accident enquiry
- Tests of the explosion resistance of construction components of buildings
- Assessment of faulty explosives according to §32 German explosives act

To perform this task the working group is independent in its organisation and personnel of the other working groups of the division, which are responsible for granting approvals and assessing the EU-conformity.
Regulations

German Explosives Act (SprengG)

§17 Approval of storage (general remarks)

2nd Provision to the Explosives Act (2. SprengV)

Regulates the storage of explosives in detail

Assignment to storage groups on the basis of transport classifications (UN Manual)

1.1, 1.2, 1.3, 1.4
Class 1 explosives

- Division 1.1 mass explosion
- Division 1.2 projection hazard
- Division 1.3 fire hazard
  - minor blast hazard
  - minor projection hazard
- Division 1.4 no significant hazard
Classification Tests

UN-Test 6(a)
Single package test

a test on a single package to determine if there is mass explosion of the contents

UN-Test 6(b)
Stack test

a test on packages of an explosive substance or explosive articles, or non-packaged explosive article, to determine whether an explosion is propagated from one package to another or from a non-packed article to another

UN-Test 6(c)
External fire (bonfire) test

a test on packages of an explosive substance or explosive articles, or non-packaged explosive article, to determine whether there is a mass explosion or a hazard from dangerous projections, radiant heat and/or violent burning or any other dangerous effect when involved in a fire
Roman candle 6 Shots
UN-Test 6(c) Classification 1.2
Titanium salute 3"
UN-Test 6(b) Classification 1.1
Titanium salute 3"
UN-Test 6(c) Classification 1.1
Brocade Purple 6"
UN-Test 6(b) Classification 1.3
Red to Green & Crackling Stars 4"
UN-Test 6(c) Classification 1.3
Celebration Crackers
UN-Test 6(c) Classification 1.4
Regulations

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1.1, 1.2, 1.3, 1.4
# 2nd Provision to the Explosives Act

## Distinction between Clearances

<table>
<thead>
<tr>
<th>Safety clearance</th>
<th>Security clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Far field</td>
<td>Near field</td>
</tr>
<tr>
<td>To neighbours and general public</td>
<td>Within the plant / company</td>
</tr>
<tr>
<td>Protection of people and structures</td>
<td>Prevention of detonation propagation</td>
</tr>
<tr>
<td>Independent of construction (except for 1.4)</td>
<td>Dependent on construction</td>
</tr>
</tbody>
</table>

Subset calculations possible!
Safety clearances

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**Storage Group 1.1**

To housing areas and equivalent buildings (e.g. other companies)

\[ E = 22 \cdot M^{1/3} \quad 220 \text{ m} \]

To traffic infrastructure (e.g. roads, railway, shippingways)

\[ E = 15 \cdot M^{1/3} \quad 150 \text{ m} \]

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e.g. 1000 kg
Safety clearances

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**Storage Group 1.2**

To housing areas and equivalent buildings (e.g. other companies)

To traffic infrastructure (e.g. roads, railway, shippingways)

<table>
<thead>
<tr>
<th>E = 58 \cdot M^{1/6}</th>
<th>184 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum clearance 90 m</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E = 39 \cdot M^{1/6}</th>
<th>124 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum clearance 60 m</td>
<td></td>
</tr>
</tbody>
</table>

**e.g. 1000 kg**
Safety clearances

### Storage Group 1.3

<table>
<thead>
<tr>
<th>Description</th>
<th>Equation</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>To housing areas and equivalent buildings (e.g. other companies)</td>
<td>( E = 6.4 \cdot M^{\frac{1}{3}} )</td>
<td>64 m</td>
</tr>
<tr>
<td>To traffic infrastructure (e.g. roads, railway, shippingways)</td>
<td>( E = 4.3 \cdot M^{\frac{1}{3}} )</td>
<td>43 m</td>
</tr>
<tr>
<td>Less than 100 kg</td>
<td></td>
<td>No clearance necessary</td>
</tr>
</tbody>
</table>

- e.g. 1000 kg
Safety clearances

**Storage Group 1.4**

- Less than 100 kg: No clearance necessary
- More than 100 kg: Minimum clearance 25 m
- Additional safety precautions: Reduction or no clearance
Security clearances

Dependent on structural design and function like:

- Covered with earth
- Barricades
- Heavy roof
- Storage facility
- Local conditions
- Buildings with explosives
- Other buildings without explosives
## Security clearances

<table>
<thead>
<tr>
<th>Gefährdetes Objekt (Akzeptor A)</th>
<th>Sicherheitsabstand (m)</th>
<th>Gefährdendes Objekt (Donator D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erdüberdeckt</td>
<td></td>
<td>Erdüberdeckt</td>
</tr>
<tr>
<td>D 1</td>
<td>2,5</td>
<td>D 1</td>
</tr>
<tr>
<td>D 2</td>
<td>2,5</td>
<td>D 2</td>
</tr>
<tr>
<td>D 3</td>
<td>2,5</td>
<td>D 3</td>
</tr>
<tr>
<td>ohne Wall*</td>
<td>2,5</td>
<td>ohne Wall*</td>
</tr>
</tbody>
</table>

### In Einwirkungsrichtung

<table>
<thead>
<tr>
<th>Gebäude und Plätze mit Explosivstoffen (ausgenommen Lager)</th>
<th>Lager mit Explosivstoffen</th>
</tr>
</thead>
<tbody>
<tr>
<td>erdüberdeckt mit Wall* oder schweren Wänden und schwerer Dachausführung</td>
<td>erdüberdeckt mit Wall* oder schweren Wänden und leichter Dachausführung</td>
</tr>
<tr>
<td>D 1</td>
<td>D 2</td>
</tr>
<tr>
<td>2,5</td>
<td>2,5</td>
</tr>
</tbody>
</table>

### Ungefährlicher Betriebsteil

<table>
<thead>
<tr>
<th>Gebäude, die der Herstellung dienen</th>
<th>sonstige Gebäude</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,0 (30 m)**</td>
<td>8,0 (30 m)**</td>
</tr>
</tbody>
</table>

**Note:**
- Wall*: Wände mit Dachausführung
- Wall**: Wände ohne Dachausführung

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Enschede (NL), May 2000
Allowed NEM:

1.4 S/G  158.500 kg
or 1.4 S/G  136.500 kg  plus 2.000 kg 1.3 G

Safety clearance: 332 m

NEM at time of incident (Estimation)

1.4  16.308 kg
1.3  153.731 kg 1.3
1.2  5.301 kg 1.2
1.1  1.660 kg 1.1  in total 177.000 kg

Safety clearance: 1.3 km !