BAM
Bundesanstalt für Materialforschung und -prüfung

Sicherheit in Technik und Chemie

10.11.2016

STORAGE OF EXPLOSIVES IN GERMANY

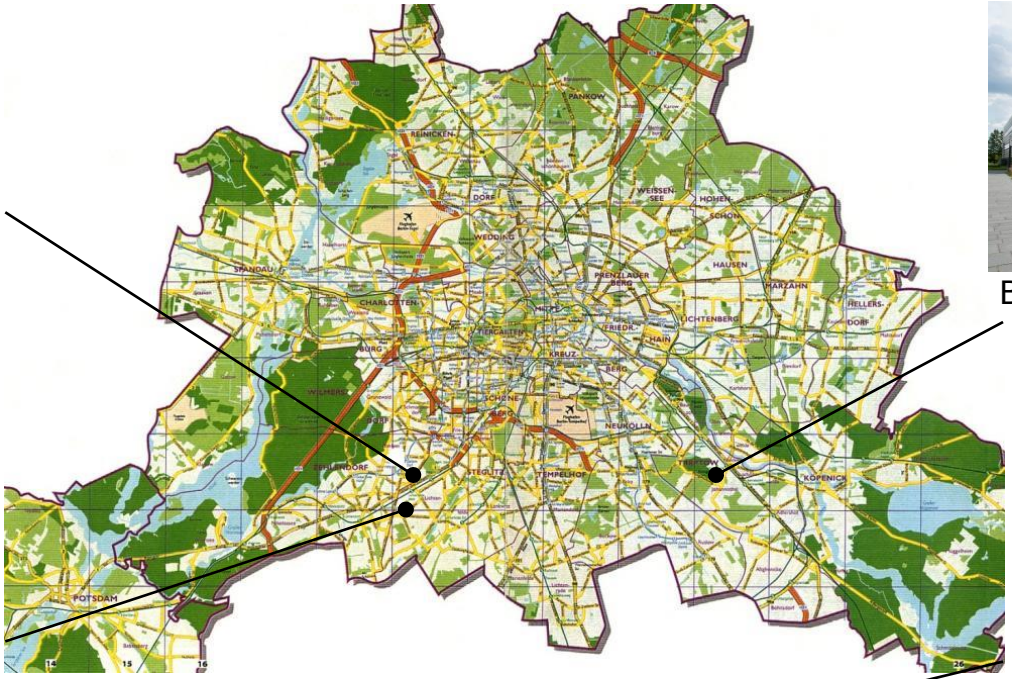
2nd Provision to the German explosives act (2.SprengV),

Dr. Moana Nolde
MJV Tønsberg, Norge

Locations

Branch Fabeckstraße

Headquarters Lichterfelde



Branch Adlershof

BAM Test-site Technical Safety in Baruth/Mark

Our status

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

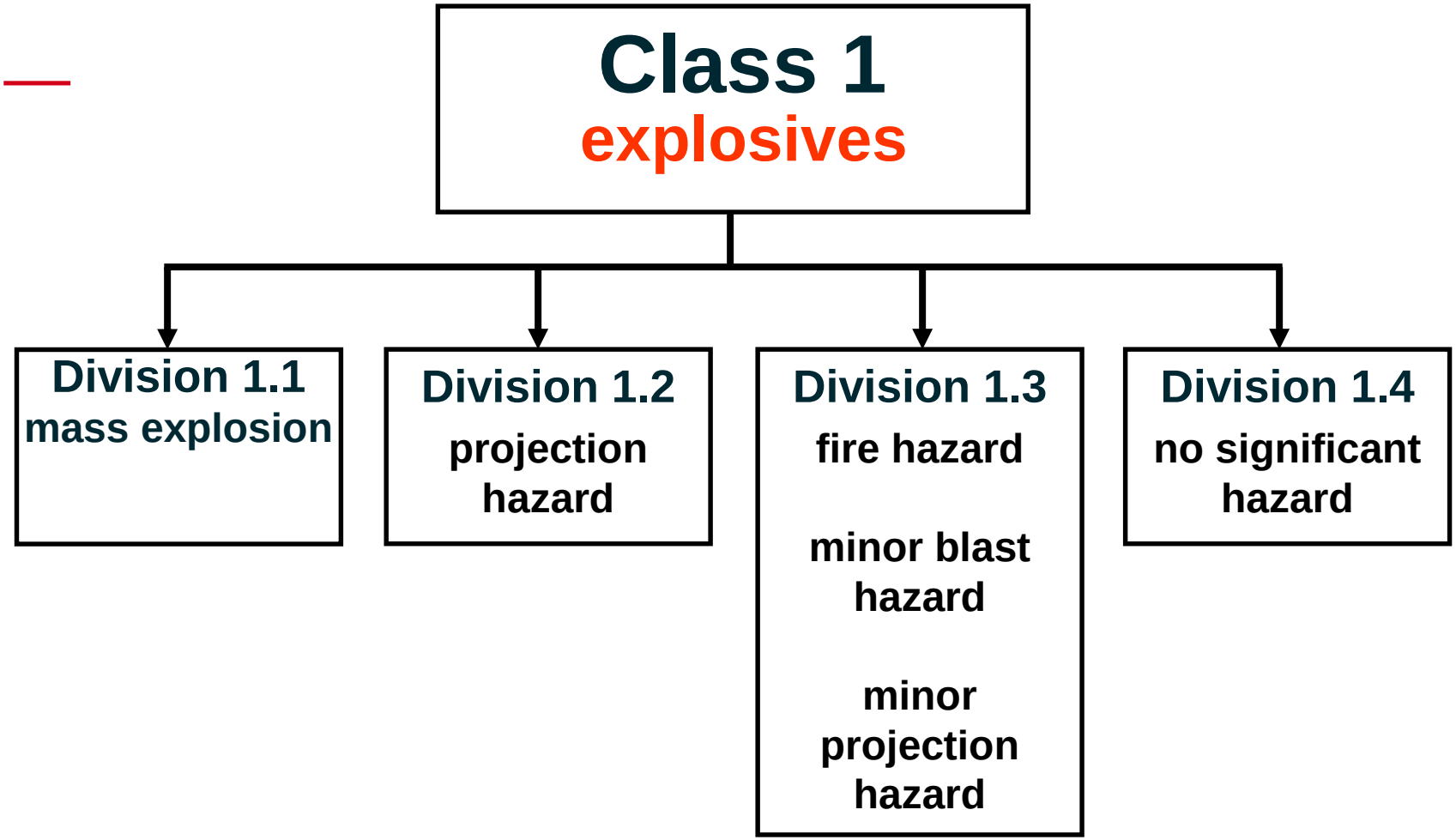
To perform this task the working group is independent in its organisation and personnel of the other working groups of the division, which are responsible for granting approvals and assessing the EU-conformity.

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 hear 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
BVD 9908300
HORSE
BRAND

Celebration Crackers
UN-Test 6(c) Classification 1.4

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2nd Provision to the Explosives Act
Distinction between Clearances

Safety clearance	Security clearance
Far field	Near field
To neighbours and general public	Within the plant / company
Protection of people and structures	Prevention of detonation propagation
Independent of construction (exept for 1.4)	Dependent on construction

Subset calculations possible!

Safety clearances

Storage Group 1.1

		e.g. 1000 kg
To housing areas and equivalent buildings (e.g. other companies)	$E = 22 \cdot M^{⅓}$	220 m
To traffic infrastrucure (e.g. roads, railway, shippingways)	$E = 15 \cdot M^{⅓}$	150 m

Safety clearances

Storage Group 1.2

e.g.1000 kg

To housing areas and equivalent buildings (e.g. other companies)	$E = 58 \cdot M^{1/6}$ Minimum clearance 90 m	184 m
To traffic infrastrucure (e.g. roads, railway, shippingways)	$E = 39 \cdot M^{1/6}$ Minimum clearance 60m	124 m

Safety clearances

Storage Group 1.3

		e.g.1000 kg
To housing areas and equivalent buildings (e.g. other companies)	$E = 6.4 \cdot M^{⅓}$ Minimum clearance 60 m	64 m
To traffic infrastrucure (e.g. roads, railway, shippingways)	$E = 4.3 \cdot M^{⅓}$ Minimum clearance 40m	43 m
Less than 100 kg	No clearance necessary	

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

Explosivstoffe, die bei einer Explosion **keine schweren** Sprengstücke bilden				Gefährlicher Betriebsteil									Ungefährlicher Betriebsteil	
				In Einwirkungsrichtung										
				Gebäude und Plätze mit Explosivstoffen (ausgenommen Lager)				Lager mit Explosivstoffen						
Gefährdetes Objekt (Akzeptor A)				erdüberdeckt	mit Wall*) oder schweren Wänden und schwerer Dachausführung	mit Wall*) oder schweren Wänden und leichter Dachausführung	ohne Wall*)	erdüberdeckt	mit Wall*) oder schweren Wänden und schwerer Dachausführung	mit Wall*) oder schweren Wänden und leichter Dachausführung	ohne Wall*)	sonstige Gebäude	Gebäude, die der Herstellung dienen	sonstige Gebäude
				A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	A 10	A 11
Gefährdendes Objekt (Donator D)														
In Wirkungsrichtung	erdüberdeckt	D 1		2,5	3,0	3,5	4,0	0,8	2,5	3,0	4,0	4,0	8,0 (30 m)**)	8,0 (30 m)**)
	mit Wall*), schwere Dachausführung	D 2		2,5	4,0	6,0	6,0	0,8	2,5	4,0	6,0	4,0[2])	8,0 (30 m)**)	8,0 (30 m)**)
	mit Wall*), leichte Dachausführung	D 3		2,5	3,0	3,5	5,0	0,8	2,5	3,0	5,0	4,0[2])	8,0 (30 m)**)	8,0 (30 m)**)
	ohne Wall*)	D 4		2,5	4,5	6,0	8,0[1])	0,8	2,5	4,0	8,0[1])	6,0 (30 m)**)	8,0[1]) (30 m)**)	8,0[1]) (30 m)**)

Enschede (NL), May 2000

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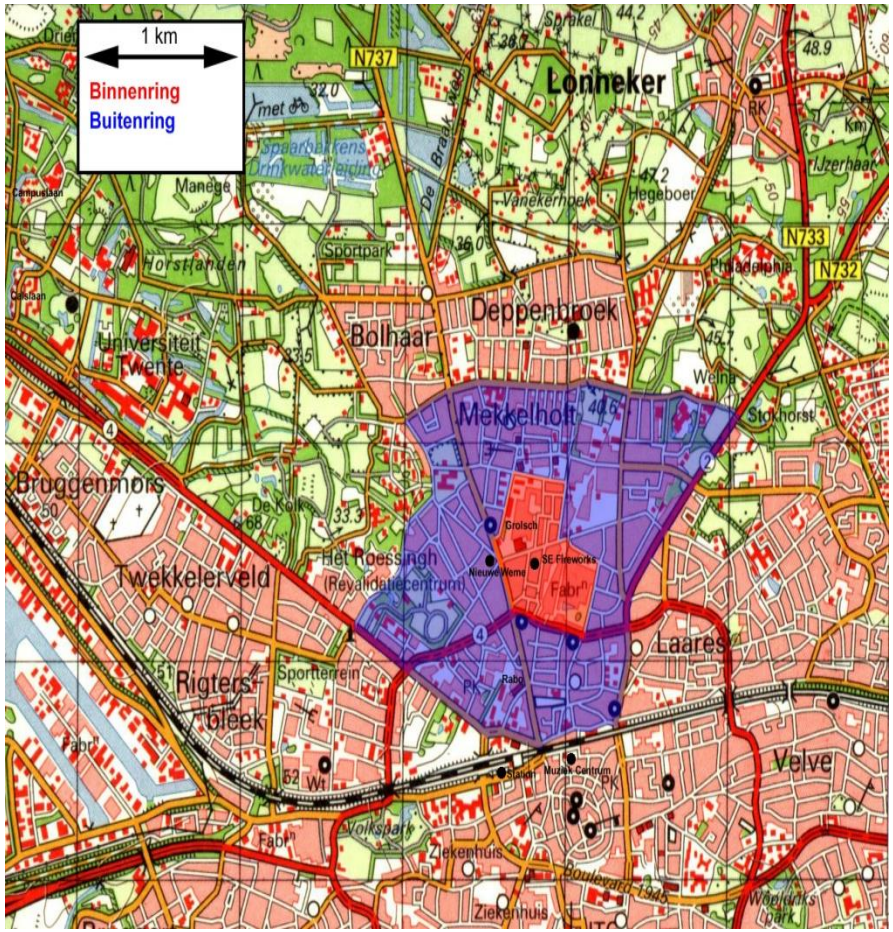

Enschede May 2000

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 clearence: 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 clearence: 1.3 km !