AUSTIN POWDER
INTERNATIONAL

Patronert Emulsjon

2018-03-07

Austin Europe GmbH

My Person

- Mark Ganster
- 43 years old
- Married, 1 Kid
- Email: mark.ganster@austinpowder.eu
- 1997 – 2004: University of Leoben
- Work experience
  - Assistent for mechanical engineering
  - Blaster since 1999
  - ~250 shifts Tunneling (Ö,Ger)
  - ~120 shifts Joanneum Geophysics
  - 2004-2014 Austin Powder GmbH, St. Lambrecht – Head of blasting service
  - Since 2014 Manager Blasting technology Europe

Explosives – Advantages Dynamites

- High Density of Product
- High Loading density
- Energybalance harmonizes with most of the rocks

Explosives – Disadvantages Dynamites

- Contents high explosives (Nitroglycol - NG) - SAFETY
- Temperature, friction and shock sensitive - SAFETY
- Dangerous in production - SAFETY
- High Nitrogen Oxides (NO & NO2) - SAFETY
- NG diffuses through skin – causes headache - HEALTH
- Stays high explosives after misfires - SAFETY

Explosives – Advantages Emulsions

- Excellent water resistance
- Very good performance
- Very low toxic fumes
- Low sensitivity against shock, friction and thermal stress
- No toxic ingredients
- No headache
- Explosives for special uses available (presplit,avalanche expl.)

Explosives – Disadvantages Emulsions

- Lower Density than dynamite (1.2 vs. 1.4)
- Risk of deadpressing

Explosives – Velocity of detonation

Examples:

• AN/FO	3,600 m/s @ 89 mm
• *Dynamite*	6,100 m/s @ 89 mm
• *Dynamite*	**3,500 m/s @ 45 mm**
• *Emulsion no AL*	5,800 m/s @ 89 mm
• *Emulsion no AL*	**>5,000 m/s @ 45 mm**
• Cast Booster (Pentolite)	>7,000 m/s

Explosives – Water resistance

Classification	*Description*	*Example*
Poor	None	*AN/FO*
Fair	Very limited, same day mild conditions	*ANFO blends*
Good	Limited, same day harsh conditions	*ANFO cartridged*
Very Good	Few restrictions	*Dynamites*
Excellent	Water has no effect	Emulsions

Emulsion Product Performance

Always use the product with the highest VOD available to initiate non cap sensitive explosives. As long as the VOD of the "booster cartridge" is higher than the VOD of the explosives to be initiated, a run up to full detonation – and maximum possible VOD – is guaranteed.

Initiation	VoD Hydromite 1
Emulex 1	**4578**
Emulex 2+	**4423**
APB 450	**4523**
Austrogel P1	**4525**
Emulex 1	**4315**
Emulex 1	**4288**
Emulex 1	**4400**

Safety

Type of explosives	*Impact Sensitivity [J]*	*Friction Sensitivity [N]*
Dynamite	> 2	> *280*
Emulex	> 20	> 360
Safety Factor of emulsions:	**10**	**1.29**

Dynamite Experience

- **03.09.2014**
- **Site clearance difficult**:

  3 Fatalities in Norway
- Driller hits dynamite → Detonation
- Shrapnels from drill rods

  hit several boxes of dynamite on the surface


The Local
NORWAY'S NEWS IN ENGLISH
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Police establish a no-fly zone over Geilo on Wednesday in the aftermath of a dynamite explosion in which two were killed. Photo: Fredrik Varfjell / NTB scanpix
Geilo explosion: Three confirmed dead
Published: 03 Sep 2014 14:20 GMT+02:00
Updated: 03 Sep 2014 18:00 GMT+02:00
Share Tweet Share reddit
Police have found the missing person bringing the number of dead to three after a dynamite explosion in Geilo on Wednesday.

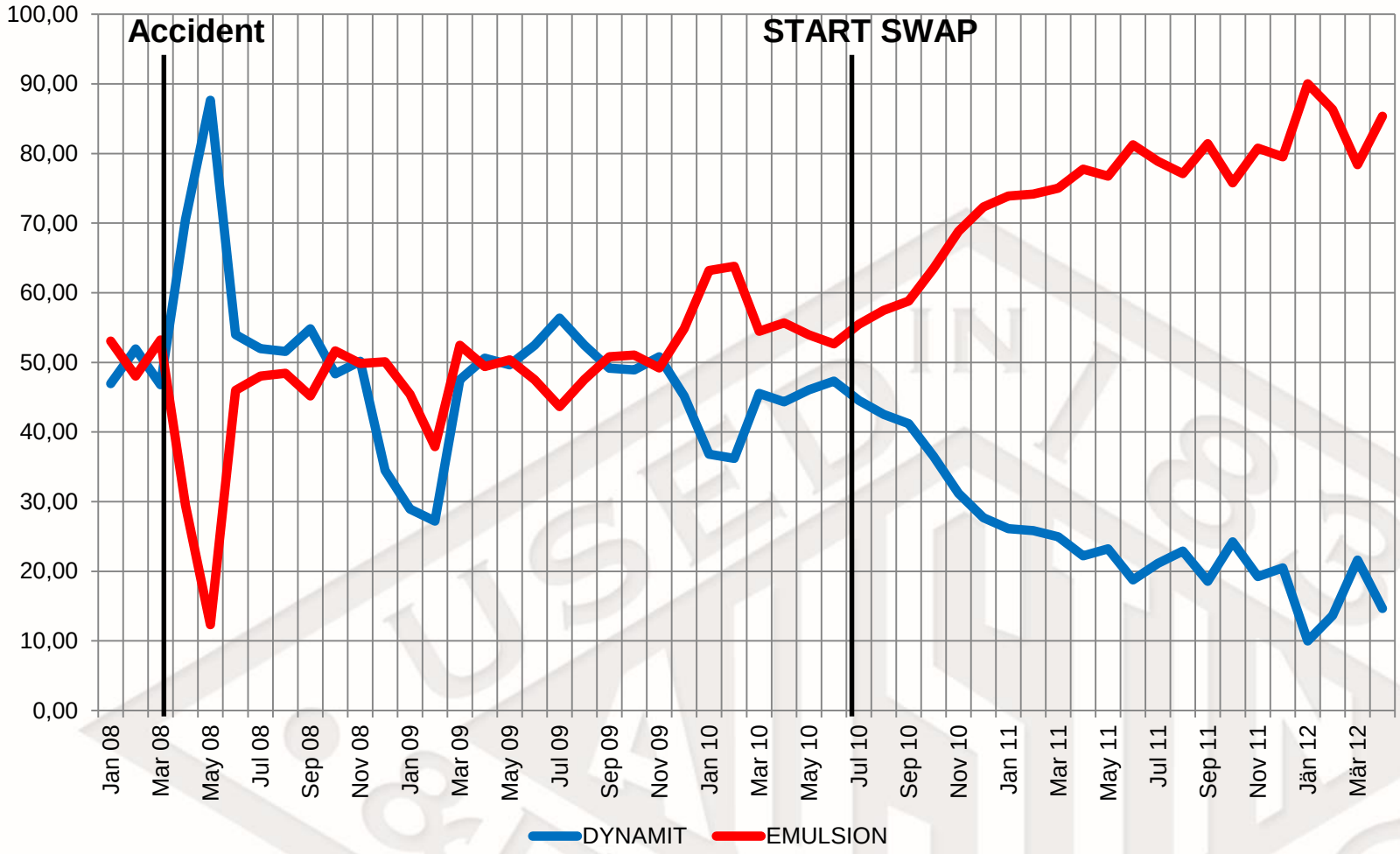
Dynamite Experience

- 29.02.2016:
- 1 fatality at construction in Norway
- Jack Hammer hits dynamite
- Explosion
- Excavator operator instantly dead

Emulsions Experience

	Emulex	Dynamite
Density, g/cm^3	1.05 - 1.24	1.40
VOD ∅ 30 mm, m/s	4200	3000
VOD ∅ 65 mm, m/s	4400 - 6000	6100
Gas volume, L/kg	845 - 925	890
Specific energy, kJ/kg	828 - 900	1020
Heat of explosion, kJ/kg	3155 - 3978	4233

Emulsions Experience



Emulsions Experience

	2007	%	2008	%	2009	%	2010	%	2011	%
DYNAMITE	2,074,638	49,29	1,668,660	55,10	1,375,223	50,13	1,299,212	42,69	872.269	22,19
EMULSION	2,134,499	50,71	1,359,642	44,90	1,368,290	49,87	1,743,883	57,31	3.057.773	77,81
TOTAL	4,209,137	100	3,028,302	100	2,743,513	100	3,043,095	100	3,930,042	100

	2012 AC 04/2012	%
DYNAMITE	157.318	15,75
EMULSION	841.502	84,25
TOTAL	998.820	100

Emulsions Experience

- Tunnels

Jahr	Gelatinös	%	Emulsion	%	Total
2008	283.258	36,09	501.550	63,91	784.808
2009	221.557	31,97	471.450	68,03	693.007
2010	208.577	26,31	584.150	73,69	792.727
2011	241.848	19,41	1.003.900	80,59	1.245.748
01-05/2012	34.650	9,30	337.896	90,70	372.546

Emulsions Experience

- Emulsions vs. the rest – Actual numbers from Austria Jan. – Dec 2017

Explosives	Quantity	%
Emulsion cartridged	4000 tons	64.5
Hydromite 100 (tunnels & mines)	988 tons	16.0
Bulk Surface	202 tons	3.3
ANFO	550 tons	8.9
Dynamite	461 tons	7.3
Total	6201 tons	100

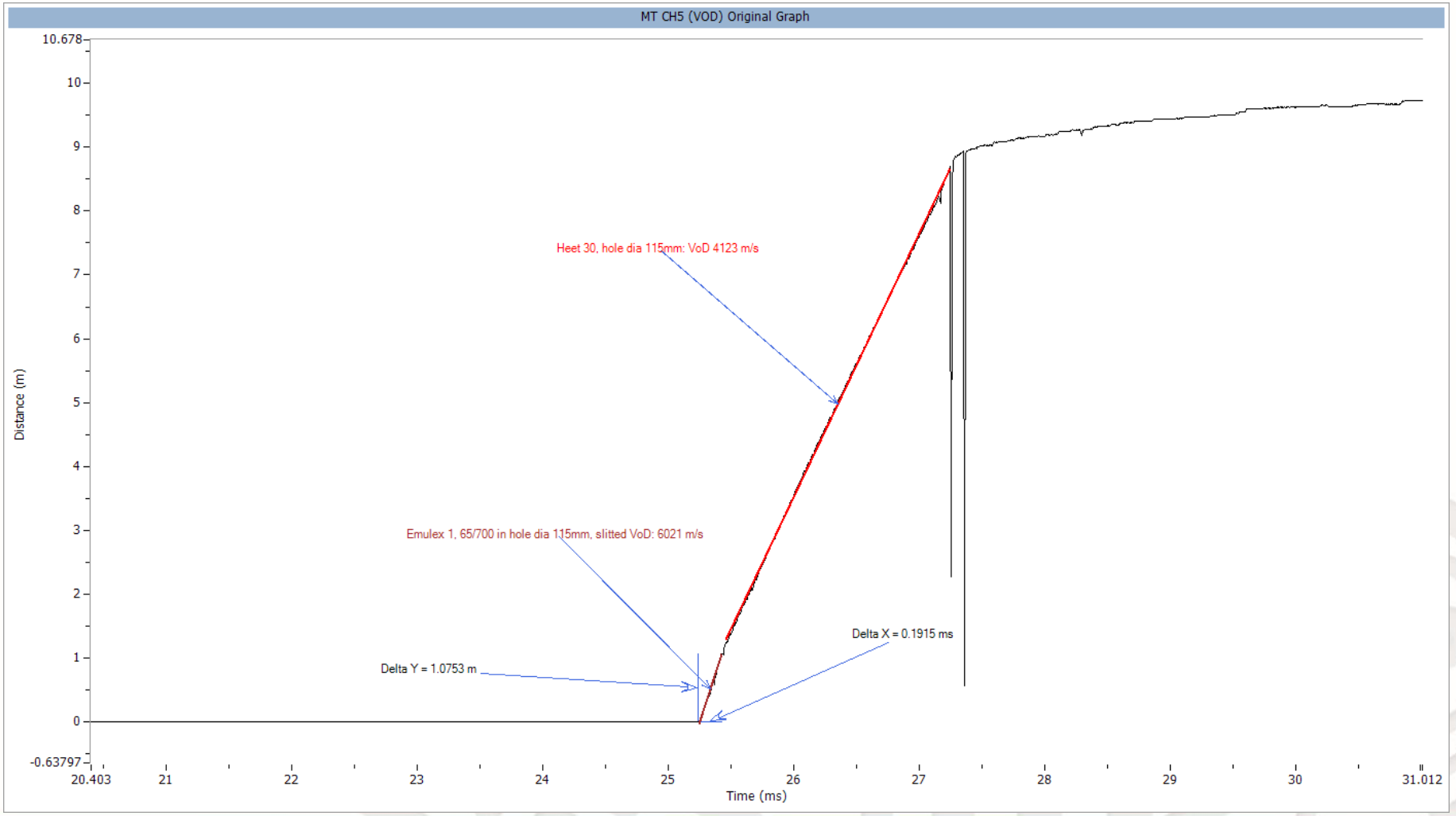
Swap effects - Quarries

dia 65 mm: 3.571 kg

dia 65 mm: 3.125 kg

dia 70 mm: 3.571 kg

Emulsions Experience



Emulsions Experience

- Recovered Product from Muckpile or holes
- Stress impact due to muckpile movement
- Stress impact by the blast
- Stress impact by the excavator

Emulsions Experience

- Blast induced shock wave & mechanical stress (heave of muckpile, excavation) leads to sufficient damage of the emulsion explosives
- Stress leads to crystallization of the emulsion
- The chemical gassing will be destroyed due to stress and the density increases
- As density increases, the emulsion becomes more insensitive to initiation
- When reaching to high densities (> 1.33) the emulsion is not going to shoot anymore – not even with a booster

There is no reported incident with Emulsion explosives in the muckpile/Jack hammer or crusher

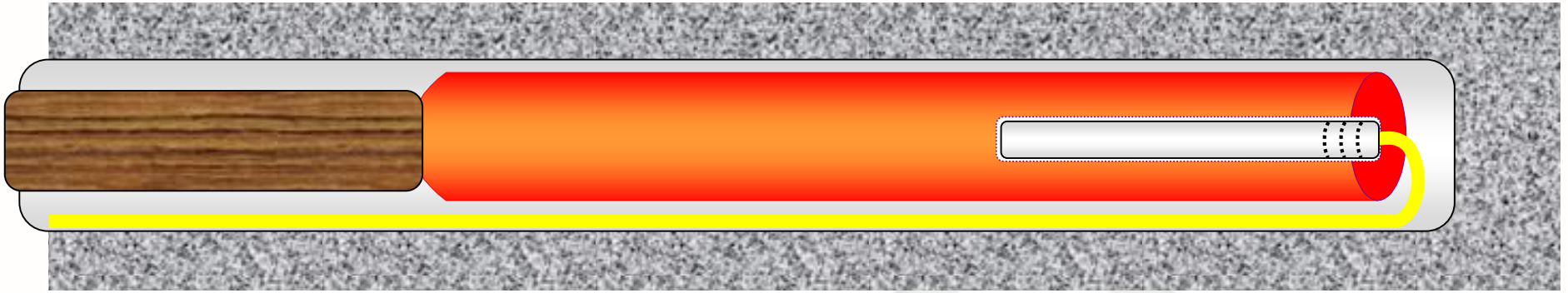
Emulsions Experience

Emulsions initiation

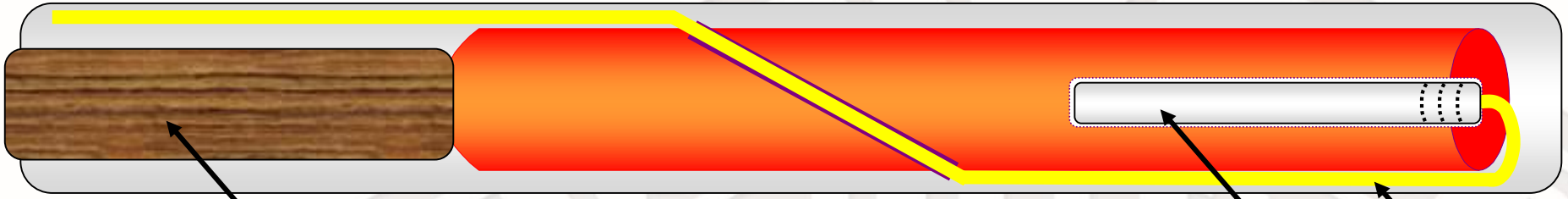
Emulsions initiation

Primer Cartridge

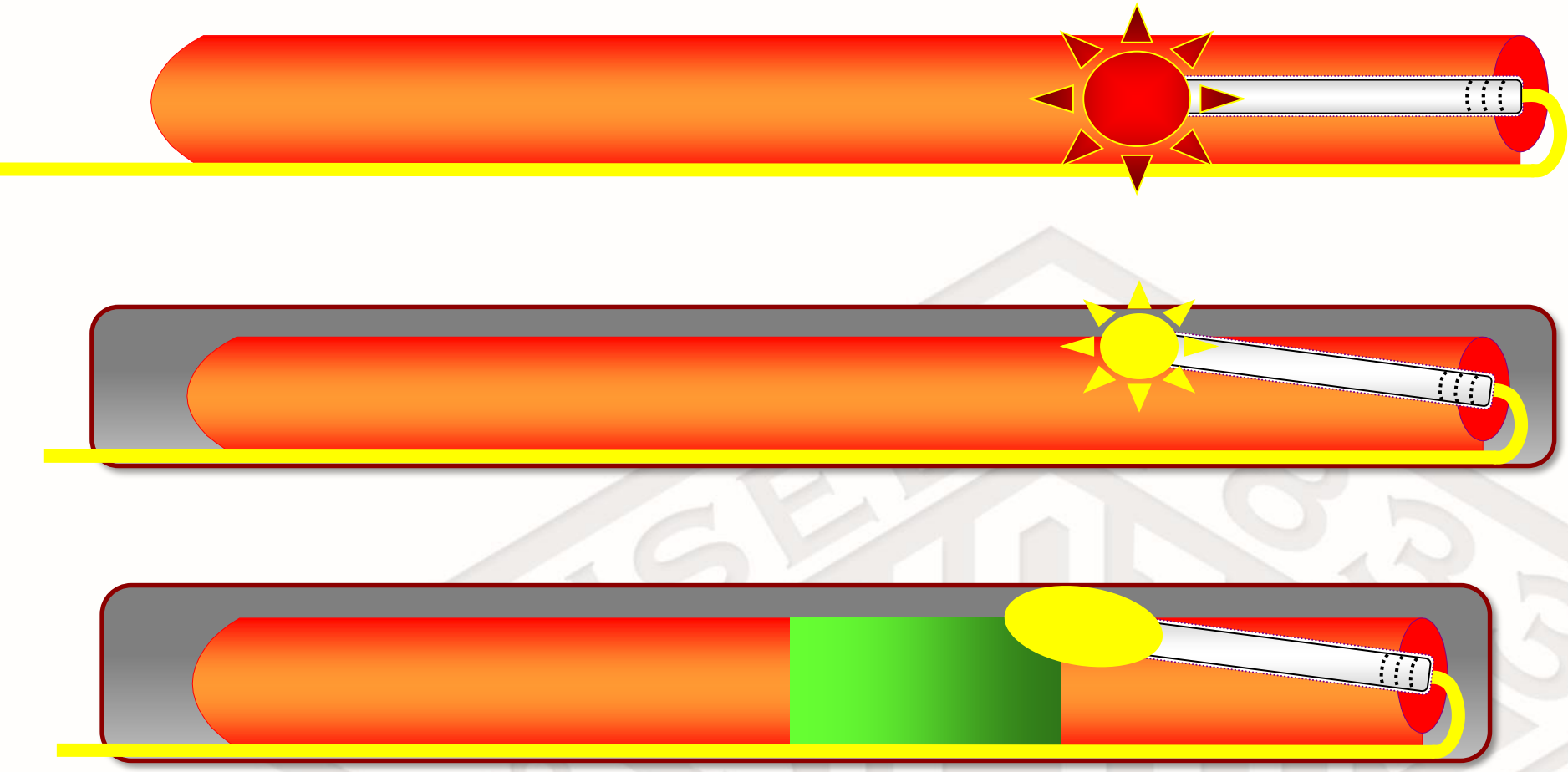
Emulsions initiation



Insert Detonator to its full depth



Emulsions initiation

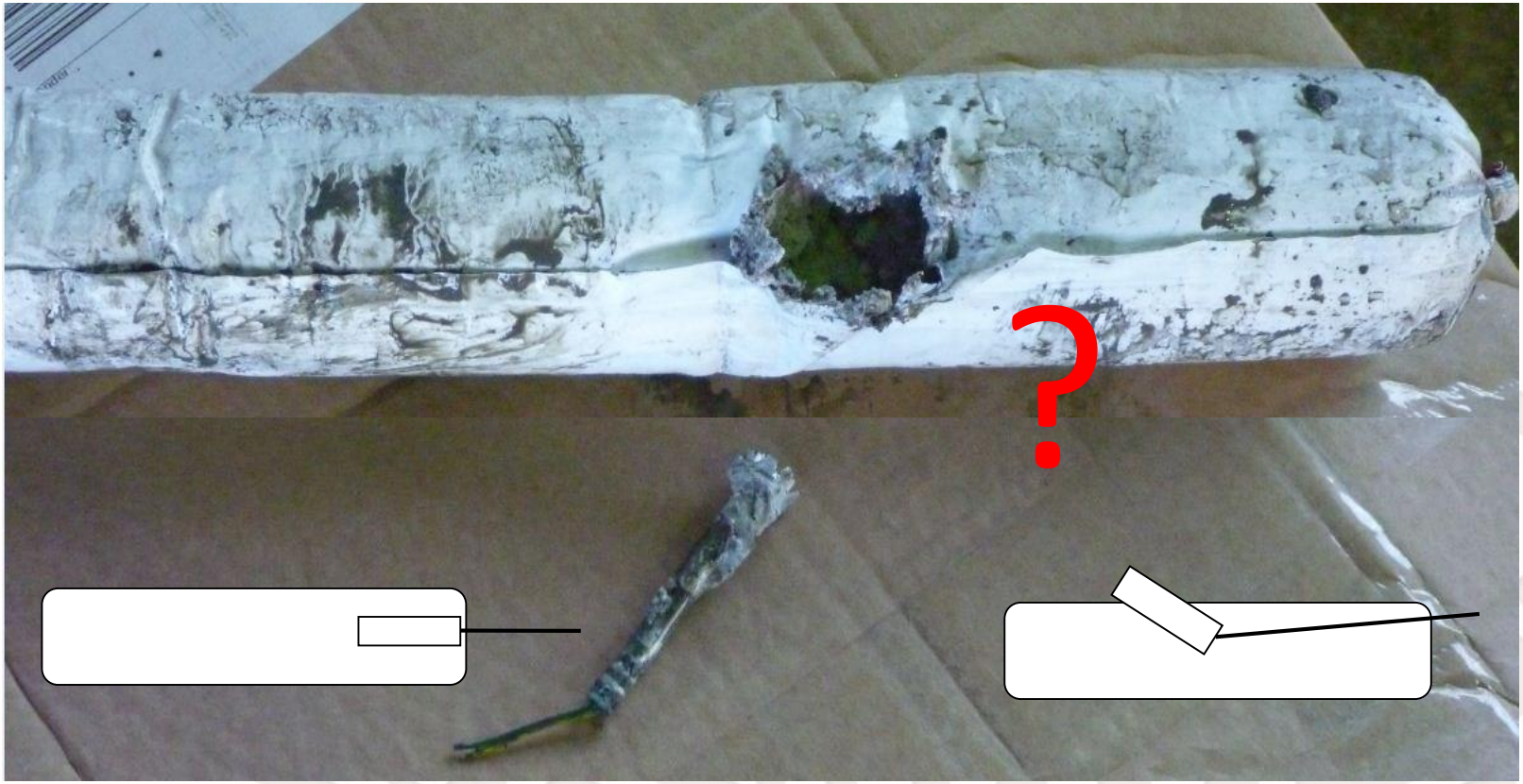


Misfire Analysis

- Have you seen this before?
- Why didn´t it fire?
- Did the detonator detonate correctly?

Misfire Analysis

- What were the results?



Environmental Issues

AGW (work place limit) TRGS 900:

-CO= 30 ml/m^3;

-NO= 25 ml/$m^{3/25}$ ppm → 2 ppm !

-NO_2= 5 ml/$m^{3/5}$ ppm → 0,5 ppm !

-Transition time: Tunneling 31.10.2017

Mining 31.10.2021

Environmental Issues

Type explosives	Average and standard deviation in L/kg			
	CO	CO_2	NO	NO_2
Dynamite (n = 12)	12 (SD = 8)	190 (SD= 19)	11 (SD = 4)	2 (SD = 2)
Permissibles (n = 5)	14 (SD = 7)	142 (SD= 56)	11 (SD = 4)	2 (SD = 1)
Powdered AN (n = 9)	23 (SD= 18)	116 (SD= 59)	12 (SD = 6)	2 (SD = 1)
ANFO (n = 25)	10 (SD = 3)	98 (SD= 11)	8 (SD = 4)	1 (SD = 1)
Emulsions (n = 27)	21 (SD = 9)	89 (SD= 11)	3 (SD = 1)	0,1 (SD=0,1)

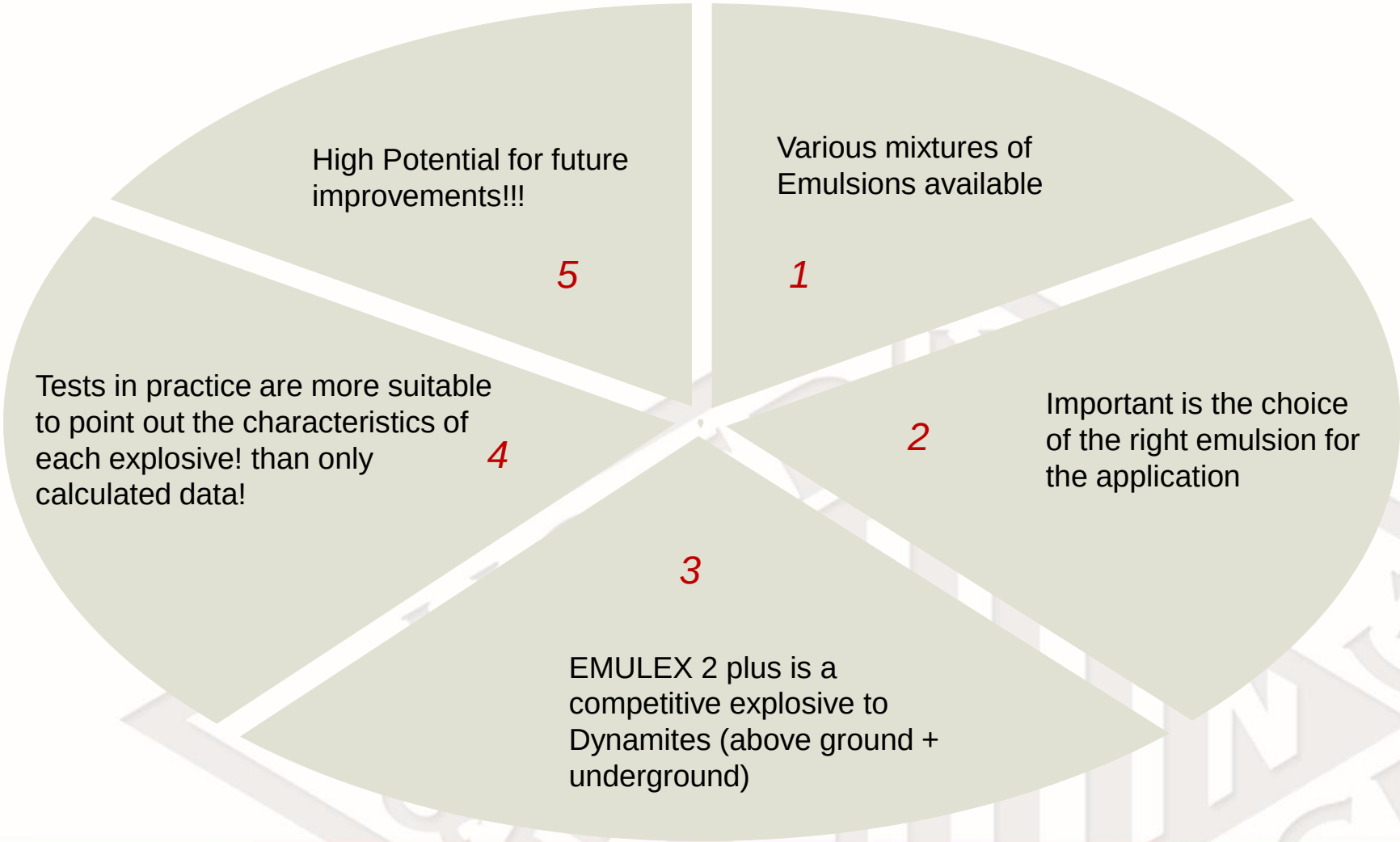
Source: BAM

Breaking News

Toyota stops selling diesel cars in Europe

Japanese auto manufacturer Toyota has said it will soon stop selling diesel vehicles in Europe, reacting to diesel's fall from grace on the Continent. The announcement was made at the Geneva Motor Show.

General conclusions



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