

**In this edition:**

**Beirut and other accidents with ammonium nitrate  
Dangers of this "virtually harmless" salt**

**The blasting of shovel excavator 259  
at the Hambach open-pit mine**

**EFEE Webinar on  
Explosives and Blasting  
Techniques**



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We in EFEE hope you will enjoy the present EFEE-Newsletter. The next edition will be published in February 2022. Please feel free to contact the EFEE secretariat or write to [newsletter@efee.eu](mailto:newsletter@efee.eu) in case:

- You have a story you want to bring in the Newsletter
- You have a future event for the next EFEE Newsletter upcoming events list
- You want to advertise in an upcoming Newsletter edition

or any other matter.

*Viive Tuuna, Chairman of the Newsletter Committee and the Vice President of EFEE and*

*Teele Tuuna, Editor of EFEE Newsletter - [newsletter@efee.eu](mailto:newsletter@efee.eu)*

*\*The articles that appear in this newsletter are the sole opinion of the authors. EFEE takes no responsibility for the accuracy or integrity of the content, and persons who rely on the content of articles do so at their own risk. EFEE encourages persons engaging in complex or hazardous activities to seek appropriate professional advice.*

## Dear friends, the President's voice

As Albert Einstein said, "Life is like riding a bicycle, to keep your balance, you must keep moving."

I have wanted for a long time to have this newsletter so that I can write a little more about our experience in the Netherlands. Even before the pandemic, the Netherlands evoked images of blue skies, sunshine, reinvigorating rain and incredibly energetic and kind people, always ready to laugh with you and offer an honest compliment. Somehow, as soon as I got off the plane, I felt at ease. I missed the Netherlands during the months it was impossible to travel.

Separately, I ventured into the beautiful city with paved streets and took in everything it had to offer. My favourite places were the Bonnefanten Museum, the buzzy Vrijthof with its many cafes and restaurants, the beautiful stone bridge Sint-Servaasbrug and Boekhandel Dominicanen. The latter is a unique bookstore sheltered into a Gothic monastery church, in which I ended up spending two blissful hours browsing their generous English selection.

These are memories and images which brighten these gloomy winter days and which hopefully send some joy and blue skies to all our readers.

I was overjoyed when the Board, Viive Tuuna, Jörg Rennert, Jari Honkanen, Johan Finsteen Gjørdvad, Mathias Jern, Espen Hugaas, Roger Holmberg, in the presence of James Tyler and

Bernard Vercoouteren van den Berge, had the chance to meet in person for the very first time in a long time in Maastricht, the Netherlands. The purpose of this meeting was to ensure that the long-awaited conference in Maastricht, that will take place 15th– 17th May 2022, will be our best one yet.

I must emphasize Jari's tremendous work done and congratulate the ASSOCIAZIONE GEORISORSE E AMBIENTE, represented by Mrs. Marilena Cardu, as a new EFEE National Association Member.

We had an effective Board Meeting preceded by viewing the Conference Center (MECC), as well as the options related to hotels, the Opening ceremony and Gala dinner.

Since this will be the last EFEE Newsletter for 2021, I express my hope and trust that in 2022 we will accomplish our plans, our expectations will be met and we will be together at ISEE 48th ANNUAL CONFERENCE ON EXPLOSIVES & BLASTING TECHNIQUE, Jan. 28 to Feb. 2, 2022, Paris Las Vegas Hotel & Casino, in Las Vegas, Nevada and at the EFEE 11th World Conference on Explosives, in Maastricht, the Netherlands. Please mark these important events in your calendar!

See you all very soon!

Doru Anghelache,  
President of EFEE





# 11th WORLD CONFERENCE Maastricht



15th - 17th May 2022 | MECC, Maastricht, Netherlands

**We hope to meet you all in Maastricht in May!**  
**[Click here for more information](#)**



*The EFEE Board sends their early seasonal greetings and wishes you all to have a beautiful holiday time in December!*

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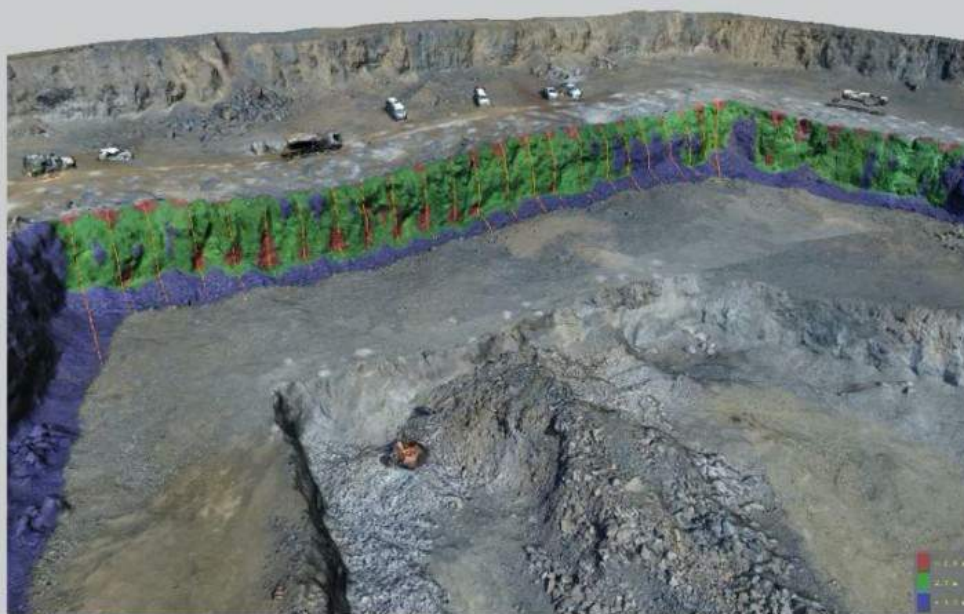
European Federation of Explosives Engineers

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# BlastMetriX UAV

## Blast Optimization

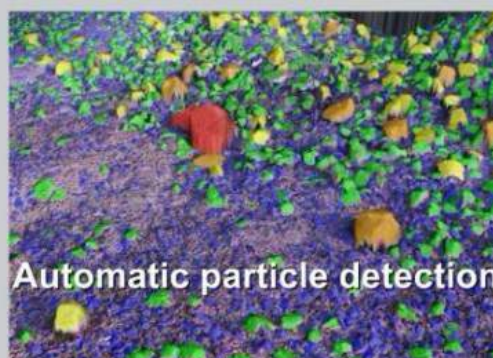
Blast Design and Blast Analysis with 3D images



3D images from drones are a perfect survey of large blast sites. 3GSM's unique blast optimization procedure bases on proactive blast design and automatic fragmentation analysis in 3D.

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- Face profiles (burden diagrams and maps)
- Pre-post blast comparison
- Quantification of muckpile (movement, volume, swell)
- Seamless data flow
- **NEW!** First 3D fragmentation analysis from drone imagery



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## **Beirut and other accidents with ammonium nitrate**

### **Dangers of this "virtually harmless" salt**

*Heinz Kratschmer*

#### **Introduction**

Ammonium nitrate (AN) is one of the bulk chemicals. World annual production in 2017 is estimated at 21.6 million tons (Google). The main application is the production of fertilizers.

The salt ( $\text{NH}_4\text{NO}_3$ ) produced from ammonia and nitric acid is a colorless crystalline substance, the usual commercial form is prills. The decomposition temperature is  $210^\circ\text{C}$ , the solubility in water is very high and, in addition, temperature-dependent (65% by weight at  $20^\circ\text{C}$ , 91% by weight at  $100^\circ\text{C}$ , based on the solution). This temperature-dependent water solubility is exploited in the production of emulsion and watergel explosives. AN is hygroscopic, i.e. it absorbs moisture from the air. Moreover, depending on the temperature, it exhibits different crystal modifications with different densities. One of these conversion points is at  $32^\circ\text{C}$ .

AN for fertilizer production and technical AN for explosives production differ only in their physical form. While AN for fertilizer production consists of dense prills, AN for explosives production contains pores in different amounts and sizes.

AN is not itself an explosive, but a fire-promoting substance (ADR Class 5.1, oxidizing). However, the classification changes very quickly: already from 0.2% combustible admixture AN becomes an explosive!

Under confinement and strong initiation (also by high heat!) AN has the ability for detonative conversion. In the process, it decomposes to nitrogen, water and oxygen with an enormous release of energy. The released oxygen can then oxidize existing combustible substances, causing a sharp increase in reaction energy. This is exploited for the production of ANFO explosives. The conversion of the optimal mixture of 94.3% AN and 5.7% oil produces nitrogen, water, and carbon dioxide and 2.7 times the amount of energy compared to the decomposition of pure AN.

#### **Disasters**

**9/21/1921 in Oppau, Germany:** A plant was built in 1911 for the production of synthetic fertilizer based on ammonium sulfate and was converted to AN production during the First World War. 20 m high concrete silos were filled from the top with AN from production, which was removed for shipping through large gates at ground level. Moisture absorption and crystal transformation cause the AN to cake into very solid piles. For loosening, blasting with small charges was carried out in the silos, resulting in the reaction of over 400 t of a total of 4,500 t of AN.



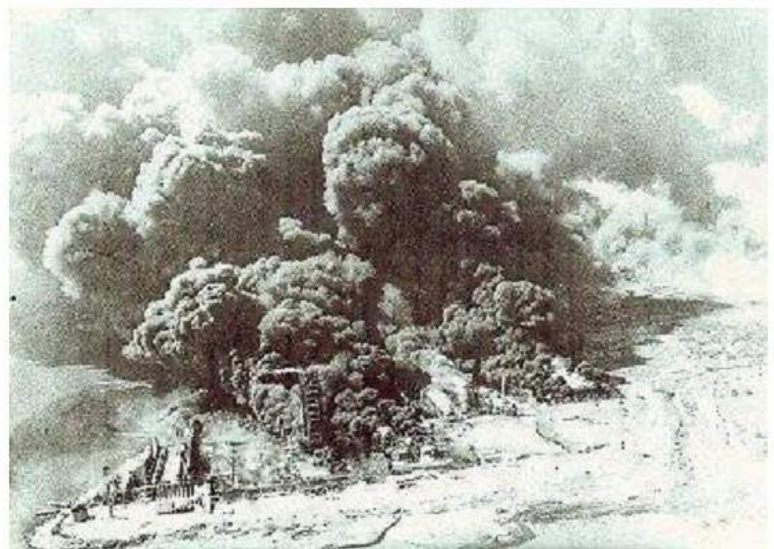
*Oppau, Germany*

Consequences: 600 dead, 2,000 injured, the crater is 120x80m and 20m deep.

**4/16/1947 in Texas City, USA:** A fire starts aboard the freighter S.S. Grandcamp in the port of Texas City. The cargo consists of 7,700 tons of AN in paper bags. The AN contains clay as an anti-caking agent and the flammable chemicals kerosene and petrolatum. The content of kerosene and petrolatum is about 1%, as was common at the time. One hour after the fire started, the cargo explodes.

The explosion causes the S.S. Highflyer, also in port, to catch fire, and its cargo of 900 tons of AN and 1,800 tons of sulfur detonates 15 hours later.

Consequences: 581 dead, 5,000 injured, 500 houses destroyed.



*Texas city, USA*

**9/21/2001 Toulouse, France:** Exactly 80 years after the Oppau accident, an explosion occurs at the AZF plant (Azote Fertilisants, operator Grande Paroisse). It involves about 300 t of off-spec AN that was stored in a pile for reprocessing. The cause is believed to be accidental mixing with waste containing chlorine and, as a result, self-decomposition.

The picture below shows the situation before and after the explosion.

Consequences: 31 dead, over 2,500 injured, approx. 1.5 billion euros in property damage

Additional effect: EU ad hoc legislation, see below.



*Toulouse, France*

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## 6. Accident at AZF, Toulouse, and environmental protection policy

B5-0611, 0612, 0614 and 0615/2001

### European Parliament resolution on the explosion at a factory in Toulouse (France)

#### The European Parliament,

- having regard to Articles 174 and 308 of the EC Treaty,
- having regard to Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances (1) and in particular Article 11 on emergency plans and Article 12 on land-use planning,

**3/27/2019 Camden, Arkansas, USA:** A truck loaded with AN begins to burn on Highway 278 about 1 mile west of Camden, due to overheated brakes. The driver tries in vain to extinguish the fire, the explosion can be heard and felt for several miles.

Consequences: Truck driver dead, several emergency personnel slightly injured, 2 police vehicles destroyed, 4.5 m deep crater in the highway.

If the regulations had been observed (evacuation in the event of a cargo fire), there would have been no casualties!



Camden, Arkansas

**8/4/2020 Beirut, Lebanon:** A fire, probably caused by welding work in the warehouse, engulfs fireworks stored in the same warehouse (!!!). The explosion of the pyrotechnics initiates the AN stored there (about 2,750 t).

Cause of the accident: boundless carelessness and failure of the authorities! The AN, which came from a confiscated ship, had already been stored in this warehouse in the port of Beirut since 2014. Despite multiple notices from port officials, the authority did not respond; the AN was stored in a large warehouse along with 1,000 car tires and 23 tons of fireworks.

The company Forensic Architecture was commissioned by the Lebanese government to reconstruct the accident by creating elaborate 3D models of the buildings on the computer and combining them with existing photographs. In addition, all available film footage and countless witness statements were processed.



Consequences: more than 200 dead, more than 5,000 injured, more than 200,000 homeless, large parts of the harbor destroyed, damage to large parts of the city.



*Beirut, Lebanon*

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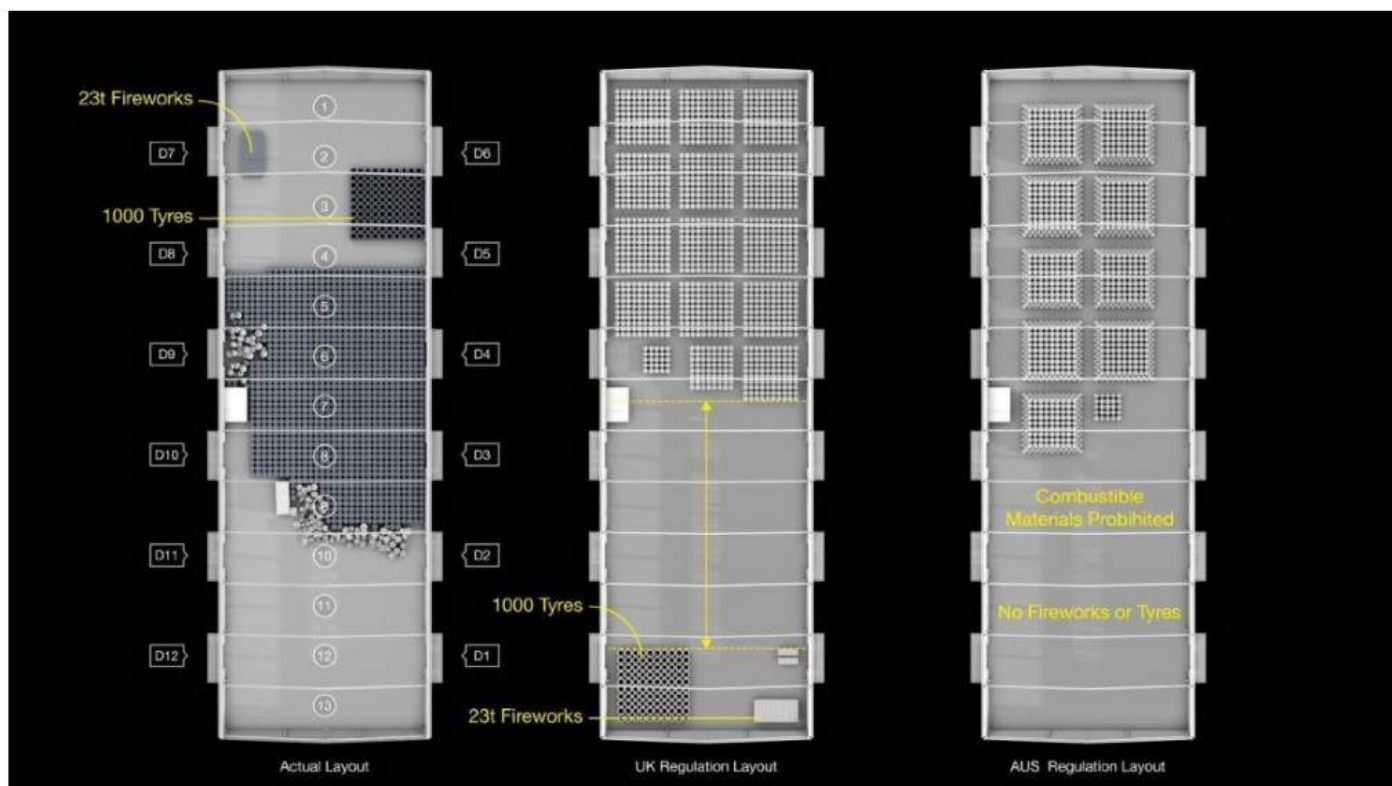
The picture below shows the 3D model of the warehouse with inserted photo. You can clearly see the condition and disorder of the big bags with AN. Temperature changes above and below 32°C cause an increase in volume in the AN, which can lead to the bursting of individual big bags.

In Australia, the stacks can be up to 500 t. The co-storage with combustible materials is prohibited, so no car tyres and fireworks allowed.

On the second image, Forensic Architecture compares storage in Beirut with possible storage under UK and Australian regulations:



According to UK regulations, the AN can be stored in stacks of 300 tons with appropriate spacing between stacks. With proper spacing, even fireworks and car tyres can be stored in the same warehouse.



## Legal situation in Austria and Germany

In Germany and Austria we have much stricter regulations for the storage of AN. In Germany, there are Technical Guidelines for Hazardous Substances (TRGS), which are also used for assessment in Austria. There is a separate guideline for AN, TRGS 511 "Ammonium nitrate", which is also the basis for the corresponding paragraphs of the Ordinance on Hazardous Substances.

Here are some excerpts from TRGS 511:

### 1. Scope

(1) TRGS 511 applies to the storage, filling and in-plant transport of

1. Ammonium nitrate,
2. preparations containing ammonium nitrate (preparations).

(2) TRGS 511 does not apply to

- 1 . Preparations with a mass content of ammonium nitrate of up to 10 per cent,
- 2 . ammonium nitrate and preparations of group A in quantities of up to 100 kg,
- 3 . preparations of groups B, C and D in quantities of up to 1 ton.
4. ammonium nitrate and preparations subject to the Explosives Act.

6.1.1 Protection against weather effects

(4) Ammonium nitrate undergoes transformation of its crystal phases at 32 °C - by additives possibly also at other temperatures. Repeated passage through the crystal transformation point leads to a change in physical form (e.g. volume change or grain disintegration of granules containing ammonium nitrate) and properties (e.g. increase in sensitivity to the effects of detonation).

The volume changes may damage the packaging material (e.g. bursting of bags). For these reasons, the substances and preparations must be protected from heating, e.g. by solar radiation.

6.1.2 Protection against contamination and dangerous joint storage

(1) Substances and preparations shall be stored separately from flammable substances and from such materials which may undergo dangerous chemical reactions with ammonium nitrate.

6.1.4.3 Prevention of heat input during hot work

(5) No welding, flame cutting, soldering and abrasive cutting work shall be carried out on bunkers, chutes, partition walls and that sort of thing if substances or preparations or residues thereof are still present on the other side of the wall. If the risk of thermal decomposition of the stored material in the hazardous area around the work site cannot be completely ruled out, the above-mentioned work must not be carried out.

The Ordinance on Hazardous Substances specifies exact quantities and distances for this purpose:

5.4.2.2 Additional Measures for Storage of Quantities in Excess of 1 Ton

(3) Group A substances and preparations and Group E preparations shall be divided into subsets of up to 25 tons prior to storage.

(4) Partial quantities up to 25 tons of Group A substances and preparations may only be stored if they

1. are separated from each other by walls of masonry bricks or wall blocks of similar strength or of concrete, the space between which is completely filled with non-combustible substances, and if the walls, including the space between them, have a minimum thickness  $d$ , which is calculated from the largest partial quantity  $M$  in each case according to the following relationship:

$d = 0.1 M^{1/3}$  with  $d$  in "meters" and  $M$  in "kilograms".

(5) The place of storage must have a minimum distance (protective distance)  $E$  from buildings used for the permanent residence of people, which is calculated from the respective largest partial quantity  $M$  according to the following relationship:

$E = 11 M^{1/3}$  with  $E$  in "meters" and  $M$  in "kilograms".

Accordingly, in Austria and Germany, all employees who handle AN are trained annually and sensitized to the dangers of handling AN:

### Einstufung



### Hauptgefahren

- ▶ wirkt brandfördernd auf brennbare Stoffe
- ▶ wassergefährdend
- ▶ bei Zersetzung oder Säureeinwirkung Bildung von Stickoxiden
- ▶ bei Erhitzen unter Einschluss Verpuffung oder Explosion möglich

*Main hazards:*

*has a fire-promoting effect on flammable substances  
hazardous to water*

*formation of nitrogen oxides when decomposing or exposed to acid deflagration  
or explosion possible when heated under confinement*



### Beim Umgang beachten

- ▶ Zündquellen fernhalten - Rauchverbot
- ▶ Vor Wärmeeinwirkung schützen
- ▶ Hautkontakt vermeiden  
d.h. geeignete, dichte Schutzhandschuhe tragen
- ▶ Schutzbrille tragen
- ▶ unter Verschluss aufbewahren
- ▶ Eindringen in Wasser, Boden vermeiden
- ▶ verunreinigtes Material in dichten Behältern sammeln



*Keep away from sources of ignition - Smoking prohibited*

*Avoid contact with skin i.e. wear suitable, tightly fitting protective gloves*

*Wear protective goggles*

*Keep locked up*

*Avoid penetration into water and soil Collect contaminated material in tight containers*



- ✓ Wie brennenden Sprengstoff behandeln
- ✓ Evakuieren
- ✓ Ausbrennen lassen

Handle burning AN or AN emulsion like burning explosives:  
 - Evacuate - Let it burn

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## The blasting of shovel - excavator 259 at the Hambach open-pit mine

Michael Schneider

*The preparations for the blast operation of an open-pit-shovel excavator after the end of lifetime are described. The choice of suitable linear cutting charges is explained as well as the removal of components and ecologic recycling of the materials.*

### 1. The excavator

Bucket-wheel excavator 259 was built in 1960. With a service weight of 7,800 t, a length of 210 m, a crawler width of 31 m, and a height of 70 m, it was truly a heavyweight. For 60 years he worked day and night, apart from maintenance and repair times. During these six decades, the excavator has reliably uncovered lignite and extracted it.

It moved 686 million tons of overburden and 204 million tons of lignite. In this way, it and its crew contributed to the usual reliable power supply in Germany. In 2020, his retirement began and he was decommissioned for good.

### 2. The road to retirement

At that time, the further path of the excavator was already determined. The decisive steps on this path were:

1. Removal and proper disposal of all lubricants and contaminated materials
2. Dismantling of components that were to be used as spare parts for other equipment
3. Protection of components that were to be used as spare parts for other equipment but whose dismantling was not possible at the time (e.g. the landing gear)



Fig. 1: Blasting object: bucket-wheel excavator 259 in the Hambach open-pit mine | Photos: Yannik Fischer 9

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4. Preparation of blasting for rough disassembly
5. Blasting
6. Successive dismantling
7. Dismantling of components and feeding of the remaining materials into the circular economy

### 3. The companies involved

The owner and operator of dredger 259 was RWE Power AG. This company also proved its professionalism in this project. In the run-up to the dismantling project, as in previous projects, it commissioned IFF Engineering & Consulting GmbH from Leipzig to prepare technology for blasting for scrapping. The tender documents were accompanied by a draft of the blasting points, and cuts by IFF Leipzig. Thus, as is often the case with other tenders, no one had to calculate "in the blue".

BENDER Recycling GmbH from Leverkusen was awarded the contract for the dismantling work. The entire dismantling, i.e. disassembly, removal, and recycling, was carried out by BENDER. Purely for the blasting, the company Liesegang GmbH & Co. KG from Hürth was commissioned by BENDER.

### 4. Selection of the cutting charge

Before you start calculating a blast, of course, the question arises about the selection of explosives. In this case, the trade-off was between the two cutting charge types, Razor and LSC-Linear Cutter hereafter referred to as LSC for short.

The steel structure of the excavator was built almost entirely in St 52. Very many components to be separated by blasting were well over 40 to 50 mm thick. These were always packages of two or three sheets riveted to each other. In addition, a closer look at the cuts to be made revealed that for some of the strong components, of all things, the cutting charge could only be applied from one side.

Thus, the cutting charge to be used had to meet the following criteria:

1. Cutting of up to 50 mm thick sheet packs, with up to three sheet packs riveted to each other. Here, special consideration must be given to the power loss of the cutting charge occurring at each joint.



Fig. 2: Preparations for dismantling the bucket-wheel excavator, (10 Demolition)

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2. Partly, due to the component, only one-sided layouts are possible
3. Steel grade St 52, higher strength steel
4. All cutting performances guaranteed by cutting charge manufacturers refer to steel grade St 37.

The largest Razor, at least known to the author, is Razor 40. The manufacturer guarantees a cutting capacity of 40 mm for this product. Razor was thus eliminated under the aforementioned criteria. Thus, written down one after the other, the decision-making seems unspectacular and unambiguous, were it not for the practical side. One gives away two advantages regarding handling that should not be underestimated. Razor can be purchased by the meter and then cut directly on the prepared blast cut. Any deviations from the cutting lengths specified in the blasting technology that might occur during preweakening utilizing cutting torches can easily be compensated for onsite. The LSC, on the other hand, must be ordered piece by piece and to the millimeter. The self-adhesive nature of the Razor also makes it easier to attach than the LSC.

### 5. The way from paper to distribution to excavator - or avoiding a hopeless mess on the construction site

230 individual blast cuts were to ensure that the assemblies of the 259 excavator were deposited on the planum of the open-pit. 16 of them had to be created on both sides. This meant that a total of 246 cutting charges were necessary.

The varying component thicknesses and compositions made the following cutting charge sizes necessary: LSC 53, 85, 128, 191, 255, 320, 425, 851 and, 2231. Each individual size was required in different lengths and quantities.

Since ESSING Sprengtechnik GmbH has taken over the distribution of the LSC, the individual cutting charge sizes are offered as standard in the lengths 305, 610, 915 and 1 000 mm. The only exception is the LSC 2231 g/m. This is only available in length 305 mm.

The cutting lengths varied between 45 mm and 1 400 mm due to the different sizes of the components. The standard lengths available from the LSC could only be used in the rarest of cases. Thus, almost every cutting charge became a special size.

It had to be guaranteed that each cutting charge piece could be clearly assigned to its theoretical explosive cut in the technology of the IFF Leipzig.



Fig. 3: Inspection of the steel structure for the selection of the cutting charge (11 Demolition)

This was the basic requirement for the safe merging of the cutting charge piece and the real explosive cut, which was located somewhere on the excavator. Only a tabulation of the 246 individual pieces was expedient here. An essential part of the table was the assignment therein of a distinctive designation for each individual piece. It had to be possible to find exactly this designation on the made-up pieces to avoid hopeless confusion during the piecing work under all circumstances.

## 6. From instruction to blasting

On the morning of the first day of the berthing work, the scheduled delivery of the explosives took place at the Hambach open-pit mine. At the same time, the demolition workers and assistants arrived there. However, no one is allowed into the open-pit without a valid access permit. All individuals must first go through general safety briefings and pass a small exam. The aim is to sharpen the view about behavior and occupational safety under the aspect of an operation subject to mining supervision. After that, you will receive the access authorization.

The preweakening of the blast cuts was completed at this time, except for a few remaining operations. Continuous controls during production guaranteed excellent quality. This laid the first foundation stone for the smooth running of the berthing operations.

The second was laid by the Essing company. Without exception, the cutting charge pieces were correctly labeled and very clearly packed. The great concern that the mooring teams might have to wait for hours for this or that cargo due to confusion was completely unnecessary.

About three-quarters of all moorings could only be reached from elevating platforms. This circumstance significantly determined all decisions regarding the mooring work. The most essential decisions, which were already made in the planning phase, were the general use of 2 lifting platforms and sufficient personnel.



*Fig. 4: Preparing the cutting charges for the steel structure lay-up work*



*Fig. 5: Attachment of the cutting charges utilizing lifting platforms*

Due to the generous space available in an open-pit mine, it was possible to define a 400 m radius without any problems. Of course, Corona had to be involved in this blast, as it is everywhere now. Except for those directly involved in the blasting and cordoning off, few people were able to watch the event live. According to the schedule prepared for the blast day, the ignition took place on time.



*Fig. 6: Blasting of bucket-wheel excavator 259 | Photo: RWE (12 Demolition)*

The result can be summed up with the simple word "storybook blasting." Every accessible blast cut was immediately subjected to an intensive survey. None could be found that was not exactly separated. Especially the one-sided strong, multi-layer sheet packages were completely cut through. The structural engineer in charge was able to clear the unit for further dismantling. A new evaluation of the situation was not necessary. The condition for the success or failure of almost any blasting is based, among other things, on the quality of the interfaces of the companies involved and the quality of the service provided by each company. From planning in advance, good technology and implementation of blasting preparations to blasting.



*Fig. 7: Blasting result - multilayer sheet packs were completely cut through (13 Demolition)*

To guarantee the success of a blast carried out as on excavator 259, a maximum of these qualities is undoubtedly required. The most important services to be provided and the associated interfaces are listed below:

- . Planning in advance
- . Creation of blasting technology
- . Production of the preweakenings
- . Ordering of cutting charges (and of course all other required blasting and auxiliary equipment).
- . Composition and delivery of cutting charges, etc.
- . Attachment of the cutting charges until the detonation is triggered.

If only one of the companies involved fails to provide the required quality, the result of the blasting is immediately called into question.



*Fig. 8: Dismantling and feeding the remaining materials into the circular economy (13 Demolition)*

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## EFEE Webinar on Explosives and Blasting Techniques

*Simon Price, Marketing and Membership manager*

Tuesday, 28th September was a memorable day for EFEE as we hosted our first webinar on explosives and blasting techniques.

At 2pm CET attendees joined from all corners of the globe Australia, Austria, Belgium, Bulgaria, Chile, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Japan, Latvia, The Netherlands, Nigeria, Norway, Poland, Portugal, South Africa, South Korea, Spain, Sweden, Switzerland, United Kingdom, United States and Zambia for this educational webinar.

The second presentation looked at blasting a huge overhanging rock formation in an emergency situation in the US presented by Jerry Wallace and William Gates, Wallace Technical Blasting, Inc.

Doru sighted the huge benefits and advancements in online education affording the ability to deliver such superb content to the EFEE membership.

Roger Holmberg, EFEE Secretary General kindly chaired the sessions introducing the speakers, adding insight and hosting the live Q&A.



### Welcome

We really want you to enjoy the event, but before we continue we want to make sure you can participate.

Let's quickly check everything and then you're on your way.

- ✔ Mic Access
- ✔ Microphone (Logitech USB Headset) (046d0a45)
- ✔ Camera Access
- ? Camera Selection
 

Last question before you head into the event, what camera would you like to use?

USB 2.0 Camera (0c45-636b) ▼



Set

👤 Live Video Call Check

Doru Anghelache, current EFEE President opened the session and welcomed the audience virtually to the webinar, introducing the programme which focussed on two specialist presentations; the first a case study looking at the technical calibration model for predicting flyrock by assessing borehole deviation using the latest technology, presented by Auã Kiahla from O-Pitblast.



The first presentation "Flyrock Estimation Using O-Pitdev Deviation Measurement System" was written by V. Miranda, F. Leite, A. Oliveira & T. Kouvonen, H. Parra. Auã Kiahla from O-Pitblast presented. Auã is a Mining Engineer from Brazil with a Masters Degree in Mining and Geo-Environmental Engineering from the University of Porto, Portugal. He has been working with O-Pitblast for 3 years as a Project Manager and Technical Consultant.



A recording of the blast was also executed to ensure the gathering of information related to the maximum throw generated. After conducting the data analysis, the authors were able to measure the corresponding safety zones that need to be implemented to diminish losses both in terms of people and machinery.

If the boreholes are poorly executed and their deviations are not identified they can cause accidents, which result in major consequences such as the loss of the company's reputation, cancellation of licences to operate in mines or quarries and the accountability of the people involved.

The work was well presented and clearly showed the technicalities of the project, its delivery and the equipment involved.

Auã described the calibration of a model for predicting flyrock with the face burst mechanism. For this, a field procedure was carried out in a quarry in Sweden that constantly dealt with problems related to projections. With the use of state-of-the-art technology, O-PitDev (inclinometer), and a drone, it was possible to measure the boreholes' deviation, create a 3D terrain with a drone survey and then combine both pieces of information to measure the corresponding critical burdens from the free face.

**Statistical Analysis**

- It was calculated "K" as a function of the critical burden, maximum throw, gravity and linear charge values of for each blast. The values used for the last two variables were 9.81 m/s<sup>2</sup> and 5.24 kg/m.

Borehole	Critical Burden - Maximum Throw (m)	K	Maximum Throw (m)
Borehole 1	2.47	21.00	110.32
Borehole 2	2.47	21.00	110.32
Borehole 3	2.47	21.00	110.32
Borehole 4	2.47	21.00	110.32
Borehole 5	2.50	20.00	100.00
Borehole 6	2.34	31.00	150.00
Borehole 7	2.25	20.00	100.00
Borehole 8	2.48	21.00	110.32
Borehole 9	2.70	20.00	100.00
Borehole 10	2.45	20.00	100.00
Borehole 11	3.90	40.00	200.00
Borehole 12	5.00	20.00	100.00
Borehole 13	2.90	21.00	110.32
Borehole 14	2.70	18.00	90.00
Borehole 15	2.80	20.00	100.00
Borehole 16	2.80	21.00	110.32
Borehole 17	2.80	21.00	110.32
Borehole 18	2.70	18.00	90.00
Borehole 19	2.70	20.00	100.00
Borehole 20	2.70	20.00	100.00
Borehole 21	2.34	40.00	200.00

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The presentation was followed by an engaging live Q&A hosted by Roger Holmberg.

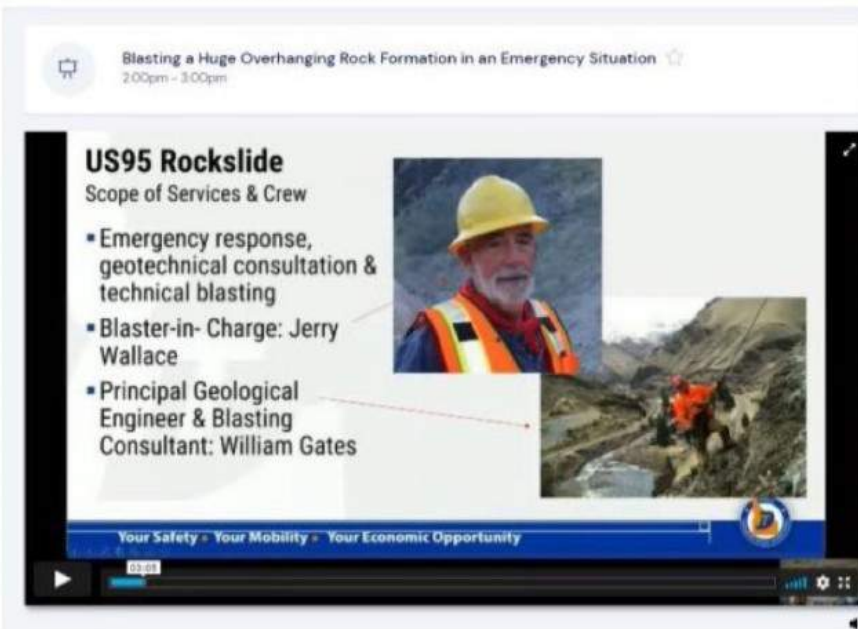
After a short break Roger introduced the second presentation "Blasting a Huge Overhanging Rock Formation in an Emergency Station" written by Jerry Wallace and William (Bill) Gates, PhD, P.E. Wallace Technical Blasting, Inc. Wallace Technical Blasting are based on the West Pacific Coast, Jerry is the 3<sup>rd</sup> generation of his family working in the industry and has a breadth of experience working in Civil Construction Blasting. Jerry is a previous president of ISEE. Dr William Gates is a retired, US Army Special Forces and is a Principle Geological Engineer at Macmillan Jacobs Associates with over 50 years of practical experience.

Jerry and Bill presented a detailed and interesting case study covering all aspects of this very technical project outlined here.

Together the rockslides dumped about 15,300 cubic meters of rock onto the highway but left a large unstable menacing remnant block of about 12,000+ cubic meters hanging above the highway.

Although this was an emergency project it was initially delayed because naturally occurring asbestos (NOA) was discovered on the rock slope. After a mitigation plan was developed, a general contractor was selected and in August the large block was drilled and blasted in a single shot to allow for reopening of the highway in early September.

The blast was designed to drop the overhanging rock mass while protecting the remaining backwall, all while keeping the material from spilling into the Little Salmon River just across the highway. All this work took place as emergency work during Covid-19 restrictions and during the time of massive wildfires in the region.



sting was safely and successfully lished through the efforts of all l, including keeping the muck pile out of the river. Cleaning up the rock slope after the shot involved rock scaling, installation of rock anchors and cable net drape. Once completed the highway alignment was corrected and paving completed just prior to winter 2020.

Their presentation was followed by a live Q&A hosted by Roger Holmberg.

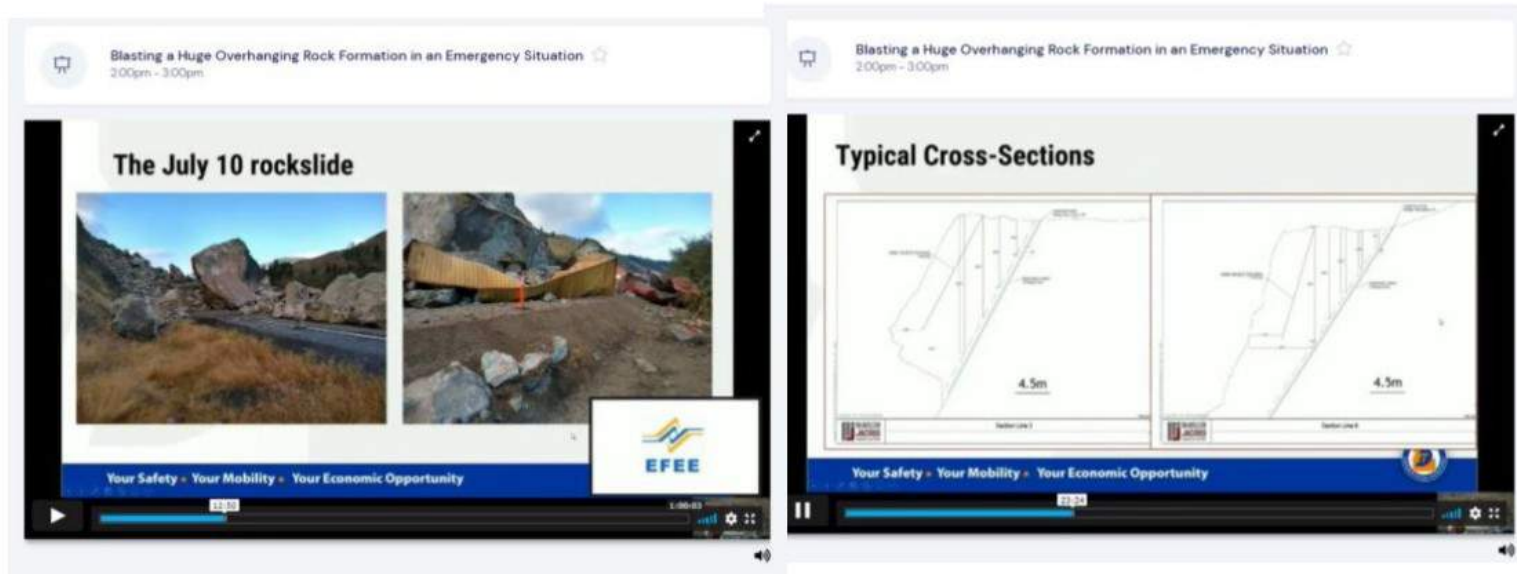
We would like to thank all of those involved in delivering this hugely successful webinar and hope to deliver more interactive content to members in the future.

On July 3 and 10, 2020, two large sequential rockslides fell near Riggins, Idaho, USA onto highway US-95 closing the state's only major north-south artery for Idaho, requiring a ten- hour detour to transport personnel, goods, and services.

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### Questions?

If you missed our webinar and would like to revisit the sessions and live Q&A please contact [marketing@efee.eu](mailto:marketing@efee.eu) where we can organise access to EFEE's virtual platform.

Access is free to EFEE members; non-members will be asked to join which of course comes with all of the additional [benefits](#) of EFEE membership.



**EFEE**

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The "Georisorse e Ambiente" (Georesources and Environment) Association, or "GEAM", was founded in 1964 as "Associazione Mineraria Subalpina" (Subalpine Mining Association), with cultural and non-profit purposes. Ever since its establishment, it operates in the field of environmental and mining geoengineering, with particular focus on fluid, solid and territorial resources, compatibility and environmental safety of production, excavation and construction activities. GEAM offices are located in Torino, inside the Department of Environment, Land and Infrastructure Engineering (DIATI) of Politecnico di Torino, and it is active everywhere on Italy national territory, also leveraging its close links with similar Italian and foreign associations. The Association organizes International and National Conferences on various technical, economic, legal and environmental issues, relating to the following main cultural sectors:

- Resource exploration, assessment and exploitation
- Civil and Mining Excavations
- Territory and Soil Protection
- Safety in production activities
- Environmental remediation, risk analysis and impact assessment,
- Sustainable Development and Circular Economy

GEAM has about 300 members, of which about 30 collective members, representing leading engineering, construction and mining companies in Italy, as well as public authorities and university departments. The majority of individual members are professionals operating as geologists and engineers in the mining, environmental and civil fields of practice.

The Association publishes:

- the GEAM magazine - Environmental and Mining Geoengineering
- the PANGEA online magazine
- a series of Study and Documentation Notebooks
- the Proceedings of National and International Conferences, and of the main *Research Days* devoted to specific topics

GEAM's mission is to create links between teachers, researchers, professionals, companies and Italian and foreign entities that carry out their activities in the field of mineral resources, the environment and in any related field. The mission is nowadays increasingly declined towards sustainability, geoengineering, and the managerial training of technical professionals.

GEAM is currently in a phase of raise, with increased participation by the University, involvement of other associations, companies and professionals in new activities, consolidation of historical memories, repurposing on the web of the prestigious and historic magazine, launch of commercial activities and new support structures.

The governance organization is structured in the following bodies: the members' assembly, the Board of Directors and Auditors, the Executive Council and the Secretariat. Each member of the Board of Directors has a specific task for relations with members, administration and secretariat, for dissemination, refresher courses, for technical commissions and for relations with other Italian and foreign universities.

GEAM's training activity is primarily aimed at graduated professionals - engineers, geologists, architects, graduates in general, construction companies, professional companies and to the public administration. The activities consist both in training courses - from a few hours to a few days - and in seminars of one or more days, and in technical visits and on-site demonstrations.

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*GEAM - Associazione Georisorse e Ambiente*

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## EFEE Board visit to Maastricht

*Jari Honkanen, Immediate past president, EFEE*

EFEE Board arranged its first physical meeting after the outburst of COVID in Maastricht, Netherlands in the end of October. Everybody waited for the meeting anxiously, unsure if the meeting could take place after all and how difficult it would be to travel abroad and by plane again. Now that the meeting has been held successfully, I can report that travelling abroad and flying inside Europe is quite as easy as it was previously assuming the traveler has been fully vaccinated. COVID precautions have caused only a few irrelevant changes. One needs only to carry a COVID passport proving receipt of two vaccinations and wear a mask at the airport and during the flight. According to my experience, COVID precautions do not cause significant delays in normal airport processes. COVID passes need to be presented only once before boarding and again before entry to your destination and they are scanned quickly.

Personally, I chose to fly to Maastricht via Brussels. Belgium required also filling of a Passenger Locator Form if you arrived by airplane, which was easy and fast. There was no such requirement if you arrived directly to some airport or by car in Netherlands. Such travelling rules as these are of course subject to change, so they need to be checked prior to every visit.

The main reason for arranging a physical meeting in Maastricht was to allow the board to visit all important venues and sites optional for the 11th EFEE world Conference on Explosives and Blasting. Thorough site visits were conducted on the first day lead by representatives of the Maastricht Convention bureau and James Tyler from Tyler Events, the conference organizer for EFEE. The tour started from the MECC Convention Centre, where meeting rooms, exhibition and lobby areas were reviewed. MECC was found to be an impressive modern conference center which will provide an outstanding and safe venue for the coming EFEE event. Hallways, lobbies, meeting rooms and conference area all allow possibility to hold safe social distancing if required.

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We will be able to provide our exhibitors and delegates significant additional space and safe passage between exhibition booths and the throughout the entire conference venue. This time even a demo stage is planned to be included in the exhibition area. Also, the workshop was planned for the conference together with the Dutch national association.

The next in line were three potential venues for the all-important gala dinner. All visited sites were extraordinary and beautiful offering ancient heritage and architecture combined with high cuisine and potential for a captivating

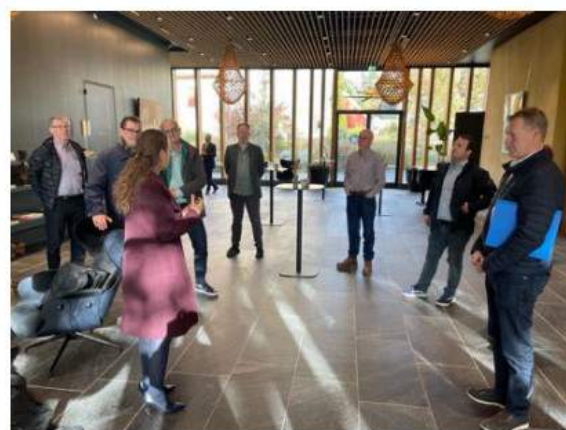
Day number two was reserved for the actual board meeting where for example financial situation and Committee news were reviewed. The meeting stated that the financial situation of EFEE is continuously good and COVID has not changed that. Newsletter, Environmental and Membership & Marketing Committees have been active and held meetings. Progress and future plans were summarized for the board. The next meeting is planned to be held in Italy to meet with GEAM, the newest national member in EFEE. The following meeting will be held in Dublin, Ireland to review conference venues for the 12th EFEE World Conference in 2023. After that all EFEE organs Board, Council and

AGM will meet in Maastricht in May prior to the 11 thConference.

Several members of the board were also able to visit the beautiful city of Maastricht by foot after meetings were finished. We found Maastricht to be a lively and picturesque city which has a tremendous history.



evening program for which our Gala dinners are known.



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It is one of the oldest cities in Netherlands dating back some 2000 years. The city has 120.000 inhabitants. It is located by the river Maas close to the Belgian border and the German border is not far either. The city offers everything required for an interesting and nice stay within easy reach by foot; historical quarters and buildings, beautiful bridges, art, shopping, vibrant night life and plenty of excellent restaurants, including several with Michelin stars. There are hundreds of excellent restaurants and bistros inside the old town, most equipped with outdoor dining areas. I guess it is needless to remind that Dutch and Belgian beer is rated to be the best in the world, but there is also both white and red wine of good quality produced in this area – the board got to taste some of that and we can surely recommend you to take a taste as well when you join the 11th EFEE World Conference on Explosives and Blasting 15th-17th of May 2022.



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On the last day a few of us were able to visit a fantastic old ENCI quarry area which also includes an underground cave system and a nearby fortress. The quarry operation has ended, and the pit has been partly landscaped and turned into a recreational park leaving still some of the quarry walls and old underground structures visible. There is still 80 km of underground tunnels remaining (out of original 230 km) around the quarry and a guided tour to visit them is available.

The cave system has a colorful history including its use as a hideout during World War II. A visit here is strongly recommended and should be interesting to all explosives engineers – I recommend to reserve half a day and good shoes for it.



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## Obituary

**Mr. Jan Klusáček** was born on 5th of August 1934 in Litostrov at Brno in the Czech Republic.

He graduated in 1953 from the industrial school in Šumperk. Because he decided for a military career he joined the Artillery Technical School in Martin, Slovakia. After successful completion and graduation, he continued at the same school as a teacher in the subject "construction of ammunition and pyrotechnics" for another 3 years.

Subsequently he was transferred to the garrison in Prague as chief of artillery armament and garrison pyrotechnician. In 1965 he was offered further employment at the Ministry of Defence in the Department of Artillery Armament.

For his civilly declared opposition to the entry of Warsaw Pact troops, he was expelled from the army in the 1970s, and like others who disagreed, and his life changed significantly.

His further professional activity was related to the new construction of the Metro in Prague, where he started as a shift shotfirer in the tunnelling of the C line tunnels in Kačerov in the organisation VKD Kladno and then continued in the newly established national company Metrostav, which specialised in the construction of the metro. Thanks to Metrostav, which in the political situation of the time defended the need to acquire professional professions and employed people affected by the regime, he was hired as a specialist - a shotfirer in the tunnel excavation profession. The results of his work were also recognised by the award of the golden badge of "Subway Builder".

He experienced surveillance and persecution, but later, as a much-needed expert, he graduated from the University of Pardubice and became a master-blaster. Even the nomenclature of the time needed experts. At work he also met prominent dissidents and was one of those whom Jiří Dienstbier, already in his position as minister of foreign affairs, came to thank for their treatment after the "revolution".

In 1990 he was rehabilitated, promoted to the rank of retired colonel, and subsequently awarded military honours in the artillery profession. Here he became involved in the organized activities of rehabilitated officers.

In 1992, he retired from Metrostav and joined company Explosive Service Ltd. as Sales Director, a position he held for the next 15 years.

As early as 1960, he co-founded the Commission on Blasting and Pyrotechnics, which gave rise to the present Society for Blasting and Pyrotechnics, of which he was later a distinguished president. To this day he has been continually active in the work of our Society. He passed away on November 17 this year, a month after being entrusted with the management of the STTP headquarters office and communications with the CSVTS. He was also a representative of the Czech Society for Blasting and Pyrotechnics in the EFEE for a long time.

In addition, he boasted membership in the Slovak Society of Drilling and Blasting and the Austrian Association of Shotfirers. In addition, he was also a recipient of the Badge of Dynamite



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for Peace, which clearly shows his adherence (as a former soldier) to the Nobel's legacy and his opinion for what purpose should be used explosives substances he had worked during whole his life.

It's good to remember such people and sometimes be inspired by them. Dedication, responsibility, honesty and help in any situation were qualities for which he had many friends and comrades, although they have diminished considerably with advancing age.

To the sorrows of your family and the professional community, your unexpected passing is a very sad fact.

You remain permanently in our memories, in our hearts and souls.

In Honour of your memory.

Czech Association for Blasting and Pyrotechnics



*Mr. Jan Klusáček*

## **Obituary for Malcolm Ingrid by John Wolstenholme on behalf of EFEE**

It is with deep regret I inform you that Malcolm Ingrid from the United Kingdom, passed away suddenly on Saturday 11<sup>th</sup> Sept 2021

Malcolm was a highly experienced explosives engineer for over 60 years, with a long and distinguished career in the explosives industry undertaking quarrying, demolition, mining, tunnelling and special effects in the air show and film industry.

He was committed to passing on his skills and knowledge and regularly gave training courses in quarry shot firing, mines rescue and special effects.

Some of the films that he worked on were "Saving Private Ryan" and the "James Bond" films "Skyfall" and "Quantum of Solace". Many individuals in the explosives industry owe their training, development and learning to Malcolm. He was very well known and respected across the world for his knowledge, professionalism and his easy manner of dealing with people.

Malcolm was committed to promoting competence within the industry and during his career he:-

- supported the aims of European Federation for Explosive Engineers (EFEE) in the development of the Pan-European Competence Certificate for Shot-Firers (PECCS) programme.
- lead and undertook the updating of British Standard BS 5607 Code of Practice for the Safe Use of Explosives in the Construction Industry.

- signed the formal agreement on behalf of UK Institute of Explosive Engineers (IExpE) with the Society of Environmental Engineers (SEE) in the attainment of professional registration.
- Was part of the team that provided the IExpE specialist entrance exams for many years until they were discontinued.

He joined the European Federation of Explosive Engineers (EFEE) on 17 November 2016 as an individual member.

He was President of the Institute of Explosive Engineers (IExpE) between 2008 and 2010.

Malcolm continued to work into his seventies as a consultant and trainer. He never lost his enthusiasm for what was his professional passion. He travelled widely and between jobs, spent time in Spain and Wales with his family.

He only recently fully retired to spend more time with his wife and family.

Malcolm was born on 23 September 1944.

He started his career working underground in a coal mine as a Pony Driver then went on to the Coal Face at Cannock Wood Colliery. It was the start of a career working with explosives that took him all around the world. He progressed to being a shotfirer at Lea Hall and Littleton Colliery before taking his family to South Africa to work for Anglo American in various mines.

He returned to the UK in 1976 to work for EPC who manufactured and supplied explosives. He provided many years of specialist technical advice both underground and in quarries across the UK, Europe and South Africa.

He adapted to the closing of the mines by developing his skills and applying his knowledge in the demolition industry. Some of the projects included UK Government St Johns House tax office in Bootle UK, cooling towers at the nuclear reprocessing plant at Sellafield UK, various coal fired power stations, chimneys, car parks, communication masts and multi-storey buildings. He worked with various UK and USA special UK explosive demolition companies.

After leaving EPC, Malcolm set up his own company MJI Associates Ltd and developed an interest in applying his skills in the special effects (SFX) aspects of the film industry. He played a significant role in not only developing the training of SFX personnel with BECTU explosives course for the film industry, but also develop and researched those techniques as they were safely applied at various UK Air shows including Southport, RNAS Yeovilton and RAF Fairford.

Similarly, with Mines Rescue Malcolm developed the use of Explosives in Mining and Tunnelling Knowledge of Explosives Course. Here he took great satisfaction not only passing on his skills but seeing and developing young people in the industry. As he said he liked to see "all young people better themselves".

In the last three years of his career, Malcolm was recognised for his skills by Anglo American who appointed him as the Resident Explosives Consultant developing the Woodsmith polyhalite mine nr Whitby in North Yorkshire.

Malcolm took every opportunity he could and again made some great lasting friends during this period. He was a humble gentle man who lived life through his family and took great pleasure in his work. He passed on his skills unreservedly to the younger generation and never kept anything back.

I and many others have been very lucky to know Malcolm. We carry him with us in everything that he taught and how he taught it.

He said his life "was a blast" and it certainly was.

I can see him now looking at whatever we were looking at and turning to say "what do you think of that Hmmm...Hmmm."



I shall miss my teacher and mentor but most of all my friend.

Rest in peace Malcolm.

John Wolstenholme  
(UK).

Past President IExpE.

23 Oct 2021.

## **New EFEE members**

We would like to welcome the following member who have recently joined EFEE. Congratulations and a warm welcome for joining EFEE as a member.

## **National Members**

ASSOCIAZIONE GEORISORSE E AMBIENTE, Italy

## **Individual Members**

Jan Henriksson, OY Forcit Ab, Finland

Jan G. Rossingh, Rossing Drilling Bv, Netherlands

Martin Leibfritz, Helmut Fischer GmbH, Germany

Benjamin Piscart, Cofoc Sa, Belgium

Simon Tose, AECI Mining Explosives, South Africa

Hana Yamamoto, Japan

Oliver F. Dams, MAXAM Deutschland GmbH, Germany

Dan Skinner, Dyno Nobel Asia Pacific, Australia

Juho Rahko, Sweco Infra & Rail Oy, Finland

Jhon Silva, University of Kentucky, USA

Amit Bhandari, Mineexcellence, Australia

## **Student Member**

Pyry Venho, A-insinöörit, Finland

Pedro Pereira, Blastthink, Portugal

Pieter van den Bosch, Arts, Belgium

## **Upcoming International Events**

ISEE 48th Annual Conference on Explosives and Blasting  
Technique January 30-February 2, 2022  
Las Vegas, Nevada, USA  
<https://www.isee.org/conferences/2022-conference>

SME Annual Conference and Expo  
February 26-March 2, 2022 Salt  
Palace Convention Center Salt  
Lake City, Utah, USA  
[www.smeannualconference.com](http://www.smeannualconference.com)  
SAFEX International Congress  
April 3-8, 2022  
Salzburg, Austria

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WORLD TUNNEL CONGRESS 2022  
UNDERGROUND SOLUTIONS FOR A WORLD IN CHANGE  
April 22-28, 2022  
Bella Congress Center Copenhagen, Denmark  
<https://www.wtc2022.dk/>

EFEE 11th World Conference on Explosives and Blasting  
May 15-17, 2022  
Maastricht, Netherlands  
[www.efee2022.com](http://www.efee2022.com)

HILLHEAD 2022  
June, 21-23, 2022  
Hillhead Quarry  
Buxton. UK  
<https://www.hillhead.com>

International Explosives Conference 2022  
June 22nd-24th, 2022  
Victory Service Club  
London, UK  
<http://www.iec-2022.com/?action=main>

EUROCK 2022  
September 12th-15th,  
2022 Helsinki, Finland  
[www.eurock2022.com](http://www.eurock2022.com)

FRAGBLAST 13 October  
15-21, 2022 Hangzou,  
China  
[www.fragblast13.org.cn](http://www.fragblast13.org.cn)

World Mining Congress  
June 26-29, 2023  
Brisbane, Australia  
[www.wmc2022.org](http://www.wmc2022.org)





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- Technical Development

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### Committee Membership (Open to all Members)

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