EFEE NEWSLETTER

October 2015

In this edition:

Forum for Notified Bodies for Explosives

The Stockholm bypass

The EFEE World Conference in Lyon - a photoreportage

The next EFEE World Conference in Stockholm

The EFEE and ISEE collaborative agreement

... and much more!

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NEWSLETTER
October 2015

EFEE

This Newsletter contains the above articles (Click on the headings to jump to the article)

We in EFEE hope you will enjoy the present EFEE-Newsletter. The next edition will be published in december 2015. Please feel free to contact the EFEE secretariat 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 a future Newsletter

Or any other matter.

Igor Kopal, Chairman of the Newsletter Committee and the Vice President of EFEE -

newsletter@efee.eu

[BACK TO TOP]

Dear EFEE members, the presidents voice

After a long summer we all got back to business. To kick off the winter season we are sending you the EFEE Newsletter, informing you about current events and developments in the explosives sector and in the European Federation of Explosives Engineers.

Before the summer season, the 8th World Conference of EFEE on explosives and blasting took place from the 26th to the 28th of April in Lyon, France. The conference was held in this beautiful French capital of Gastronomy. Almost 400 experts and specialists of the field chose to attend the conference in Lyon. There was a wide range of specialist papers, which was well received by the delegates. The two workshops preceding the conference were likewise received with great interest and a substantial number of participants. The event gathered far more booth holders than what is normal for these kind of conferences. As something new, there was a substantial discount for members, that is why the conference also gave a large amount of new members. We welcome you all, as we are very glad to enlarge the group of members. All in all, the conference was a great success and EFEE is looking forward to the next conference, which without a doubt, once again, will surpass the previous conference.

The next and 9th EFEE World Conference on explosives and blasting will be held in Stockholm in 2017. Not only is it the first time the conference will be held in Scandinavia, the countries of which have been great contributors to EFEE. It is also the home country of one of the most important individuals for the Explosives business. We can already now reveal that the Gala dinner will be held at the historic Nobel family factory, the perfect location for the European Federation of Explosive Engineers to gather. As the president of EFEE I can almost guarantee that the spirit of Alfred Nobel will join the festive event.

The decision of the 2017 host city came after three very qualified cities had announced their interest to be host cities of the 9th and 10th EFEE conference in respectively 2017 and 2019. The three cities were Stockholm (Sweden), Levi (Finland) and Bucharest (Romania). Finland and Romania were focused on the 10th EFEE conference in 2019 and that is why Stockholm became the host for 2017. The 2019 EFEE conference was decided by a draw and it was only by a single vote that Finland came out victorious. Therefore the 10th EFEE world conference on explosives and blasting will be held in the north of Finland, namely the city of Levi. Finns also claimed to be close to Santa Clause, who has his workshop there.

[BACK TO TOP]

Romania became national member of EFEE after the election for host city. A project which has been led by a group of Romanians in the explosive business. One of the driving forces has been Mr. Doru Anghelache. Doru also presented Romania’s bid to host the 10th EFEE conference.

The EFEE board congratulates the two host cities on their victory. But just as much as we congratulate Romania on their membership and hope they will repeat their bid for host city the next time new host cities should be found.

Apart from our conference every second year EFEE tries to use its influence to improve the condition for our trade. Among this, EFEE is a part of several EU bodies, in this edition of the newsletter you will find a report of the EFEE participation in the forum of notified bodies for explosives. Held in Sofia, Bulgaria, the 11th of May 2015. At the same time EFEE is still seeking to find co-funding for the development of a Pan-European educational system for shot-firers.

The Board wishes all members, colleagues and friends of the Federation a great autumn, we thank you for the last Council and General Assembly held in Barcelona on the 25th to the 26th of September 2015 in Barcelona. We are looking forward to see you again at the next Council meeting, General Assembly and AGM, which will be held on the 11th and 12th of April in UK.

Johan Finsteen Gjødvad, President of EFEE

[BACK TO TOP]

The 8th EFEE World Conference in Lyon

From the 26th to the 28th of April 2015, almost 400 specialists from the explosive business gathered in Lyon France. Here the 8th world conference on explosives and blasting was held with great success.

The participants were from 48 countries, namely: Armenia, Australia, Austria, Belgium, Bosnia, Brazil, Canada, Chile, China, Colombia, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Greenland, India, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Morocco, Nigeria, Norway, Peru, Poland, Portugal, Republic of Kazakhstan, Romania, Russia, Saudi Arabia, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, Turkey, Ukraine, United Arab Emirates, United Kingdom and the USA.
The conference was held in the beautiful French capital of Gastronomy. The Conference was arranged together with the two national French organisations; French Group of Explosives Engineers GFEE and Syndicat National des Entrepreneurs de Travaux, SYNDUEX.

The conference had high end papers from specialists of our field. Papers accompanied by great presentations were grouped into the following subjects:

- Demolition
- Environmental Impact
- Blast optimising
- Education and Training
- Product Development
- Initiation System
- Regulations and standards
- Case studies
- Safety, Security and Risk

The presentation was of a high level and was well received by the delegates. Apart from the actual conference two workshops were held on Environment and modern technology in blasting prior to the actual conference. This was also received with great interest and important discussions by a substantial number of participants.

The event gathered far more booths (49) than any previous EFEE conference. Here the latest products, equipment, accessories and technique used was at display and was followed with great interest by the rather big group of gathered specialists. When talking to the booth-holders they all expressed how great the event was and how the participants were of great relevance to their respective business. This is just the kind of fora EFEE intend to create. We are happy it was possible and glad to be the initiator for the delegates to talk to suppliers, designers and manufactures.
On behalf of the EFEE board I thank all the delegates, specialists, speakers and booth-holders for participants. Furthermore, a special thanks to Lubrizol Ltd, Orica, EPC Group, Maxam Corp International, Davey Bickford, Sigicom AB, OJSC 'NMZ 'Iskra' and Potters Europe, who sponsored the event and made it happen.

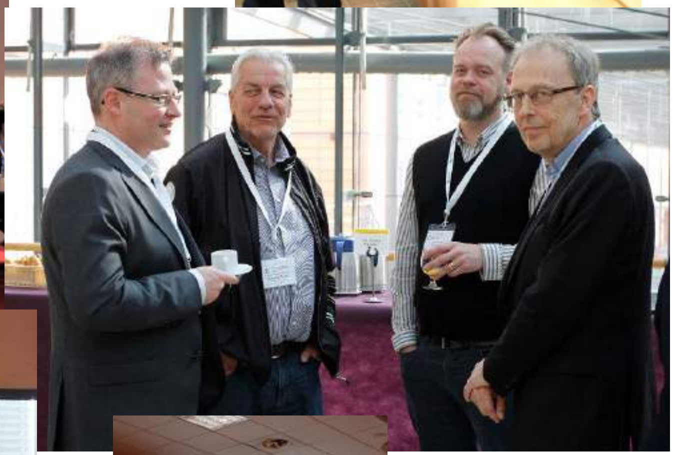
[BACK TO TOP]

All in all, the conference was a great success and EFEE are looking forward to the next conference, which without a doubt once again will surpass the previous conference. The next and 8th EFEE world conference on explosives and blasting will be held in Stockholm in 2017.

Johan Finsteen Gjødvad, President of EFEE

The 8th EFEE World Conference in pictures



[BACK TO TOP]


EVERYTHING FOR BETTER BLASTING
BLASTER'S RANGER II
Seismic-S
Seismicstar
Oilstar
Emulex
AND GAS

[BACK TO TOP]

For more pictures please visit the following link:
teeletuuna.grimsun.eu/failid/EFEE_World_Conference_2015/album/

Pictures taken by Teele Tuuna, editor of EFEE Newsletter

[BACK TO TOP]

EFEE and ISEE Collaborative Agreement

The International Society of Explosives Engineers is proud of our relationship with EFEE. As president of the ISEE, I was honored to sign a renewal of our mutual assistance contract in Lyon, France at the 2015 EFEE 8th World Conference. A major benefit of our working relationship is to sponsor board members from each group to attend each other's conferences. This attendance serves as a great learning tool to view how another association manages their conference plus offers a vast opportunity to make new acquaintances and attend beneficial training sessions.

Mike Koehler - President of ISEE and Johan F. Gjodvad - President of EFEE shake hands after signing the EFEE and ISEE collaborative agreement in Lyon, April 2015

[BACK TO TOP]

ISEE Strategic Plan

Many EFEE members are familiar with the ISEE, but for those who are not I would like to briefly provide more detail. The International Society of Explosives Engineers began as The Society of Explosives Engineers in 1974 in the United States and matured into the International Society of Explosives Engineers. The Board of Directors consists of members from diverse backgrounds, countries, and regions. The ISEE constitution requires we maintain board diversity to provide representation for all the various disciplines within the society. The Mission Statement of the ISEE is "To Advance the Science and Art of Explosives Engineering." Similar to EFEE, providing education to students, field personnel, management, and regulatory agencies is a priority of the ISEE. The ISEE houses a fantastic industry library. The Blasters' Handbook is a must purchase for both students and those working in the explosives industry.

We are currently building new training modules, which will coincide with each chapter of the Blasters' Handbook. The ISEE has an Education Foundation that provides thousands of dollars in annual scholarships to students working in explosives, mining, and related fields. Please keep in mind that these scholarships are available internationally.

[BACK TO TOP]

Our strategic plan located on the wheel graph highlights the society’s goals. Each of our many committees align their action items to this strategic plan. The strategic plan is work in progress at all times, but is revisited approximately every five years to ensure proper alignment.

The ISEE has many committees and a few sections that meet annually. The committees also work on issues year round via email and conference calls. The list below entails all the committees and sections. Several of the committees are handled solely within the Board of Directors and others are open to the general membership.

ISEE Committee & Sections List

Audit Committee
Awards Committee
Blasters Training Committee
Chapter Development Comittee / Management Workshop
Conference Advisory Committee
Conference Program Committee
Constitution Committee
Education Committee
Ethics Committee
Explosives Security Committee
Governmental Affairs / Transportation
International Committee
ISEE Standards Committee
Membership Committee
Nominating Committee
Planning Committee / Strategic Plan
Publications Committee
Public Education / Relations Committee
Technical, Safety and Environment Committee
Blast Vibration & Seismograph Section
Drilling Section
Fragmentation by Blasting Section
SEE Education Foundation / Board of Trustees Report

The ISEE’s next annual conference will be held in Las Vegas, Nevada USA from January 31, 2016 through February 3, 2016. Please visit our website www.isee.org for organizational details, the library, and calendar of upcoming events.

Michael (Mike) Koehler, President ISEE, President B.E. Consultants, Inc.

[BACK TO TOP]

E4 The Stockholm bypass "Forbifart Stockholm" is a new route for the European highway (E4) past the Swedish capital.

Förbifart Stockholms tunnelprofil med ramper upp till trafikplatserna på Lovö och i Vinsta. Observera att profilen inte är proportionerlig.

The new link will connect the southern and northern parts of the Stockholm County, relieve the arterial roads and the inner city of traffic and reduce the vulnerability of the Stockholm traffic system.

A new link west of Stockholm has been under investigation for several decades and a large number of different alternatives have been studied. To reduce the impact on sensitive natural and cultural environments, just over 18 km of the total of 21 km of the link are in tunnels.

The land acquisition plan is now adopted and approved by the government. The work on the project planning for building documentation is ongoing. The construction work for the first main contracts is planned to start in 2015. The Stockholm bypass will take approximately 10 years to finish.

When the link opens for traffic it will be one of the longest road tunnels in the world. By 2035, the Swedish Transport Administration (Trafikverket) estimates that The Stockholm bypass will be used by approximately 140.000 vehicles per day.
Nitro Consult have made all risk analysis and will do the environmental impact controls as vibration and noise monitoring and house inspections.

[BACK TO TOP]

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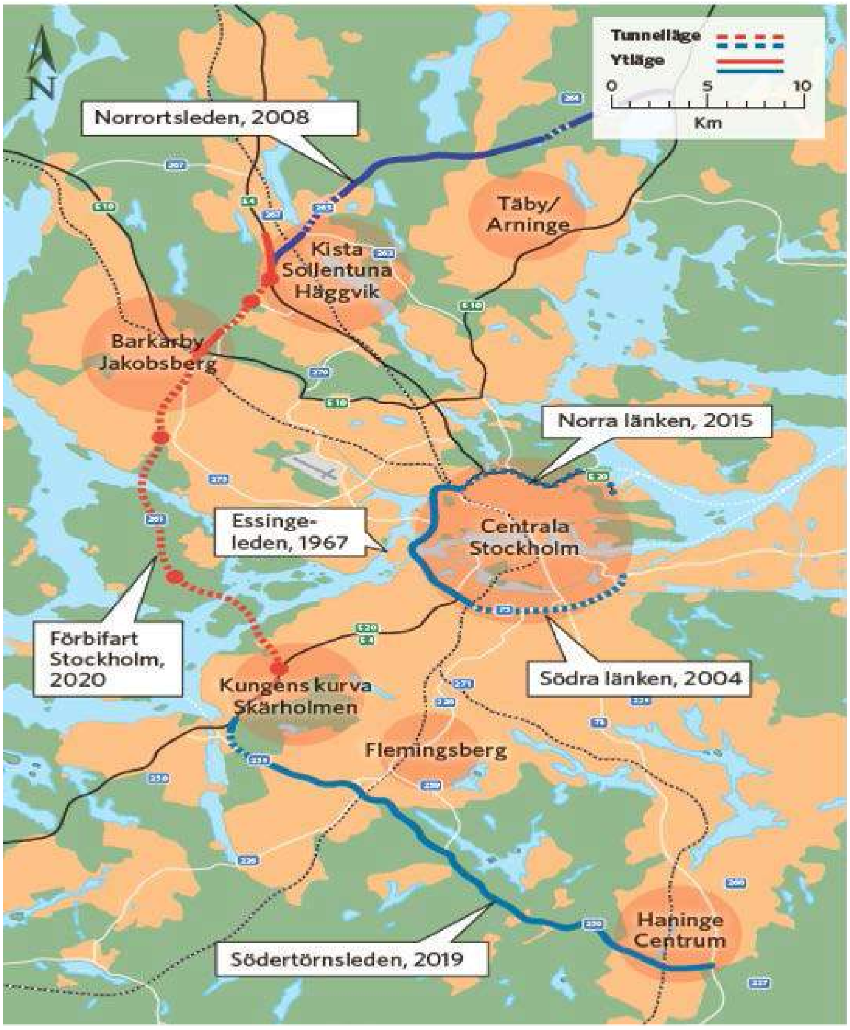


Donald Jonson

[BACK TO TOP]

Danish experiences with obtaining regulatory approval for explosives storage facilities

ABSTRACT: In 2008 Denmark introduced new legislation regarding the commercial use of explosives. The legislation introduced new requirements to explosives storage facilities, including specifying safety distances to various types of objects like schools, hospitals, major roads and housing. The safety distances are based on the AASTP-1 Manual of NATO Safety Principles for Storage of Military Ammunition and Explosives and its guidelines for storage of more than 500 kg NEQ, but are applied to all storage of more than 0.5 kg NEQ.

The legislation poses a challenge to users of explosives as Denmark is a fairly densely populated and urbanised country without large tracts of undeveloped land and therefore there are practically no areas that meet the safety distance to roads or housing. This, combined with the fact that permits given under the previous legislation were usually valid for 5 years, has led many Danish users of explosives into a limbo in recent years, where permits for storage of explosives expired but no new permits could be given.

The legislation however allows for exemption from the safety distances if a risk analysis deems the storage facility safe. Usually risk is defined as likelihood multiplied by consequence but this alone does not solve the problem, as there are no risk acceptance criteria set.

Currently the only solution is to design new explosive storage facilities in such a way that the facility itself will contain or mitigate the consequences of an accidental explosion, to a level where the consequences at nearby objects will be less than if the safety distances had been met

Some of the possible parameters that affect the projection of consequences include the NEQ, orientation, size, ventilation areas and possible burial of the facility, along with earthworks and terrain features between the facility and the object in question.

Up to now, half a dozen storage facilities have been approved using this method.

Recently, the Danish Emergency Management Agency (DEMA) has proposed risk acceptance criteria, giving the possibility to include likelihoods in the risk analysis. The criteria are pending approval by the Danish Ministry for Justice and so far no storage facilities in Denmark have been approved based on this.

[BACK TO TOP]

1. Introduction

Denmark is generally a flat country with an underground consisting of gravel and clay. Apart from the small island of Bornholm, the bedrock is far below the surface and therefore the use of explosives is generally less common than in some of the neighbouring countries.

The main civilian use of explosives in Denmark is in the construction industry for cutting concrete piles, removing unwanted concrete, demolition or landscaping.

This leads to a relatively low number of civilian users of explosives, spread around the country and to a relatively low knowledge of the properties of explosives amongst the authorities and population in general.

2. Legislation

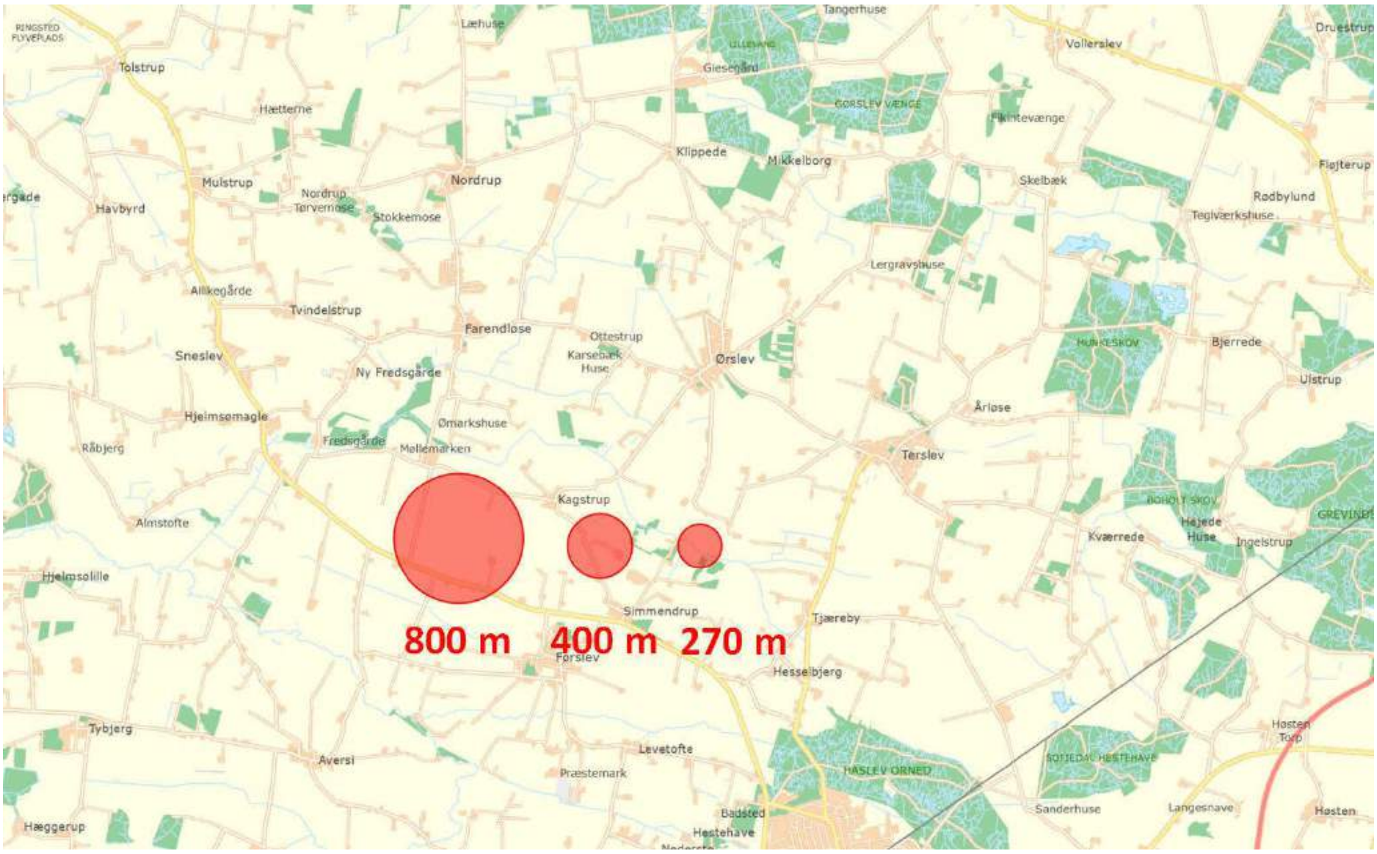
The current Danish legislation on the civilian storage of explosives are given in the Administrative Order on Explosive Materials (Bekendtgørelse om eksplosivstoffer) BEK 1247 of 30 October 2013.

For the storage of more than 500 g of regular explosives (Hazard Division 1.1), the relevant requirements are given in Table 1

Table 1: Requirements for the storage of more than 500 g of HD 1.1 explosives in Denmark. Excerpt from BEK 1247.

Article	Requirement
5.1	Police approval
5.2	Storage must be inaccessible to third parties
5.3	Stored articles must not be subjected to impact, friction, heat etc.
5.4	Storage may not be in the same building as dwellings
5.6	Stored articles must be kept in the original packaging
7.1.2	Safety distances must be observed, See Table 2
7.1.3	Storage must be in a cast (concrete) vault or in a safe
7.1.4	Vault or safe must be locked at all times
7.1.5	Storage facility must have an automatic burglar alarm
7.1.6	The storage facility may not be used for storing other items
7.1.7	Compatibility groups must be observed
7.1.10	Signage: Danger, Explosives, No smoking etc.
7.1.11	Firefighting equipment must be present
14.1	The police can under certain circumstances grant an exemption from the regulations in Article 7
14.2	Exemption from the safety distances in Article 7.1.2 requires the applicant to submit a risk analysis that shows that the storage facility is safe. The police submits the risk analysis to the Danish Emergency Management Agency for approval

[BACK TO TOP]



Common safety distances in Denamark

The safety distances referred to in article 7.1.2 are based on AASTP-1 Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives and are calculated using the formula where **D** is the safety distance and is the quantity of explosives, **k** and **n** depend on the nearby object in question and are shown in Table 2.

$$D = k \cdot Q^n$$

[BACK TO TOP]

Table 2. Safety distances for the storage of more than 500 g of HD 1.1 explosives in Denmark.

Excerpt from BEK 1247.

No	ObjectCalculation parameters		Minimum safety distance
1	Hospitals, schools, kindergartens, tall buildings and similar	k = 44,4, n = ⅓	Dmin = 800 m
2	Dwellings	k = 22,2, n = ⅓	Dmin = 400 m
3	Buildings and other activities not related to the storage facility, cf. row 1 and 2.	k = 22,2, n = ⅓	Dmin = 270 m
4	Public roads, ports, railroads and similar without constant dense traffic	k = 14,8, n = ⅓	Dmin = 180 m
5	Public roads, ports, railroads and similar with constant dense traffic	k = 22,2, n = ⅓	Dmin = 270 m
6	Occupied buildings within the same site as the storage facility	k = 22,2, n = ⅓	Dmin = 270 m
7	Other storages of explosives without traverse protection	k = 22,2, n = ⅓	Dmin = 90 m
8	Other storages of explosives without traverse protection	k = 2,4, n = ⅓	Dmin = 9 m

3. Approval procedure

Before an explosives storage facility can be built, an regulatory approval must be obtained. The applicant must submit an application to the police, containing plans for the storage facility, specifying the location and intended amount of explosives to be stored.

The police will then forward the application to the Danish Emergency Management Agency (DEMA) for commenting. DEMA will then check whether the regulations, including the safety distances are observed and issue recommendations to the police on whether to approve or reject the application. The police will then inform the applicant of the decision.

[BACK TO TOP]

In cases where the safety distances are observed, this process is relatively easy and straight-forward.

The challenge is that Denmark is an highly urbanised and relatively densely populated country with a population density of ~130 per km2 and a developed road network. Therefore it is almost impossible to find any areas where the safety distances to dwellings and roads can be observed. Consequently, all applicants have to ask for exemption under Article 14.2 of BEK 1247 and produce a risk analysis showing that the site is safe.

3.1.Risk analysis

In general risk is defined as shown in Equation 2.

(2) *Risk = Probability Consequence*

Risk is often expressed in terms of the expected number of fatalities per year. A standard method for conducting a risk assessment is to estimate the probabilities and consequences of the adverse events and compare the product thereof to a set threshold value or acceptance criteria. This method is for instance used for risk assessments for sites containing dangerous substances in accordance with Directive 2012/18/EU (the Seveso III Directive).

The challenge is that in the current Danish regulations, there are no set acceptance criteria, a criteria that can be administratively defined by the Danish Ministry for Justice.

Therefore, a slightly different approach is needed, where it is assumed that an explosion of the largest possible magnitude will definitely take place (probability set to 1) and then designing the storage facility in a way that ensures that the consequences (overpressure) at any nearby object will be equal to or less than if the safety distances of BEK 1247 had been observed.

4. Design of storage facilities

There are six parameters that influence the magnitude of the pressure at a certain distance from an accidental explosion in an explosives storage facility. They are:

[BACK TO TOP]

-	Charge weight	[kg]
-	Stand-off distance	[m]
-	Room volume	[m3]
-	Vent area (door)	[m2]
-	Orientation in relation to the storage facility	[front, side, rear]
-	Interlaying terrain	[-]

For a planned explosives storage facility, all of the nearby objects mentioned in Table 2 must be identified and the overpressure at each object must be determined and shown to be lower than if the safety distances of BEK 1247 had been observed.

The American Defence manual UFC 3-340-02 Structures to Resist the Effects of Accidental Explosions (formerly known as TM 5-1300) provides graphs of the relationship between pressure, scaled distance and scaled venting to the front, side or rear of a partially vented four-wall cubicle. Scaled distance is defined as seen in Equation 3.

$$Z = \frac{R}{W^{\frac{1}{3}}}$$

where Z is the scaled distance, R is the stand-off distance and W is the charge weight.

Scaled venting is defined as seen in Equation 4.

$$A_{v,s} = \frac{A}{V^{\frac{2}{3}}}$$

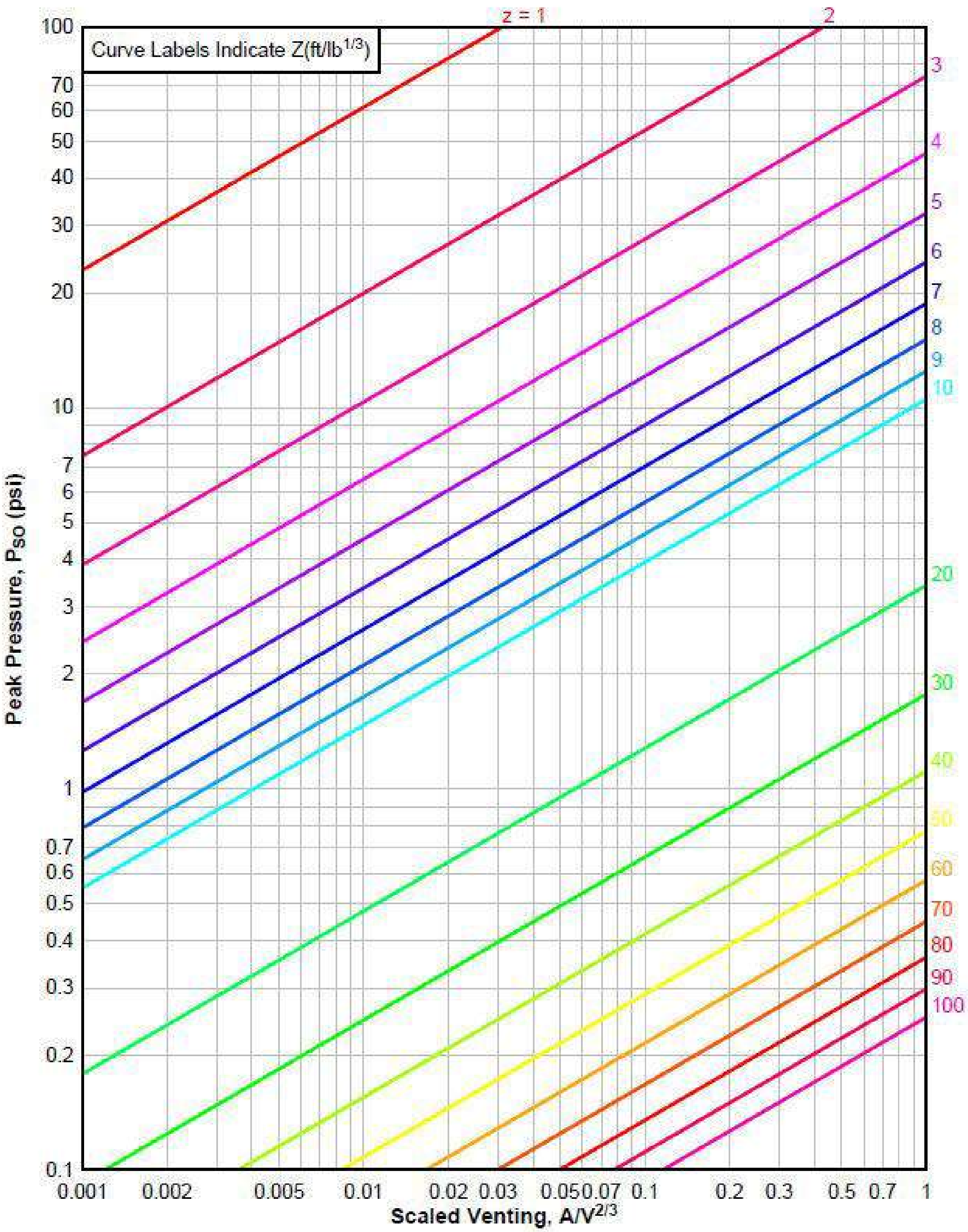
where Av,s is the scaled venting, A is the venting area and V is the room volume.

The NATO manual AASTP-1 Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives provides guidelines to whether an object should be considered to be in front, to the side or rear of the storage facility.

The above relations are then used to determine a set of related values for the room volume, vent area, allowable charge weight and facility orientation, that will produce tolerable pressures at all nearby objects. This is an iterative process that is not easily automated.

[BACK TO TOP]

Figure 2-188 Peak Positive Pressure at the Side of a Partially Vented Four-Wall Cubicle



[BACK TO TOP]

4.1. Terrain

The method presented above is generally valid for flat open terrain. Any permanent terrain features present between the explosives storage facility and a nearby object can be taken into account, say if there is a hill between the storage facility and an object.

4.2. Fragments

The legislation specifies minimum distances (see Table 2) due to possible fragments. As the civilian use of explosives rarely includes cased explosives like grenades, only secondary fragments from the storage facility are considered.

If the storage facility is built as a buried structure with an earth cover and the cover is free from rocks or stones, it is possible to neglect the minimum distances. AASTP-1 also specifies minimum criteria for cover thickness.

4.3. Other considerations

Apart from the safety distances, the storage facility must also be designed to meet a number of other criteria with regard to:

- General construction standards and codes (Eurocode)
- Ventilation
- Indoor climate (temperature, humidity)
- Burglary prevention and alarms
- Fire safety
- Lightning conduction
- Etc.

5. Outlook

The current practice only includes the consequence aspect of the risk analysis. Therefore all the explosives storage facilities designed using this method are several orders of magnitude safer than they might have to be. DEMA is aware of this and work is currently ongoing to define risk based criteria, that will also allow the probability of an explosion to be taken into account in the risk analysis.

[BACK TO TOP]

DEMA has proposed risk based criteria as shown in **Table 3**.

Individual risk	Acceptance criteria
Persons directly involved in work with explosives	Rules for general labour safety (Rules set forth by the Danish Working Environment Authority)
Other persons employed in the same business	10-5 per year
Third person	10-6 per year
Risk to society	A curve of accumulated frequencies where the frequency for 1 death is 10-4 per year and which decreases in relation to the square of the number of deaths. The frequency for 1,000 deaths must be 0.

Formally the risk criteria must be issued by the Danish Ministry for Justice, so DEMA's proposed criteria have not yet been approved but work is already ongoing for at least one company to submit an application for approval based on the risk based approach.

6. Conclusions

Since the implementation of the Administrative Order on Explosive Materials in 2008, civilian users of explosives have had difficulty in obtaining the required permits and approval to store explosive materials.

The legislation provides safety distances between explosives storage facilities and nearby objects, that cannot be kept in practice. Therefore users must provide a risk analysis that shows that the facility is safe. The legislation is very conservative, as it only considers the potential consequences of an accidental explosion and does not allow for the probability of occurrence to be taken into account.

Therefore a practice of designing explosive storage facilities in such a way that the facility itself will contain or mitigate the consequences of an accidental explosion, to a level where the consequences at nearby objects will be less than if the safety distances had been met, has been developed and implemented. Currently, half a dozen explosives storage facilities have been approved using this method.

[BACK TO TOP]

A process has been started by DEMA to allow the probability of occurrence to be taken into account. Work is ongoing to get the first approval based on this method, but the proposed risk criteria have yet to be confirmed.

A new risk based method will reduce the overall cost of construction because facilities could be placed closer to other objects and would not have to be as sturdy as before. Even though the cost of the risk analysis would be higher, the overall cost will be lower.

C. A. Andersen, S. Qvist, K. C. Jørgensen, NIRAS A/S, Allerød, Denmark

References

Danish Ministry for Justice, 2013, Administrative Order on Explosive Materials (Bekendtgørelse om eksplosivstoffer) BEK 1247 of 30 October 2013 incl. addenda and corrigenda

United States Department of Defence, 2008, UFC 3-340-02 Structures to Resist the Effects of Accidental Explosions, Change 2, September 2014.

NATO, 2006, AASTP-1 Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives.

EU, 2012, Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC, July, 2012.

[BACK TO TOP]

New formulas for charge weights in blast demolition

Abstract: All actual existing calculations of charge weights in blast demolition I know only were found in a empirical wise and not in strong physical relations. That's why I began to compile the physical relationships of explosives, like energy, detonation velocity, explosive density, gas density to get blast pressures. Then I was creating a idealized "cylinder model" with a linear charge in a cylindrical tensile resisting material for normal charge cases. For dimensioning *first* charges I created a blasting "wedge model". With that physical models, material properties and a new term for the "blast strength" an equation to the blast performance of any explosives new formulas for charge weights in blast demolition could be derived.

1. Blast pressures

In principle detonating explosive makes two parts of pressure to be added: a) the gas pressure, a quasi static part $\mathbf{p_{stat}}$ (jump function) and b) the pressure pulse, a dynamic part $\mathbf{p_{dyn}}$ (pulse function)

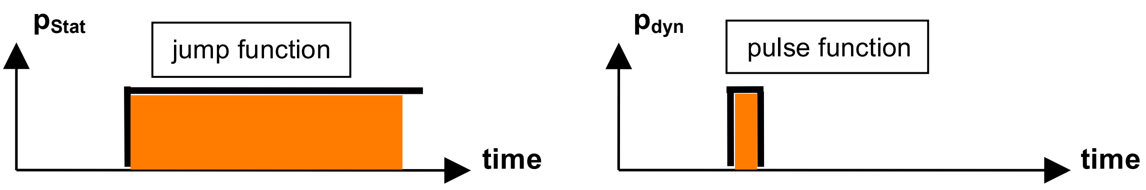


Figure 1. Explosive pressure parts, idealised functions

1.1 Gas pressure p_{stat}

Equalise in a cylinder the inner energy $\mathbf{E_i = V_L \cdot p_S'}$ of the pressured charge volume $\mathbf{V_L}$ and the outside energy $\mathbf{E_a = V_S \cdot p_0}$ of the depressed gas volume $\mathbf{V_S}$ and you get a simple formula for the gas pressure $\mathbf{p_{Stat}}$:

(1) $$p_{stat} \approx V_S^* \cdot \rho_L \cdot p_0$$

V_S *...Gas volume per kg explosive [m³/kg]
ρ_L ...Specific explosive volume, explosive dense [kg/m³]
p_0 ...Atmospheric air pressure (p_0 = 0,101 MN/m²)

Example:
Eurodyn 2000: V_S^* = 0,90 m³/kg, ρ_L = 1400 kg/m³ : $\mathbf{p_{Stat}}$ = 0,90 · 1400 · 0,101 = 127,2 MN/m²

[BACK TO TOP]

1.2 Pulse pressure p_{dyn}

(2) $p_{dyn} = \rho_S \cdot v^2 / 2$

ρ_S ...specific gas weight, gas dense [kg/m³]
v ...explosion velocity in inclusion

Example:
Eurodyn 2000: v = 6000 m/s, ρ_S = 1,4 kg/m³ : $\mathbf{p_{dyn}}$ = 1,4 · 6000 ² / 2 = 25,2 · 10 ^{6} N/m² = 25,2 MN/m²

1.3 Superposition to max. pressure - p

Melzer: Charge weights in blast demolition

(3) $p = p_{stat} + p_{dyn}$

Example: Eurodyn 2000: p = 127,2 + 25,2 = 152,4 MN/m²

2. Blast strength - S

The performance of an explosive named “blast strength” can be expressed in following form:

(4) $S = p^2 / \rho_L$

p... Explosion pressure [MN/m²]
ρ_L ...Specific explosive volume, explosive dense [kg/m³]

Example: Eurodyn 2000: $S = p^2 / \rho_L = 152{,}4^2 / 1400$ = 16,58 MN²/(kg·m)

[BACK TO TOP]

3. Cylindric models for charge weight

3.1 Tube model

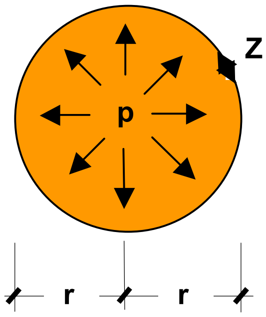


Figure 2, Explosive cylinder (length: 1 m) with tensile ring force **Z** [MN/m]

The first formula for the necessary radius **r** of the charge is very simple but very unusually:

$r = Z / p$

Z… tensile ring force per length [MN/m]
p… explosive pressure [MN/m^2]

With the cylinder volume and the "blast strength" **S** a better formula for the charge weight **L*** has got:

(4) $L^* = \varepsilon \cdot$ ¶ $\cdot Z^2 / S$

L^*…charge weight per m [kg/m]
ε … factor of safety, $1 < \varepsilon < 1{,}5$
Z… tensile crack ring force per m length [MN/m]
S…blast strength, $S = p^2 / \rho_L$ [$MN^2/(kg \cdot m)$] (see capt. 2)

This formula no. depends of the blast body volume. With it you can calculate the charges of water filled steel columns, water filled concrete columns or silos.

3.1.1 Examples: water filled steel blasting

If steel columns are hollow like boxes or tubes they can be filled with water and be blasted with linear bar charges. The tensile force **Z** depends by welded boxes only of the welding seams with the thickness **a** and the ultimate tensile stress σ_Z: $Z = \sigma_Z \cdot a$.

[BACK TO TOP]

Melzer: Charge weights in blast demolition

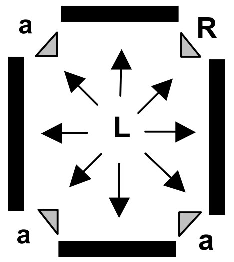


Figure 3, Water filled and blasted steel box column

Example: Eurodyn 2000: S = 16,58 MN²/(kg·m), ε = 1,0; welds: a = 6 mm, σ_Z = 470 MN/m² Z = 470 · 0,006 = 2,82 MN/m²; L* = ε ·¶ · σ_Z² / S = 1,0 ·¶ · 2,82² / 16,58 = 1,506 kg/m .

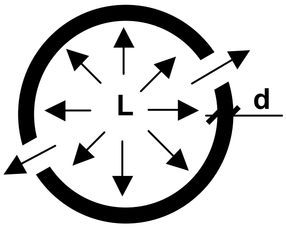


Figure 4, Water filled and blasted steel tube column

Example: Eurodyn 2000: S = 16,58 MN²/(kg·m), ε = 1,0; tube: d = 10 mm, σ_Z = 470 MN/m² Z = 470 · 0,01 = 4,70 MN/m²; L* = ε ·¶ · σ_Z² / S = 1,0 ·¶ · 4,70² / 16,58 = 4,185 kg/m .

If steel has to be cracked by explosives the charge weights are strong increasing. If the exampled steel tube has a wall thickness of only *two centimetre* the needed charge weight increase already to L* = 16,7 kg/m!

3.2 Cylindrical model for homogeneous material

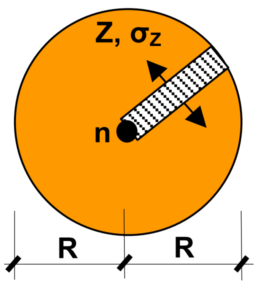


Figure 4, Cylindrical blasting model (length: 1 m)

[BACK TO TOP]

With the cylinder volume, a constant material property $\boldsymbol{\sigma_Z}$ and the "blast strength" **S** a formula for the specific charge weight **L*** has got:

(5) $$L^* = \varepsilon \cdot \sigma_Z^2 / S$$

L^*…charge weight per m³ [kg/m³]
ε … factor of safety, $1 < \varepsilon < 1{,}5$
σ_Z …tensile stress resistance [MN/m]
S…blast strength, $S = p^2 / \rho_L$ [MN²/(kg·m)] (see capt. 2)

This formula for homogeneous material depends of the blast body volume. With it you can calculate the charges of no reinforced concrete, steel, stone and wood.

Melzer: Charge weights in blast demolition

Example: Eurodyn 2000: S = 16,58 MN²/(kg·m), $\varepsilon = 1{,}5$; concrete C 20/25: $\sigma_Z = 2{,}9$ MN/m² $L^* = \varepsilon \cdot \sigma_Z^2 / S = 1{,}5 \cdot 2{,}9^2 / 16{,}58 = 0{,}761$ kg/m³ .

This calculated charge weight is good comparing with the existing traditional charge weight for no reinforced concrete.
In the most cases like slim structure members with rectangular cross section (columns, bars) the concrete can be supposed as no reinforced. Only circle wired columns and cubic reinforced blocks must be calculated as reinforced.

4. Model check

The described models "Tube" and "Cylinder" need for a good work of the charge *four, three or minimal two free sides* to expand the blasted material. All *two dimensional* possibilities are shown the following picture (n…number of free degrees).

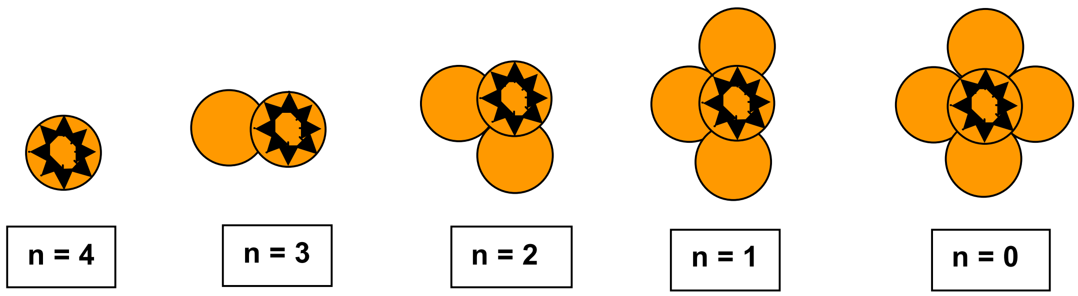


Figure 5, Cases of free degrees of a charge

In case of n = 4, 3 or 2 the models "Tube" and "Cylinder" can be used correct. In case of n = 1, only *one* free side (start charges), it is necessary to find a competent model describing this relationship real. In case of n = 0 (all sides resist) the blast will be failing.

[BACK TO TOP]

5. Wedge model for first charges with only one free side

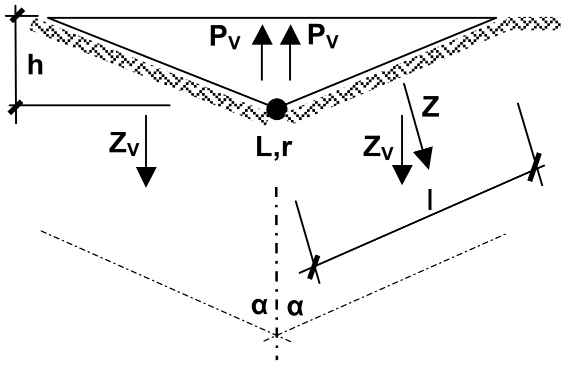


Figure 6, Wedge blasting model (1 m length)

r…Radius of the charge
p…Explosive pressure
σ_Z…tensile stress resistance

Equal weight of vertical forces $Z_V = P_V$ (**without vertical reflection** of explosive pressure on the ground):

$r \cdot p \sin \alpha = \sigma_Z \cdot h / (\sin \alpha \cdot \cos \alpha)$

Melzer: Charge weights in blast demolition

$\sigma_Z \cdot h / (r \cdot p) = \sin^2 \alpha \cdot \cos \alpha$

To overcome the constant material property and break off the wedge with a minimal energy an angel **α = 54,7 °** is necessary;
α = 54,7 °in
$r = \sigma_Z \cdot h / [\, p (\sin^2 \alpha \cdot \cos \alpha)]$
$\mathbf{r = 2{,}60\ \sigma_Z \cdot h / p_L}$
with $L^* = ¶\, r^2 \cdot \rho_L$:

(6a) $\mathbf{L^* = \varepsilon \cdot ¶ \cdot (\, 2{,}60\ \sigma_Z \cdot h\,)^2 / S}$

ρ_L …Explosive dense [kg/m³]
L*…Charge weight per m³ [kg/m³]
ε … Factor of safety, 1 < ε < 1,5
σ_Z …Tensile stress resistance [MN/m]
S…Blast strength [MN²/(kg·m)] (capt. 2)

Example: Eurodyn 2000: S = 16,58 MN²/(kg·m), ε = 1,5; h = 0,3 m concrete C 20/25: σ_Z = 2,9 MN/m² : $L^* = \varepsilon \cdot ¶\, (2{,}60\ \sigma_Z \cdot h)^2 / S = 1{,}5\ ¶\, (2{,}60 \cdot 2{,}9 \cdot 0{,}3)^2 / 16{,}58$ = 1,45 kg/m³ .

[BACK TO TOP]

But **with 100 % vertical reflection** of explosive pressure the angel **α** becomes to **45,0 °** and the equation (6a) becomes to:

(6a) $\mathbf{L^* = \varepsilon \cdot ¶ \cdot (\sigma_Z \cdot h)^2 / S}$

With 100 % vertical reflection the same explosive weight like the general cylinder formula (5) is given.

6. Conclusions

Blasting is only cracking. That's why the tensile stress resistance is the most important blast material property to take in account. The performance of an explosive named "blast strength" **S** depends on the explosion pressure **p** and the explosive dense $\boldsymbol{\rho_L}$.

To calculate charge weights **L*** three blast crack models were created. All model bodies are 1 m long within 1 m long charges. The "tube model" uses a tensile resistant tube. The "cylin-der model" uses a tensile resistant cylinder. These models require minimal two free sides per exploding charge. If there is only *one free side* (in case of start charges) you have to use the "Wedge blasting model" with a tensile resistant wedge body. The charge weights calculated with the "Wedge model" and *without vertical reflection* of explosive pressure on the ground are almost 7 times higher than the values calculated with the "cylinder model". But *with 100 % vertical reflection* of explosive pressure on the ground the result is the same as calculated with the general cylinder formula. The reality may bee lays between it.

Dr.-Ing. Rainer Melzer
Project office of structural demolition, Dresden, Germany

[BACK TO TOP]

Meeting of the Notified Bodies for Explosives

On 11th and 12th May 2015 the Notified Bodies for Explosives came together for their annual meeting in Sofia. Thanks to the good cooperation and talks with Federico Musso, Head of the Explosives Working Group, the EFEE was given the chance to attend this meeting as a permanent observer.

Our organisation made use of this opportunity to attend and was represented by Jörg Rennert. Topics such as current issues regarding the implementation of the EU Directive about Track and Trace as well as EU Directive 2014/28 were covered.

This Directive is going to replace the Directive 93/15 from 20th April 2016 onwards. It covers the required methods for evaluating compliance and the Notified Bodies in charge. The Directive defines which requirements must be met by the Notified Bodies in order to be able to evaluate compliance. This not only helps to achieve comparability of the single Notified Bodies. The EU Directive 2014/28 contains also numerous advices for market surveillance.

While the EFEE took part at a Notified Bodies' meeting for the first time, it became clear that this opportunity is seen as quite helpful and constructive for both sides. The bilateral exchange and sharing practical experiences and reports form an important basis for supporting the work of the Notified Bodies for adapting explosives test methods to the practical requirements and to actively contribute to establishing rules and regulations.

The EFEE is going to use these workshops to represent the interests of its members on a bigger platform. So if you have any questions, wishes or issues in connection with the evaluation methods for explosives, please let us know. We will be pleased to address them when working together with the Notified Bodies.

Jörg Rennert, Member of the Board, EFEE

[BACK TO TOP]

Honorary Members

European Federation of Explosives Engineers (EFEE) has five types of membership:

- National Association membership
- Corporate membership
- Individual membership
- Student membership
- Associate membership

In addition to above listed membership types there is one very special type of EFEE membership which was not granted yet. According to EFEE Article of Association part VI. and Article 16 "The Board can nominate individuals who have particularly earned it in connection with the Federation, to become Honorary Members." After 27 years of EFEE history the Board has used this article for the first time and nominated and approved first two EFEE Honorary Members on the meeting in Lyon 24th of April 2015. We are really glad that we can share with you the information that first two EFEE Honorary Members were unanimously nominated and approved:

- Mr Walter Werner from Germany
- Mr Raimo Vuolio from Finland

We are quite sure that both of them are sufficiently known for many of you but let us please introduce and summarize their professional career on this occasion.

Walter Werner

Walter Werner was born on 21st of September 1943. In 1965 he attended a basic course for blasting operation and he got his shotfirer licence. He studied business administration in Cologne. From 1970 he worked together with his father in their own company. This was a company for demolition of buildings including blasting operation. In 1977 he took over the management of the company. The company of Walter Werner carried out the first blasting demolition of a skyscraper in Germany in Hamburg. Since 1980 Walter Werner has been working also as an official expert for blasting demolition. From 1981 to 1997 he was the president of German Blasting association. In 1988 he came up with an idea to form European Blasting Organization. As a result of this idea EFEE was founded by Walter Werner in the fall of 1988 and he was the first president of EFEE. Walter Werner was also father of reunion of the east and west part of the German Blasting organizations.

[BACK TO TOP]

From 2006 to 2010 he was the president of the German Demolition Association. He worked also as a Board member of EFEE for a long time and he was responsible for election and audit committee. Walter Werner has been married for 45 years and he is father of four children. He lives in Stolberg close to city Aachen.

Walter Werner

[BACK TO TOP]

Raimo Vuolio

Raimo Vuolio was born on 9th September 1936. He studied metallurgy and mining in Helsinki University of Technology, in 1964 (MSc.). In 1965 he got his master shotfirer licence. He followed his education at Helsinki University of Technology in 1978 (LicSc.) and in 1990 (DSc.). From 1964 until 1970 Raimo Vuolio worked as a Supervisor of explosives and later as a Blasting consultant. His employment continued in company OY FINNROCK AB in 1970. From 1970 until 1974 his position was Technical manager and from 1974 until 2001 Managing director. He was fully focused on two main business areas - Blast Design and Blasting consulting. During his years in Finnrock Raimo Vuolio has been involved in most urban area blasting projects in Finland. Some examples of very challenging urban area projects where Raimo Vuolio has been involved during his employment in FINNROCK:

- Finnish Parliament House excavation (Helsinki, Finland 1975)
- City Forum excavations - shopping center (Helsinki, Finland 1982 - 1984)
- Hotel Scandic in city center (Helsinki, Finland 1998)

From 2002 his business career continues in KALLIOTEKNIIKKA CONSULTING ENGINEERS OY where he works as a Special consultant in charge of supervisioning of demanding projects and blast designs. Some examples of very challenging urban area projects where Raimo Vuolio has been involved during his employment in Kalliotekniikka:

- Kampi Center - shopping center, central bus terminal (Helsinki, Finland 2002 - 2004)
- Helsinki Music Center excavation (Helsinki, Finland 2007-2008)
- Kehärata - ring rail road Helsinki center to Helsinki-Vantaa airport excavation (Helsinki, Finland 2008-2012)

Raimo Vuolio has also contributed considerably to many other large projects for example - Olkiluoto Nuclear Power Plant, Vuosaari harbour project Helsinki, Vuoli railway tunnels Helsinki, Helsinki metro tunnels, Länsimetro tunnels and US embassy rock blasting. He has published hundreds of articles in books and papers and also issued textbooks of excavation and blasting field. He has been teaching blasting techniques in several different technical schools and universities. Raimo Vuolio is also an examiner of shotfirers authorized by Ministry of Social affairs and Health.

[BACK TO TOP]

Raimo Vuolio took part in the founding meeting of EFEE in 1988 and was one of founding members with Walter Werner. He was also the president of EFEE in 1997-1998. Raimo Vuolio is married and has two children.

Raimo Vuolio

Dear Walter Werner and Raimo Vuolio we welcome you in newly formed group of EFEE Honorary Members. We thank you very much for your excellent work and contributions dedicated to EFEE and we look forward to see you in the future on EFEE Council meetings and EFEE Conferences.

Igor Kopal, Vice President of EFEE
Chairman of marketing and membership committee

[BACK TO TOP]

Stockholm will host the next EFEE World Conference in 2017






Stockholm- An Overview

- Closer than you think
- Efficient & reliable
- Excellent flight connections
- Efficient public transportation systems
- Spectacular scenery
- Great accommodation
- Alfred Nobel's City

[BACK TO TOP]

The Brewery Conference Centre

Location
The Brewery is situated in the city centre of Stockholm, right by the sea. Overlooking the City Hall and the Old Town.
History
The Brewery is one of the most characteristic elements in the skyline of Stockholm. Beer was produced here for over 100 years to satisfy the thirsts of Stockholmers and the last bottle ever to be filled was capped in 1971.
Conference & Banqueting
With 18 meeting spaces and a total of 9000 square meters The Brewery's space is extremely flexible and they can host between 10 - 3500 delegates.

Hilton Stockholm Slussen Hotel

The Hilton Hotel would be the main accommodation hotel
Location
The hotel is a 4-star property and is a 10 minute walk from The Brewery. Half an hour boat trip to the Winterviken.
Accommodation
This 8 floor hotel has 287 well equipped guestrooms

[BACK TO TOP]

Gala Dinner Venue

What better venue than the old Nobel family factory to host the Gala Dinner.
Location
The Winterviken is set in the beautiful town Vinterviken, only 15 minutes away from Stockholm city.
History
Vinterviken is the historic place where Alfred Nobel 1865 started his world wide dynamite imperium.
Venue
The Big Hall in the old plant for production of sulphuric acid built in 1890-91 can accommodate up to 500 guests for a seated dinner.

Educational Tour

- Stockholm tunnelling project
- Mine Visit
- Alfred Nobel City Tour

[BACK TO TOP]

In Summary

- The city of Alfred Nobel
- Free Hosted Welcome Reception at the City Hall
- Beautiful City with superb International Travel Connections
- A unique Gala Dinner held at the Nobel family factory

[BACK TO TOP]

New EFEE members

EFEE likes to welcome the following Members who recently have joined EFEE

Company Members

Rothenbuhler Engineering. USA
http://www.RothenbuhlerEng.com

TRAYAL CORPORATION A.D., SERBIA
www.trayal.rs

Dynatrac NIG LTD, NIGERIA
www.Dynatrac.org

Austin Europe GmbH, AUSTRIA
www.austinpowder.com

EPC-Groupe, FRANCE
http://www.epc-groupe.com

geo-konzept GmbH, GERMANY
www.geo-konzept.de

Ontaris GmbH & Co. KG, GERMANY
http://www.ontaris.de/

Individual Members

Paulo Aguilera, Davey Bickford, Chile
Gary Bulbeck, Davey Bickford, Australia
Joao Campos. Davey Bickford, Chile
Alexander Efimkin, Uralchem Trading SIA, Latvia
Laurent Gihoul, New Lachaussée, Belgium
Amarnath Gupta, Premier Explosives Ltd., India
Tuomo Hänninen, Oy Finnrock Ab, Finland
Keith Jordan, Nelson Brothers, LLC, USA
Thomas Kaivez, Yara Belgium SA, Belgium
Trevor Little, Blasting Geomechanics Pty Ltd, Australia

[BACK TO TOP]

Robert McClure, R.A. McClure Inc., USA
Andrey Nazarov, EuroChem , Russia
Niclas Nilsson, Oy Forcit Ab, Sweden
Evgeny Onatskiy, EuroChem, Russia
Christian Ostbye, EuroChem , Colombia
Jeremy Prew, Yara International, United Kingdom
Demosthenes Efstratiadis, SEISMOTER Europé - Geophysics & Blasting, Italy
Farouk Al Ali, Qassim Cement Company, Saudi Arabia
Tony Liu, Qingdao Iro Taihe International Trade Co.,Ltd., China
Mehdi Taoumi, Compagnie Africaine des Explosifs – CADEX, Marocko Alexander Schroefl, Hirtenberger Engineering & Technology, Austria
Richard Hosley, Connecticut Explosives Company Inc., USA
Mike Koehler, B.E. Consultants Inc.,USA
Oleksandr Rieznik, Unigran Service LL, Ukraine
Andrii Bereben, Unigran Service LL, Ukraine
Salah Alanazi, Saudi Chemical Co., Saudi Arabia
Alberto Duro Carreño, Construction Company, Switzerland
Maria M Nwaigwe, Dynatrac Nigeria Ltd., Nigeria
Johan D'Hooghe, Recycling Assistance BVBA, Belgium
Michael Williamms, Brown and Mason Ltd, United Kingdom
Bernardo Zuniga, Servicios Mineros Tricomin S.A. , Chile
Hikmet Sinan iNal, SOLAR Patlayıcı Maddeler San. A.Ş., Turkey

National Member

Romanian Association of Explosives and Blasting Engineering (A.R.D.E.), ROMANIA

Student Member

Juho Rahko, Aalto University, Finland

Honorary Members

Walter Werner, Germany (EFEE´s first President 1988-89)

Raimo Vuolio, Finland (EFEE President 1997-98)

Upcoming Events

WORLD DEMOLITION SUMMIT 2015
November 6, 2015
Amsterdam, The Netherlands
http://www.khl.com/events/exhibitions/

[BACK TO TOP]

ISEE 42nd Annual Conference on Explosives and Blasting Technique January 31 –February 3, 2016
Las Vegas, USA
www.isee.org

World Tunnel Congress 2016
April 22-28, 2016
San Fransisco, USA
http://www.wtc2016.us/

24th World Mining Congress
October 18-21, 2016
Rio de Janeiro, Brazil
http://www.wmc.org.pl/?q=node/127

Wise words -"Become a Blaster and get stone rich!"

[BACK TO TOP]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[BACK TO TOP]