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SAFEX CONGRESS XX



SALZBURG

23 till 28 April 2023

From the Desk of the SG

Suddenly we are in the last quarter of 2022. It has been an eventful year- people and companies coming to terms with the Covid-19 pandemic, life slowly retuning to a new normal and global travelling opening up.

The latter allowed the Board of Governors to give the go ahead for the Congress in Salzburg in 2023. Arrangements for this event are well in hand and you should have received registration documents by now. We have a full suite of events including two full days of plenaries. I look forward to meeting you at the Congress. A bulletin on the full programme will be issued after all the papers have been edited.

DATE	ACTIVITY	CONCURRENT ACTIVITY
Sunday, 23 April	Registration - Training	
Monday, 24 April	Registration - Training Training Session	
Tuesday, 25 April	Training Session Board Strategy Session Registration – Workgroups	
Wednesday, 26 April	Registration - Workgroups Workgroup Sessions Registration - Congress Welcome Reception	
Thursday, 27 April	Registration - Congress Plenary Sessions – Open Day	Spouses' Programme
Friday, 28 April	Plenary Sessions – Closed Day General Assembly of Members Gala Dinner	Spouses' Programme
Saturday, 29 April	Congress Excursion	

Two very successful Webinars were run during 2022. The first one on PETN Manufacturing Safety and the second on Explosives Transport Incidents. These events are well attended and will become a permanent part of our annual programme.

This Newsletter covers a wide variety of topics -the first on Barricades as a Safeguard is a discussion paper and we would appreciate your comments on which QD or QRA criteria to be applied. Below is a link from Australia asking for comments on safer storage of AN in NSW. Public participation closes on 18 November:

[Safer storage of ammonium nitrate in NSW | Have your say NSW](#)

We also reflect on truck fires, reactive ground, safety and security with AN, the role of the Expert Panel and end up with some explosives history presented with permission from the IChemE

We also start the Newsletter with a note from Sanjeev Gandhi the CEO of ORICA in which he reiterates his and Orica's commitment to safety and to SAFEX International. Safety starts at the top and with the CEO walking the talk I find it inspirational to have these committed leaders in our Industry.

Safex article by Sanjeev Gandhi - CEO ,Orica



At Orica, safety is our number one priority, always. We pride ourselves on conducting our business safely and responsibly, from how we work with our communities and suppliers, to how we manufacture our products and deliver value for our customers.

We operate in a complex global environment and industry. The decisions we make at work can have far reaching impacts on our business, our colleagues, our customers, our communities and the world we live in. Our primary goal is to ensure that everyone returns home, safe and unharmed at the end of each day, and this is backed by our unwavering global commitment to Safety, Health, Environment and Security (SHES).

We are always looking at ways we can improve our approach to SHES at Orica, making it a safer and more respectful place to work. In 2021 we implemented a refreshed SHES strategic plan, and heading into the 2023 financial year we are

making [good progress](#) in optimising our SHES initiatives and processes across Orica's global operations.

Instilling a safety culture at Orica

We are passionate about cultivating a culture of safety through our Major Hazard Management (MHM) program, a program that is integral to our strategic safety focus areas, defining key safety controls and establishing rigorous verification protocols. During the 2021 financial year, our leaders completed over 10,000 independent verifications of our key hazard controls. MHM is reinforced every day through our Safety Leadership Interaction program, a program that empowers and educates our leaders and employees in all aspects of safe working, while enhancing communication and implementation of our safety controls across our business.

Creating a culture of safety in which all employees are empowered, and expected, to call an immediate stop to work if they observe a potentially hazardous situation - this is core to our MHM program. We regularly communicate MHM stops internally to encourage our people to speak up and call a stop if they feel unsafe.

Health and well-being of our stakeholders

Our people and communities we operate in are critical to our success, and we act to safeguard the health, safety and well-being of these stakeholders at all times.

We are governed by our Code of Business Conduct (our Code), our guide us to ensure we're doing the right thing and delivering on Orica's purpose, vision and values.

We updated our Code and Whistleblower Policy in July 2022 to reflect changing societal expectations, strengthen our culture of safety and emphasise our strong position on respect for First Nations Peoples and their cultural heritage, human rights, modern slavery, and workplace sexual harassment. The updates highlighted everyone's authority, and obligation, to stop work to protect our people, communities the environment and Indigenous cultural heritage.

The update emphasises the importance of speaking up if our people see something wrong. We are absolutely committed to ensuring everyone can raise concerns freely, without fear, and that any concerns are dealt with swiftly, fairly and confidentially using our confidential, anonymous Speak Up service and Whistleblower Policy.

Environmental protection and our lower-carbon future

As a leading mining and infrastructure solutions provider with global manufacturing capability, responsibly managing our impacts to society and supporting a fair transition to a net zero economy is fundamental to creating sustainable value for our stakeholders.

In 2021, we announced our ambition to achieve net zero emissions by 2050. We have made several advancements towards our

ambition, including our recent announcement that Orica will be powered by 100 per cent renewable electricity by 2040.

As we look to accelerate the decarbonisation of our own operations over the next decade, we are committed to working collaboratively with government, industry, academia, and our customers to find solutions for a more sustainable and lower-carbon future. To help achieve our sustainability goals, and support our customers to reach theirs, our focus remains on innovating sustainable solutions, building climate resilience and circularity, and fostering relationships and transparency.

We recognise the responsibility we are entrusted with, and the unique opportunity to harness our technology and digital solutions to advance and champion for a safer and more sustainable industry. We are investing in new technologies, while strengthening and developing our existing suite of products and solutions to encourage more sustainable mining practices through digitisation and automation.

For example, our WebGen™ 200 technology, the world's first fully wireless initiation system eliminates the need for downlines and surface connecting wire. This technology can communicate through hundreds of metres of rock, air and water to initiate blasts. By eliminating the need for downlines and surface connecting wires, WebGen™ allows mine personnel to be removed from dangerous zones of the mine compared to traditional blasting systems.

Or our Avatel™ technology, a mechanised development charging system that enables sites operators to locate, clean, prime and load our bulk explosives and WebGen™ wireless initiating systems without the need to place boots on the ground – reducing the need for human intervention in mining and mineral extraction practices.



We're also continuing to leverage our expertise in technology to respond to a growing interest in renewables, recycled or lower-carbon and circular solutions such as Cyclo™, 4D™ and Fortis™ Protect.

And across our suite of digital technologies, we are positioning to quantify value delivered at every stage of the mining value chain, including reduced energy consumption, cost, or emissions, as well as the ability to manage environmental factors like dust and vibration. Having access to this information will allow our customers make more informed, sustainable decisions on site, and move our industry towards a more sustainable future.

Product security

As a global manufacturer of commercial explosives and blasting initiating systems, we have a responsibility to ensure we partner with and sell to organisations that will use our products for their intended purpose. We also have a responsibility to eliminate or minimise any risks to safety, health, or the environment across the lifecycle of our products and services.

We take our product security responsibilities seriously and strive to be champions of a safe and secure value chain. We select our partners following detailed due diligence covering security across the product lifecycle, from transport to storage and end use. Our key controls cover compliance protocols, audit and inspection programs, plant and equipment design standards, and asset maintenance programs.

Supporting a safer industry

We know our people and the expertise they hold are key to the safety and success of our customers and teams. Our internal expert panels capture and maintain expert knowledge of significant events that if realised, could result in serious injury or fatalities. Our expert panel members are recognised subject matter experts, and meet regularly to stay connected and ensure we're aligned on our safety approach and procedures across the business.

We're committed to learning from our incidents and sharing our experiences, and we are fully supportive of the SAFEX program and its work to encourage progression towards a safer, more sustainable industry.

Every day, our people bring our purpose to sustainably mobilise the earth's resources to life, through a commitment to safety, focus on teamwork and collaboration, and a drive to deliver value to our customers, community, and other stakeholders. Orica has an unwavering commitment to health and safety, and as a global leader in mining solutions, we have an important role in creating a safer, more sustainable industry to drive positive outcomes for all of our stakeholders.

Best wishes and stay safe,

Sanjeev Gandhi

Orica CEO and Managing Director

About ORICA

Orica (ASX: ORI) is one of the world's leading mining and infrastructure solutions providers. From the production and supply of explosives, blasting systems, mining chemicals and geotechnical monitoring to our innovative digital solutions and comprehensive range of services, we sustainably mobilise the earth's resources.

Operating for over 145 years, today our 13,000+ global workforce supports customers across surface and underground mines, quarry, construction, and oil and gas operations.

Sustainability is integral to our operations. We have set an ambition to achieve net zero emissions by 2050 and are committed to playing our part in achieving the goals of the Paris Agreement.

Find out more about Orica: orica.com

REMEMBER TO BOOK YOUR PLACE AT THE SAFEX CONGRESS IN SALZBURG

The forms below are also available on the SAFEX Website or contact me at secretariat@safex-international.org.

BARRICADES / where to locate them?

By

Francois Le Doux

Barricades, natural or artificial, are important safeguards in the business of explosives.

After summarizing the benefits of barricades, this article raises the question of their effectiveness if the barricade is located within the radius of the crater should an explosion occur, opening a debate on which QD or QRA criteria to be applied then.

1)What do barricades protect from?

Barricades are primarily intended to prevent prompt propagations, by stopping high velocity fragments: they can stop the high-speed fragments with a trajectory close to horizontal and some of the crater ejecta.

Barricades can usually not stop fragments with a parabolic trajectory, i.e. an upward trajectory over a standard barricade before falling down and reaching their terminal free-fall velocity. Taller barricades can stop some if not all 'side impact' debris (the horizontal debris with a lobbed trajectory). See e.g. UN IATG 05.30 for a good description of different functional types of barricades.

The overpressure effects are moreover reduced behind a barricade, for a distance limited to some multiples of the barricade height: A barricade close to the explosion donor will stop horizontal debris, while a barricade close to the receptor will stop horizontal debris and, in addition, give some degree of protection from the pressure wave.

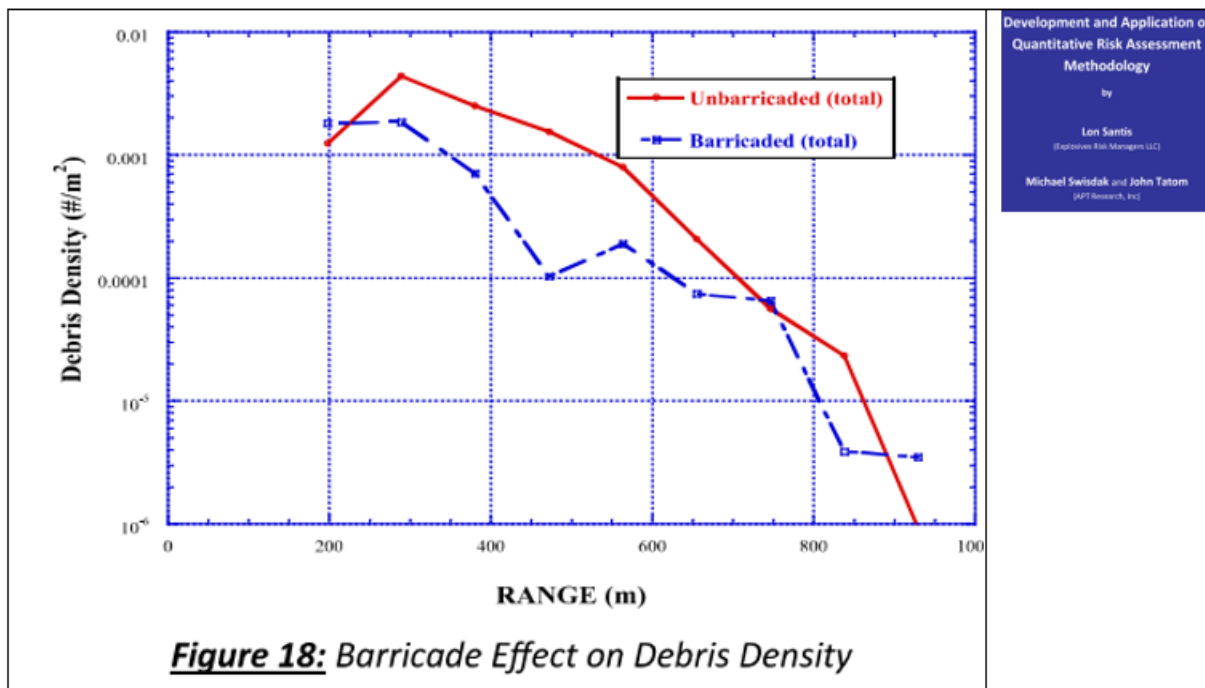
A barricade limits some of the interactions with the surroundings, for example protecting from the radiations of an external fire, of from the collision by a maneuvering or circulating vehicle, etc.

2)Reduction of debris

In terms of QD distance, barricades reduce the required inter-magazines distances, but not necessarily the magazine-to-people distance(s). For example the IBD (inhabited building distance) remains the same because the pressure wave and its consequences as well as the 'lobbed' debris are the preponderant risks at greater distances, not the low angle debris generated from origin. Indeed the reason that barricades offer no Q/D or risk reduction at IBD is that all the fly through/low angle debris has already 'landed'; the furthest distance that the fly-through can travel is fully defined by the initial height and the velocity vs gravity, which will be less than IBD for any reasonable combination of height and initial velocity.

To stop the high speed debris is the primary benefit of a barricade: To illustrate somewhat quantitatively this effect, one may refer as an example to some full scale test results described in the Safex document "Development and Application of QRA methodology" by Lon Santis, Michael Swisdak and John Tatom. See picture above and graph below.

In this example (for illustration only), the debris density is reduced by a factor 5 to 10 in the range 300-600m from the blast if compared to a similar situation but with no barricade. Moreover the debris stopped by the barricades are the high speed ones, with most damage potential and potential domino effect



Development and Application of
Quantitative Risk Assessment
Methodology
by
Lon Santis
(Explosives Risk Managers, LLC)
Michael Swisdak and John Tatom
(JPT Research, Inc.)

The curve also highlights the evidence that most debris is concentrated close to the explosion, generally the further away, the lower the debris density. There is an area of lower *collected*-debris density directly around the PES, because passing above / not fallen down yet. Vertical debris 'never' goes as far as side angle and fly through is also shorter range, as discussed earlier. Secondary debris of course may still be generated from buildings or constructions destroyed by the shock wave. They are however of a different nature, capable of causing damage and/or casualties but probably not energetic enough to make other explosives present on site explode by direct initiation/propagation.

3) Barricade design, not only thickness and height

The rules for height and thickness are well defined in many standards. In practice the barricade must be sufficiently high and large to capture the debris, and sufficiently thick to stop them, typically some 3 feet or some 1 meter thick at the crest, depending the unit system. Donor and receptor should not "see" each other; some countries consider the height to equal at least the height of the storage building, some consider also a 2° rule. It is slightly more complex if the receiver (ES: exposed site) is two or more stories high: a compliant barricade will still ensure that no fly through reaches the receiver (ES) regardless of ES-height.

To be effective, the material of construction is also relevant, while it is not always defined in all standards. One may refer again to UN IATG 05.30. Earth, sand, etc are suitable materials. Generally speaking, too large particles, such as rubble from demolished building, should not be used (risk of enhanced projection hazard), but the further from the donor (PES, potential explosion site), the less it matters.

This being said, where should the barricade be placed, is a barricade equally effective wherever its location between receptor and donor? In particular with class 1.1 or 1.5 explosives that generate craters, potentially undermining the barricade if too close. Short answer: Yes, it matters (and is complex).

Let's review and comment different situations:

Case 0: what if the distance between the barricade and the donor is... zero? Typically for an ECM (Earth Covered Magazine) or for earth mounded just against the wall of the donor. This question is well treated by e.g. NATO or ATF (see for example [Explosives Storage Requirements - Barricades & Bullet Resistance | Bureau of Alcohol, Tobacco, Firearms and Explosives \(atf.gov\)](#)): If the distance is zero from the donor, then it is not effective as barricade from the donor. ECMs protect the product INSIDE from incoming debris, shock waves, etc. That said, they will also contain 'outgoing' blasts up to a certain point, past which point they become very bad indeed. Therefore no credit in QD or QD tables specific for the design must be used. Software such as IMESA FR for example cover this aspect.

Case 1: It is mentioned in different standards to keep some **one meter** between the donor and the foot of the barricade as a good practice, for access, circulation, cleaning, etc. This approx. 1 meter must be understood only as a minimum.

Case 2: If the barricade remains *out* of the predicted crater, then the barricade plays its full role. For a given height, the barricade is more effective when it is closer to the donor (PES); A barricade that is both far from the donor (PES) and far from the receiver (ES) is less effective, because fast projectiles in shallow trajectories can fly over it and land on the receiver (ES).

Case 3: If the barricade is *within* the radius of the predicted crater, how effective will it be? Answer: It should be considered as unbarricaded but may in fact be worse (at closer range), as detailed hereinafter.



Figure 19: Barricade Remains—Post Detonation

(Picture extracted from SAFEX reference, *ibid*)

However, this question of the location is not always explicitly addressed in existing standards, which can be misleading. A barricade must be both properly constructed and properly sited.

How far away the barricade must be from the predicted crater to play its full role, at protecting:

- other explosives, especially stored outside
- assets (inside is normally a company choice, outside to count)
- people, especially in the open or at Process or Occupied Buildings distance (but not at public works distance and IBD, which are far away anyway).

Actually, should any QD credit be allocated if the barricade is within the crater? Probably no, on which basis?

If yes, should the credit be differentiated depending on the receptor (people vs assets vs explosion propagation to other explosives). Probably yes.

When the location is addressed in a standard, the recommendation is always to keep the barricade **out of the potential crater**, some standards (UN IATG, NATO standard, British Army standards,... deriving from same consensus or experience anyway) tolerating a maximum of one third of the barricade within the predicted crater.

And the author would add (as a comment and additional condition relevant for more vertical barricades e.g. bastion walls) the **crest must remain entirely out of the crater radius**. This condition is common sense and can moreover be deduced from the explanatory schemes included in standards.

The radius of the crater is classically estimated based on following formula: Radius = K.Q^(1/3)

K=0.5 is a usual figure by default and 1.0 a conservative figure (in metric units, Radius is in meters and Q in kg of TNT equivalent). Typical K-figure range from 0.2 for hard ground (hard rock bed or solid concrete basement, that would also generate dangerous fragments) , 0.7 (clay) or even 1 for a soft ground (e.g. sand, that would not generate fragments).

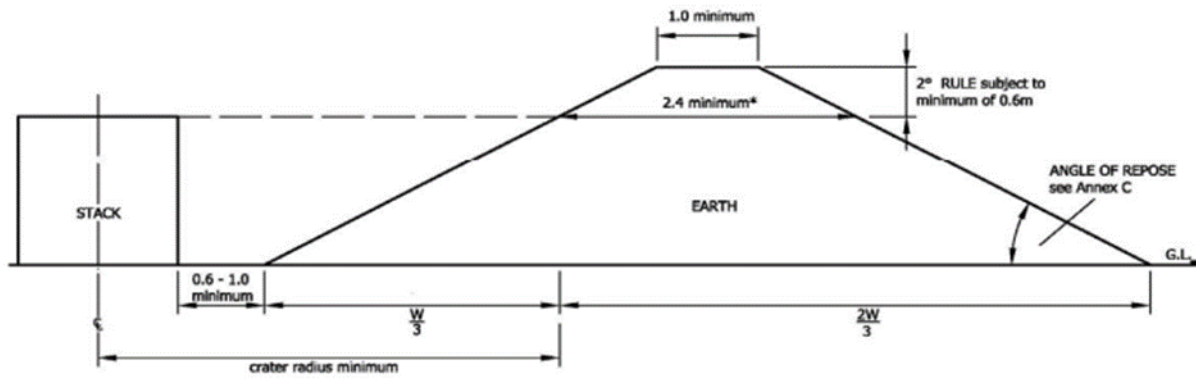
Providing the barricade is built with the right materials, it is likely that any barricade, even within the crater, may still have some kind of positive impact in reality. Especially if the amount of explosive present at the time of an accident and/or the predicted crater are smaller than anticipated; so it is generally better, even if space is limited, to build a barricade than nothing. But the big question is if any credit in terms of QD or QRA can be allocated. If yes, on which factual and demonstrated basis (e.g., full scale testing, empirical experience, etc). A logical and conservative approach dictates no credit; unless proven otherwise, no credit should be given.

On the other hand, if the barricade is destroyed but was built with inappropriate materials, then it may even be worse (generation of additional debris) for some exposed categories, for example for people exposed in the open.

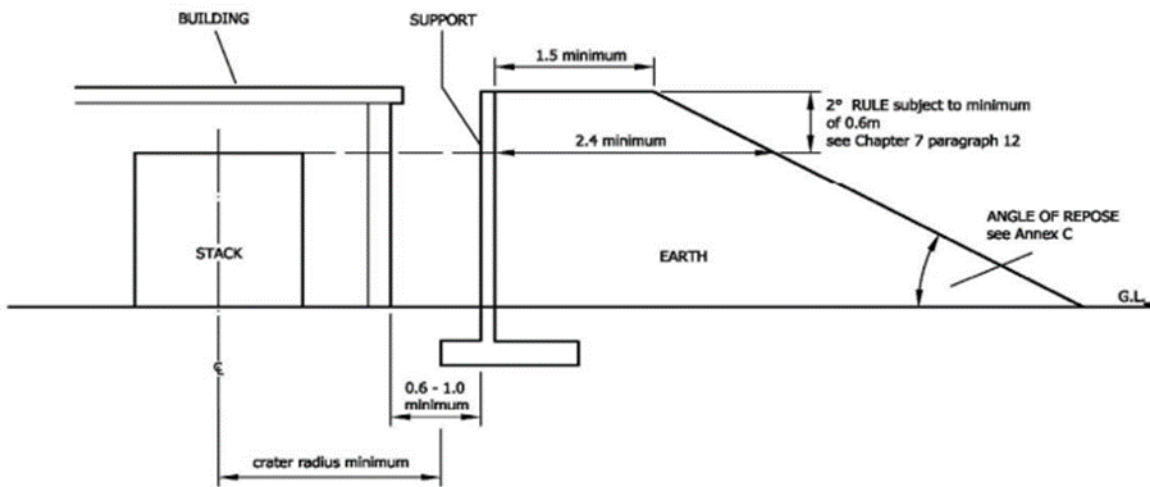
Case	Donor / PES Potential explosion site	Receptor / ES Exposed site	Reduced QD-Distance thanks to the barricade	References, Examples
A	Earth covered	No barricade	No	See NATO, ATF, etc.
B	No barricade	Earth covered	Yes, the barricaded QD-distance applies.	Id
C	Barricade touches the wall of the donor	No barricade	No	Id
D	No barricade	Barricade touches the wall of the receptor	Yes, the barricaded QD-distance applies.	Effective ES barricade
E	Barricade out of the crater	No barricade	Yes, the barricaded QD-distance applies.	Effective PES barricade
F	1 barricade, but in the crater*	1 barricade, out of the PES crater*	Yes, the barricaded QD-distance applies.	Effective ES barricade.
G	Barricade in the crater* and built with <i>appropriate</i> materials	No barricade	No The unbarricaded QD-distance applies and/or no credit in a QRA for the barricade.	Author's opinion In line with UN-IATG-05.30, British Army standard, French civil explosives ref., ...
H	Barricade in the crater* but built with unknown or <i>inappropriate</i> materials	No barricade	No The unbarricaded QD distance should apply. In case of QRA (e.g. using the software IMESA ^{FR}), the donor should be selected as generating primary fragments (even if the donor in itself is not of this category).	Author's opinion

*in the crater meaning here “more than one third in the predicted crater and/or the crest partially in the crater”. One may refer to schemes below, extracted from British Army document, JSP 482 Edition 4, that present the advantage to include the crater radius not only in the text but on the scheme itself.

ALL DIMENSIONS IN m



ALL DIMENSIONS IN m



Thanks to all who supported this article; special thanks for their review and support to Bill, Erik and Rolf who will recognize themselves.

Contact: Francois.Ledoux@yara.com

Did you hear the one about the missing 20 tonnes of ammonium nitrate?

By
Ken Price

It could only happen in Queensland.

To quote the report from the Queensland explosives inspectorate: *“A full (20 tonne) off-spec shipping container of security sensitive ammonium nitrate (SSAN) was incorrectly stored in the empty container area.*

“A transport triple road train combination vehicle attended the mine site reload to collect empty residual bulk SSAN containers and the full container was loaded onto the centre trailer and incorrectly recorded by the site consignor as an empty residual container.

“During the journey from the reload location, the driver identified that a container was full and activated his security plan and travelled to a secure location.”

From the above and the detailed report, it is not clear to me if it was the container or the contents that was faulty. But you have to wonder...

How could a container loader driver not tell the difference between a full and empty container? A lift of 23 tonnes vs 3 tonnes??
The road train driver could tell something was not right when driving his triple road train.

Would putting scales on the lifter make any difference?

If the container was faulty, how did it get past the pre-loading inspection? And how was it allowed to be loaded on the truck for return?

If it was the ammonium nitrate that was faulty, what sort of QA is in place at the point of loading to allow dispatch of off-spec product?

How on earth were the stock levels reconciled at the point of use?

Does anyone audit the security systems in place for SSAN? Are all those fancy paper trails really effective? [I've seen many of them. Container number and seal number on the factory documentation that goes with the driver to the receiver who checks them into storage and then stocks are reconciled weekly and monthly etc. They all seem to work or am I too trusting?]

The road train driver was one person in this saga who was on the ball. He realised that there was a discrepancy in his load; supposedly empty containers and he has a lot more ammonium nitrate on board than his documents say. He stopped in a safe place and activated his security plan: call the boss, get further instructions and head to a secure location for more investigation.

And I'm sure it would not only happen in Queensland. Some 2000 tonnes managed to be ignored in Beirut, but that's another story.

Speaking of Beirut

Do I sound bitter? All that I have read about the tragedy in Beirut points to gross incompetence at the highest levels in that country. Not the port management who were trying to get the product removed from site. (Though you have to wonder about the wisdom of storing explosives (fireworks) in the same warehouse.)

Now I see from an article in Deutsche Welle (a German public broadcaster financed by federal tax resources.) that Jorge Moreira was arrested in Spain for extradition to Lebanon. He has been charged under Lebanese law with terrorism and murder in Lebanon over his role in bringing ammonium nitrate explosives into the country.

It appears that Mr Moreira was an employee of Mozambican firm Fabrica de Explosivos de Mocambique (FEM), and ordered the 2750 tons of Ammonium Nitrate that were consigned from Georgia to Mozambique. Through a series of mishaps the ship finished up in Beirut where it was seized by Lebanese authorities after a company filed a lawsuit against its owner over a debt dispute. Full article here: [Beirut blast suspect arrested in Spain | News | DW | 21.04.2022](#)

So what we seem to have is Lebanese officials going after an employee of a Mozambiquan explosives company because the ammonium nitrate he ordered from Georgia blew up in Lebanon after it was seized on its journey and incompetently stored in Lebanon.

Maybe you logistics and supply people in the explosives business should ensure that your employees have appropriate protection in place for you because this could happen to any of you.

And it doesn't stop there...

From France24 [Lawsuit filed in US over Beirut blast for \\$250 mn \(france24.com\)](#):

"Victims of Lebanon's deadly 2020 port blast have filed a quarter-billion-dollar lawsuit against a US firm for its suspected links to the tragedy, a Swiss foundation assisting the plaintiffs said Wednesday.

"Accountability Now said in a statement that the claim was filed this week in Texas against US-Norwegian geophysical services group TGS.

"The company owns British firm Spectrum Geo, which a decade ago chartered the Rhosus ship, which was carrying the ammonium nitrate that was subsequently unloaded at Beirut port and exploded on August 4, 2020."

Despite reading the complete article several times I can't fathom the link between the plaintiffs and the defendants, but I guess one can find a lot of links with \$250 million at the end of the chain.

Junkyards

It's not junk. It's still good. I might need it some day.

How many times have I said that to my wife when she is standing there with my precious property (junk) in front of her, asking: "how come it is cluttering the house or the shed".

And how many times have I thought the same when checking a mine or explosives reserve and I see old magazines, disused manufacturing vehicles, out of service ammonium nitrate augers and a great collection of parts like helical displacement pumps or parts, bearings, seals, hoppers, and the list goes on.

At the personal level, this accumulation of stuff would be called hoarding.

At the business level, it could be called one of many things, two of which spring to mind: dangerous, and wasted money.

It's potentially dangerous because ammonium nitrate particularly manages to hide in all sorts of unusual places and has been responsible for deaths when someone cuts into a piece of equipment without knowing about the ammonium nitrate hidden there. That old stuff has probably been dumped when the new version arrived and may never have been cleaned.

It's wasted money because you are paying rent for the storage area and losing money you could have put to better purposes if you had sold the old equipment, even as scrap.

If you must keep your old plant and parts, try to do it properly.

Keep it in a designated area and keep it neat. Untidiness, even in a junk yard infects the thinking of the whole plant. It's a good idea to fence it off.

Keep it on your depreciation schedule. You may minimise your losses.

Catalogue it same as you do for operating plant. That way you have some chance of knowing where it is if you really do need it some day. This is particularly relevant for magazines. I've seen my share of securely locked magazines with no idea where the key is. One in particular was on a stores laydown area for about 10 years and no one knew whose it was, if it still contained product or where the key was.

Periodically wander through the junk and try to dispose of what you can. Perhaps a good job for a vacation student. Turn him loose to track the history of items in the cemetery: what is it, who put it there, how long has it been there, how much is it worth as scrap metal, why can't we get rid of it?

Safely resolving reactive ground when blasting

Presented By

Dirk Voogt

When a South African zinc mine experienced a premature detonation in one of its blastholes, BME was soon on site to investigate the incident and apply a safe strategy to proceed.

According to BME technical services manager Deon Pieterse, the cause of the detonation was the reactive ground being drilled for blasting. This was an example of the exothermic chemical reaction that can occur between sulphide-bearing rock and ammonium nitrate-based explosives in the blasthole.

"The mine was found to have geologically bounded reactive zones within its rich zinc deposits," said Pieterse. "Due to the natural process of weathering and leaching, the upper benches of the transition zone are more prone to reactivity – as these benches contain more exposed sulphide or sulphide bearing rock and soils."

He noted that the area being blasted had previously been mined and did not have a history of ground reactivity. Where reactive ground is known to occur, reactive zone mapping of the geology of the mine can be used to mark out potential reactive ground areas in the current and future mining blocks.

"In this case, an unexpected detonation of three holes occurred after the loading process was completed and before blast firing," he said. "There were no injuries associated with these events."

The blast block was immediately evacuated and barricaded. For two days, other blast holes showed signs of reaction. This included the emission of smoke and yellow orange reacted emulsion froth coming out of the blast holes. After signs of reaction ceased, and the pit was declared safe, and an in-pit inspection was conducted. Ground samples were collected from the reactive areas and sent for ammonium nitrate and ground reactivity analysis.

"During our inspection, 35 holes were found to have shown signs of reaction," he said. "Other holes were temperature checked with in-hole readings of between 131°C and 170°C at one metre below the hole collar. South Africa National Standards require detonators to function nominally up to 85°C; anything above this increases the possibility of unplanned detonation."

Ground samples were collected from the reactive areas and sent for testing at the BME's Losberg laboratory. Here, extreme reactions were observed in two samples of reactive ground that had been loaded with uninhibited bulk ammonium nitrate explosives.

“We monitored the temperature of the samples during testing with a temperature data logger, and measured temperatures exceeding 700°C within an hour of mixing the samples,” he said.

BME was then able to apply its urea-inhibited bulk emulsion – brand named INNOVEX™ RG – which is specially designed for use in reactive ground. Applying the same tests, this inhibited emulsion did not react, or cause any temperature spike.

“We then conducted ongoing characterisation work to understand the reactive ground at the mine,” said Pieterse. “As mining progresses, drill samples are analysed and tested, helping us to build reactive zone maps of the geology.”

In terms of safety practice associated with reactive ground, he explained that mines should conduct a risk assessment where they suspect reactive ground. This should include the monitoring of potential reactive ground indicators. If reactive ground is identified, he outlined a range of controls to manage this risk.

“Mines can use urea-inhibited bulk emulsion, as urea reduces the rate of reaction and slows heat build-up,” he said. “Blocks should then be kept small enough to be fully charged and fired the same day.”

He noted that, in some instances, holes may need to be sleeved with plastic liners before charging – to isolate the explosives from the blasthole walls. Drill assistants should then keep drill cuttings clear of the blast hole collars, to a radius of at least half a metre.

“Drill cuttings that mix in with explosives present a higher risk of rapid temperature build-up,” he said. “Clearing the hole collars of drill cuttings will prevent activity around the hole collar – such as charging and hole priming – from pushing cuttings back into the hole and onto the explosives column.”

As a rule, personnel on the block must be kept to a minimum during the priming and stemming activities. They should also be careful to check that all explosive and initiation products used to blast reactive ground are compatible; also, each product must be qualified to operate within the temperature range.

“It is important that imported stemming material must be tested to be free of reactive ground,” he said. “Unless stemming can be done rapidly using a stemming truck, blast holes should remain unstemmed.”

He warned, however, that with no stemming in the blast holes, there may be increased air blast and more flyrock from the surface cratering.

“If the holes need to be stemmed, then this must be done just before blasting time – so that all holes remain open for long as possible to release heat,” he said. “This reduces the risk of hole deflagration and unexpected detonation.”

He highlighted another benefit of having unstemmed holes: they can be observed more easily. For instance, reacting holes may emit visible fumes, in colours of yellow, orange, red and brown. If this occurs, then the blast area should be immediately evacuated and secured, and personnel moved to a safe distance.

What can the Expert Panel do for me and my operations? And why should I use an Expert?

By

Andy Begg

By way of introduction the Expert Panel has been with us now for many years and members of the panel have been quietly contributing to SAFEX through direct assistance to SAFEX members on request and by contributing to the newsletter, GPG’s, e-learning modules, webinars etc. However, in talking with the panel members I believe that the Experts are a very under-used source of expertise that is available to our members.

So why should you use the Experts? Simple – they are experts and collectively cover almost every technical and safety aspect of our products and operations. Many of the Experts are retired employees of explosives companies who will have had many years' experience in explosives - operations, engineering, plant maintenance, R&D, safety services - - - and now offer their skills in these areas as specialist services. A few of the Experts are still employed by explosives companies but are still able to assist other companies by agreement. There are one or two Experts who have previously been employed in the inspectorate and have expertise in testing and classification.

Experts will expect to be requested to sign a confidentiality agreement with each client. Often there will be safety related observations of good practice that may be applicable to other clients and in such cases approval to share will be requested from the original client. In my experience this is almost always granted – but verification is still required.

What does it cost to use an Expert? This will depend on the request from the member. Often the member is asking a very specific question that will have a relatively short answer as the Expert will simply pass on the information they at no charge. If the request requires the Expert to devote more time – perhaps visiting a site for an audit, incident investigation or training, undertaking background research and providing a formal report or participating in web-based meetings – then the cost would be on an agreed basis between the client and the Expert.

Here are just some of the skills that the Experts can provide. (A more complete list can be reviewed in the Skills Matrix in the SAFEX website but it is summarised at the end of this paper)

Safety Management Systems design and implementation.

This is a critical area of company safety policy and in safe operation. The Expert members have considerable experience in developing and implementing safety management systems across the world.

Leading Hazard Studies and Risk Assessments.

Hazard identification and assessment are critical stages in project development to ensure that the basic design and mode of operation of a plant or piece of equipment are to a high standard of safety. SAFEX Experts offer the skills to lead or participate in such studies. They are able to devote 100% of their time unlike many in-house leaders who also have other responsibilities to fulfil. They are able to be totally objective as they are fully independent of the project. They bring a breadth of knowledge and experience that can only be gained by years of practice in the explosives industry.

It should be noted that Hazard Studies entail more than a HAZOP and are critical elements of successful project management from conception to completion.

Auditing services

The Expert Panel can provide experienced auditors able to undertake a wide range of audits. Once again because of their experience in explosives they are able to focus as appropriate on explosives specific issues that would not be obvious to a general third party auditor.

Audit scopes include:

- Management system – how inclusive is the management system and how well does it operate?
- Operational audit on plant procedures – how comprehensive are the operating procedures and are they understood and being complied with at plant level?
- Specialist audits – these look in detail at specific critical procedures to assess appropriateness relative to best industry practices. Typically, such audits would include
 - Permit to work system
 - Hazard Studies
 - Explosives controls –Blast protection, PPE, Fire safety - -
 - Maintenance system
 - Incident investigation
 - Basis of Safety

- Management of Change

From their experience auditors are often able to provide very specific recommendations on how to address issues raised in an audit.

Project management

Many of the Experts will have been directly involved in plant design and construction and will be able to advise on explosives specific safety aspects of plant layout and equipment selection.

Safe management of redundant facilities and equipment

The age of our business and technology changes have resulted in the need to decommission many plants over the years. The assessment of the requirements to ensure the safe decontamination and demolition of plants and equipment and the remediation of the plant areas require specialist knowledge. Several of the Experts have hands-on experience of undertaking large projects of this type.

Training

Members of the Expert group are very well qualified to provide training across a wide range of topics in most if not all areas found in a typical Safety Management System.

Incident investigation

Many of the Experts have been involved as a leader or members of serious incident investigation teams. They also have experience in undertaking peer review of completed incident investigations.

Acquisition & Divestment

Experts may also support Due Diligence teams as a member or leader of the SHE team aiming to review and assess Safety, Health and Environment aspects.

For acquisitions, as an example, the environmental liability effects, particularly the civil liability risk for clean-up costs, property damage and personal injury due to toxic or hazardous wastes, may exceed the value of the assets being acquired. The Experts can assist in the preparation of an integration plan prior to taking ownership of the acquisition, including strategies to introduce the company SH&E culture and address significant risks identified in the risk profiling.

For divestments the experts may provide the necessary support to understand and disclose existing or potential problems, and to assess remediation costs.

The SHE findings in Due Diligence can be important in negotiation of the acquisition/divestment price.

Expert Witness

Many of the Experts are highly regarded in their areas of expertise at international level and have been called on to act as "Expert Witness" in formal prosecution cases following serious incidents.

Networking

The Experts are generally very well connected with their peers not only in the explosives industry but in other industries and often academia and can be very useful in expanding a search area for information.

Regulations

Several of the Experts have considerable knowledge of and experience in national and international regulations governing explosives manufacture, use, import/export, storage and transportation and can advise on such matters. If you are having problems convincing a regulatory authority that your systems are safe these experts may be able to help.

How do I engage with an Expert?

Experts can be contacted directly using the contact details in the Website if you are sure you know that the Expert has the skills you require. If you are not sure which Expert would be best suited to meet your needs, then contact the Secretary General and we will suggest which Experts you should consider.

Expert names and contact details (can also be found in the website)

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Expert Panel members’ skills topics

Explosive facilities and machine design	Incident investigation	Hazard studies	Auditing	Risk assessment
Operations risk management	HSE system development & implementation	Environmental legacy management	Explosives regulations in the US and at the UN	Explosives testing and transport approvals
Training	Military explosives process safety	Incident investigation & reporting	Explosive Safety Site Planning	Static Electricity control
Emergency planning	Demilitarization processes	Computational Modelling	Condensed phase, gas and dust explosions	Acquisition and divestment SHE Due Diligence
Environmental Legacy Management	Compliance testing	Nitration Chemistry	Explosives disposal	Equipment design
Explosion effects analysis	Regulatory compliance	Quantitative risk analysis	Basis of Safety	Clean room setup and compliance
Electromagnetic compatibility with explosives	Explosives project management.			

EXPLOSIVE VEHICLE FIRES

By

Stephen Caldwell and Stephen Brace

A number of incidents have occurred over the past 10 years or so, where fires in explosives vehicles (Mobile Explosives Manufacturing Units and Explosives Transport Vehicles included) have not been extinguishable and have spread to the point where the explosives payload carried by the vehicle has detonated. In some cases the process of the fire spreading has been slow enough to afford sufficient time to evacuate personnel to a safe distance, but in others there have been casualties and fatalities.

Explosives vehicles can and should be protected from such incidents by the provision of a number of fire prevention measures and extinguishing means. There are usually statutory requirements but additional safeguards should be established through the process of conducting professionally lead Hazard Studies and Fire Risk Assessments.

All of the above has resulted in a host of compliance requirements for explosives vehicle design, testing, equipment and training (eg the ADR Code) which are intended to prevent fires from occurring in the first place, but also for

suppressing and fighting fires if they break out. This article is confined to fire suppressing and fighting measures and considers what may have been omitted.



Electrical isolation or ADR switches.

These switches are supposed to be positioned directly adjacent to the vehicle battery, and, if possible, an additional switch can be provided on the dashboard inside the cab. These switches must be clearly marked so that even personnel not familiar with the explosives vehicle can see them and operate them.

In some countries these switches are required to be purely mechanical, fail safe and lockable. The European ADR code allows for these switches to be relay operated thus allowing for two switches, one at the vehicle battery and one on the dashboard of the cab – termed ADR2.

ADR switches are also required in vehicles carrying other hazardous goods and are often an option offered by truck manufacturers. These relay operated ADR switches do not comply with the mechanical isolation requirement of certain countries and it must be remembered that there is always a low voltage power supply to these switches.

Isolation switches are supposed to totally isolate the battery from the vehicle electrical system. Then, in the case of an electrical fire, the electrical power source is totally cut off. The purpose being that if electrical power is removed, the source of energy is then removed and this, coupled with use of fire extinguishers, should result in the fire petering out.

The provision and design of electrical isolation switches should at a minimum meet the minimum legal requirements. However, they should really be established by carrying out Hazard Studies and Fire Risk Assessments as this may identify unique site-specific circumstances and product, user practice, process and equipment developments that often run ahead of regulatory changes..

Fire extinguishers.

Primary fire fighting equipment such as fire extinguishers are not provided to fight fires within the explosives payload but rather to fight fires which may occur in or around the vehicle itself, before the fire spreads to the payload. The requirement for fire extinguishers can depend on the size of the vehicle. For example the European ADR code specifies an 8 kg fire extinguisher for a vehicle from 3.5 to 7.5 tons and a 12 kg fire extinguisher for a vehicle of more than 7.5 tons. Some countries require an explosive vehicle carry a minimum of two 9 kg fire extinguishers no matter the size of the

vehicle or it's payload.

In all cases fire extinguishers must not be locked or hidden away, they must be stowed securely but easily accessible and clearly marked so that a person not familiar with the vehicle can see and access them.

Again, the provision of fire extinguishers should meet the minimum legal requirements but should be established by carrying out Hazard Studies and Fire Risk Assessments.

Engine fire suppression systems.

Vehicle fires often have their origin in or around vehicle engine bays or from the tyres. The engine bay areas are often hard to access. In a cab-over design the cab has to be tilted forward by jacking it over, a slow process. In conventional truck designs the engine is concealed under a bonnet or hood which can become too hot to touch, preventing opening in the event of a fire.

Hazard Studies and Fire Risk Assessments carried out on explosives vehicles have identified these risks and it has become a common requirement for explosives vehicles to be equipped with engine bay and tyre fire suppression systems. These can be manually or automatically activated and consist of a built in fire extinguisher connected to a fire reticulation system with nozzles directed to all areas around the engine bay and to the wheels.

Fuel and Diesel power.

All fuels are flammable but diesel is far less flammable than petrol. In addition, diesel powered vehicles do not have spark plugs and the associated high voltage ignition systems, and are not as prone to backfire and emit exhaust sparks. The outcome of Hazard Studies and Fire Risk Assessments conducted on explosives vehicles should always result in the recommendation for explosives vehicles to be diesel powered.

Some of the greatest fire hazards occur at re-fueling points as other hazards are often present at such places in the form of other vehicles, equipment and personnel; which or who are not directly involved with the explosives vehicle. This is why it is normal standard practice for explosives vehicles to load fuel first before loading explosives.

Training, accidents and fires.

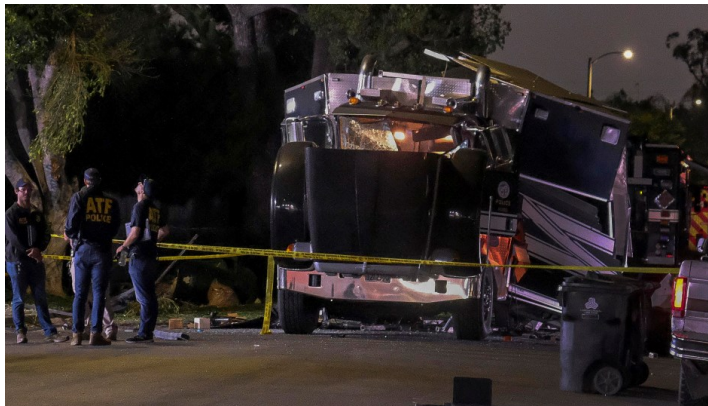
For those transporting explosives on public roads in Europe, ADR training is mandatory. As part of this training aspects of fire suppression means and fire-fighting measures are covered. However, this training, as far as we are aware, as conducted by most training organisations, does not cover how actually to fight a fire.



Fires are an ever-present risk in vehicles and it is important to fight vehicle fires as soon as they occur to prevent them from spreading.

The above point cannot be expressed enough as despite all the precautions taken by those transporting explosives and explosives raw materials, fires will still occur. These fires are usually associated with the vehicle engine, battery, electrical system, dashboard, cab, fuel tank, brakes and tyres, but they can also start as a result of an accident. The explosives vehicle operator is a vital person who needs to be properly trained: not only to prevent motor vehicle accidents from occurring and to prevent fires from breaking out in the first place, but also, and to stress again, to fight fires with primary fire fighting equipment immediately, and with purpose, confidence and effectiveness. Failing this the operator must be trained to give guidance to other support personnel who are not knowledgeable about explosives such as emergency response teams, municipal or general fire fighters etc, to fight fires with secondary fire fighting equipment such as pressure water hoses or foam spray systems.

If the above measures fail, the operator must be properly trained to know at what stage to call it quits and to have the



authority – or at the very least an authoritative manner – to instruct all personnel to leave the fire and evacuate the area calmly but without hesitation to a safe distance.

The above requirement of a person transporting dangerous goods and explosives should make it plain that not everyone has the aptitude and temperament to take on such a responsible role. It is the actions within the first minutes of an incident, when the operator is often on his own, that will often determine whether the fire peters out to a safe conclusion or intensifies to a possible disastrous outcome. Many individuals forget or ignore all they have been taught in these critical and stressful first few minutes. Worst still, they may wait for someone else to tell them what to do or evacuate the site immediately when there was a good opportunity to extinguish the fire. Therefore, selection and recruitment of the right person is another vital cog in preventing vehicle fires getting out of hand and leading to catastrophic results.



Parking and explosives vehicles left unattended.

Parked or unattended vehicles can be a high risk, particularly if left full or partially loaded with explosives. Most countries' legislation does not allow loaded explosives vehicles to be stopped (other than for normal traffic reasons), parked and left unattended under any circumstances. If they have to be parked unattended for any reason (a delivery was cancelled, nightfall, force majeure etc), specific safe parking areas are required to be designated. These safe areas are usually designed to be secure, fenced and guarded enclosures outside the prescribed safety circles from other explosives or flammable storage facilities or buildings. It is a normal requirement for electrical isolation switches to be activated and locked-out for parked explosives vehicles.



It is also good practice, under normal and standard operating procedures that take place without incident, that once the vehicle has finished its duty and is parked-up, that it is monitored for at least 30 minutes; that is, it is within operator or CCTV view. It is often when a vehicle has been worked hard and is hot, and it is now stationary without the cooling effect of air movement, that fires can break out. Such observation can lead to a minor fire being dealt with before it proceeds to becoming a major one.

Initial observation and conclusions

If all of the above requirements are met, it would be very unusual for a fire to occur and burn to destruction in an explosives vehicle, yet these incidents have occurred and in a few cases lives have been lost even when no vehicle accident has occurred. In some of these cases it has been because the primary fire could not be extinguished despite many extinguishers having been used.

Anecdote: recollections of a simple past by one of the the authors.

Many years ago, possibly in 1968, I was 12 and had ridden down to the local car garage to pump my bicycle tyres. A car pulled up to the forecourt of the garage to take on fuel.

Just after the car stopped adjacent to one of the petrol pumps, a fire broke out in the engine compartment. The driver panicked and ran away. The pump attendant immediately raised the alarm by shouting... within seconds the garage mechanic came out running with a fire axe and a fire extinguisher. The fire was not yet extensive, but the car's bonnet was too hot to touch. The mechanic was calm, opened the door, released the handbrake and got the attendant to help him push the car out of the petrol station towards the pavement on the other side of the road. Once the car was moving, the mechanic used the axe to chop a few holes in the bonnet and successively inserted the fire extinguisher nozzle into these holes and discharged it into the fire. It was all over. The fire was out in less than a minute. Without the axe to chop holes into the bonnet, it was quite possible that the fire would not have been put out.

Perhaps there is a simple lesson to be learned from this experience.

Many fires in cars or trucks, whether a fuel, electrical, plastic or oil fire, will occur behind some panel, sheet metal, body part, dashboard or door etc. These can be locked or sealed or can get very hot, and therefore difficult or impossible to open. It's probably only tyre or spillage fires where the fire would be on an outer accessible area. It must be very difficult to put out a vehicle fire without a fire axe to chop the shielding panel open and insert the fire extinguisher nozzle.

I remember seeing fire extinguishers, fire hose reels and fire hydrants in many places when I was a kid. They were always at the entrances to buildings, sometimes behind breakable glass windows. There was one thing that was always part of these fire fighting kits: a fire axe, painted red so as not to confuse it with any other axe.

The vision I had and still have of a fireman is someone of a calm and authoritative demeanour with a special bulky uniform with reflective tape, a strange curved helmet, big clodhopper boots... and a fire axe over his shoulder!

Where have all the fire axes gone?

And... a trend in all modern vehicles

An insidious trend in the design and construction of vehicles over the past 30 years is the increased amount of plastic used. I have an old 1956 car and there is almost no plastic used in its construction, except for some wire insulation. Even the dashboard is steel. I have a modern car built after 2015 and almost everything is made of plastic. Even the engine valve cover, the sump and some of the body panels are plastic! What are the chances of putting out a fire in the steel car as opposed to putting one out in the plastic car? I suspect the plastic car is an order of magnitude more flammable than the steel car. With this development, have our training, practices and procedures kept up with the change to these modern combustible materials?

Final Conclusions

We believe we are missing a few tricks.

We casually think that fire extinguishers alone can put out a vehicle fire, yet the modern vehicles we use today are complex with hidden and inaccessible places where fires can develop (not just engine bays, but in dashboards, fuse boxes, HVAC systems etc), but to where no extinguisher stream can be easily directed. We then provide no means, no implements and no training as to how to get to these places and put out fires that may occur there, particularly in the critical first few minutes.

We have moved into a world where everything around us is far more flammable than it used to be. Almost everything is now made of plastic, but our thinking remains formed by our knowledge and experience of the past when almost everything was made of steel.

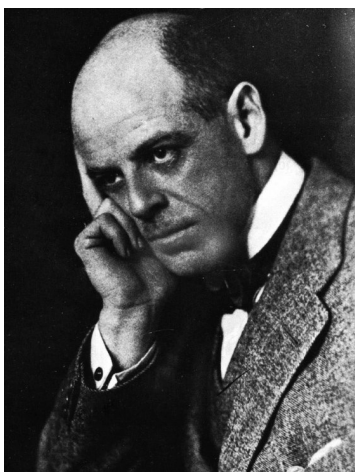
Have you, as an organisation responsible for safely transporting explosives and explosives raw materials, kept up with these modern developments? Have you undertaken the necessary Hazard Studies and Fire Risk Assessments, and recruited and then trained the right people? Are you ensuring the risks to your employees and the public, and the reputational risk to the company, are kept as low as reasonably practicable? Are you taking the necessary steps to maintain the very survival of the business? Fires on explosives vehicles, developing more quickly and intensely than of years gone by, are often those incidents when these questions are unfortunately answered in the negative.

The Explosive Foundation of IChemE

And the lesser-known chemical engineers who helped shape it, from Martin Pitt

WITH IChemE's Centenary celebrations under way, I wanted to use this month's article to explore the chemical engineers who influenced the early development of the Institution, but who are typically obscured by the long shadow cast by the profession's founder, George E Davis.

KENNETH BINGHAM Quinan



At the beginning of the first world war, both Germany and Britain had a problem. Unless the war finished quickly – and governments were realising this was unlikely – they would run out of explosives. Germany's problem was the lack of nitrogen compounds, which were mainly mined in places controlled by the British Empire. The brilliant solution was the Haber-Bosch process by which ammonia was made out of thin air.

Britain's problem was different. It did not have much manufacturing capability – it imported most explosives by sea from South Africa and the



US.

In 1915 there was the Shell Crisis where the British army literally had too little ammunition, causing a great political furore, and a Ministry of Munitions was established.

In anticipation of this, KB Quinan, an American, and the General Manager of Cape Explosives in South Africa – the second-largest such factory in the world) – was summoned to the UK in December 1914 to build a national explosives factory in Oldbury. It was built in record time and was in production by May 1915. He continued to build others with an exceptional skill in organisation. A key feature of this was the use of mass balance, now familiar to us but then a novelty.

Many were also constructed in Canada, vastly increasing the amount of munitions available.

After the war, Prime Minister David Lloyd George told Parliament: "It would be hard to point to anyone who did more to win the war than Kenneth Bingham Quinan."

Although not generally known to the public, Quinan impressed the Government – strongly helped by fans including Arthur Duckham and William Macnab – and people in the chemical industry were impressed by his methods. Hence Quinan's example was used to rapidly restore and expand the general chemicals industry. In this respect he probably was more important historically than George E Davis. However, he turned down the offer of a knighthood and returned to South Africa for the rest of an inventive career that was not restricted to explosives.

You can read more about him here: <https://bit.ly/3L7ugVx>

ARTHUR Duckham



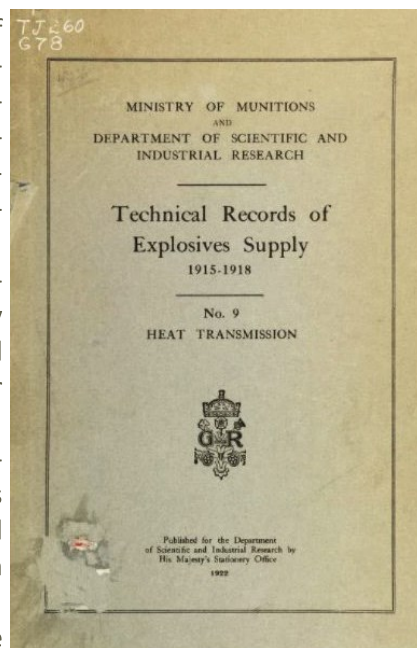
Two important explosives are trinitrotoluene and trinitrophenol, which obviously need toluene and phenol – derived from coal along with coke and gas. An expert in their production, and inventor of the vertical retort for this process, Arthur Duckham joined the war effort, becoming Deputy Director of Munitions Supply. His organisational ability and understanding of engineering practice led to other responsibilities – including Director General for Aircraft Production – and he was knighted for his service. Unlike Quinan, who shunned publicity, Duckham was a great marketer – for himself, his business and the profession. His efforts though, were hindered while the US remained neutral until 1917. During this period Germany

ranged contracts to buy up all surplus US phenol and convert it into aspirin to prevent it being sent to the UK – in what was later known as the Great Phenol Plot.

After the war Duckham's business boomed, expanding beyond the coal products industry, in substantial part due to his ability as a salesman, and his contacts industry and government. He was convinced that chemical engineering deserved own distinct institution, and chaired the committee which finally achieved this in 1922.

This larger-than-life character was its first President. Quinan was the first Vice President, and South Africa was the first place outside the UK to have a branch.

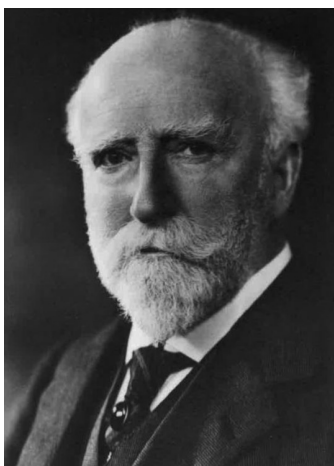
Of the first 300 applications for membership of IChemE, 54 had worked on explosives. Of the first 16 presidents, ten had done work for the ministry of munitions.



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in its

WILLIAM Macnab

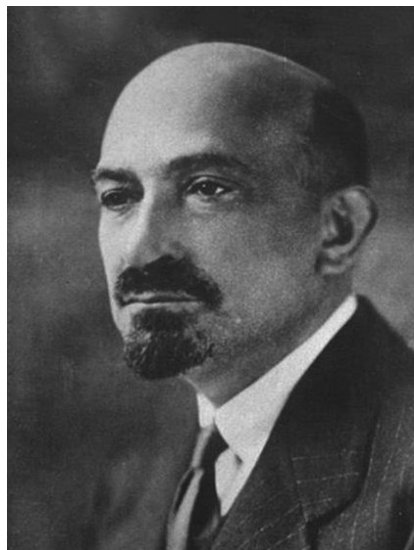


Macnab was already known as an expert on explosives by the start of the war. In 1914 he gave a series of lectures to chemists being recruited for the war effort and in 1918 he summarised what had been learned in the ten-volume *Technical Records of Explosives Supply*. In between, he was one of the original members of a Committee on Explosives, and was involved in the construction of many factories. The introduction to the Technical Records was where he argued that the success of the explosives industry should not be discarded after the war but used as a model for a new chemical industry.

As an original member and Vice President of the Society of Chemical Industry – which Davis had tried to make the Society of Chemical Engineers – he was a key figure in the formation of its Chemical Engineering Group, which in 1918 had 400 members. Macnab was one of the founding members of IChemE, which was formed largely from this group.

When he became IChemE President in 1935 his address at the AGM was “Chemical Engineering in Explosives Manufacture”.

CHAIM WEIZMANN



As well as explosive compounds, there was a shortage of acetone. This was an essential solvent in the manufacture of cordite, the main propellant used by the army and navy as well as in lacquering aircraft wings to waterproof and stiffen them. Since pre-war, this had mainly been imported from Germany and Austria, so its supply ceased. It could be made from wood, but it took 100 t to make 1 t of acetone, increasing the demand for wood as well as needing the factories to make it. The alternative was to make it from ethanol via acetic acid and calcium acetate. This desperate situation caused Winston Churchill to ask: "What proportion of our total explosive or propellant output could be based upon 10 million gallons of whiskey?"

Enter Chaim Weizmann, a Russian-born biochemist, who had studied in Germany and Switzerland, but a British citizen since 1909. Amongst those who know, he is considered the father of industrial fermentation. At the University of Manchester in 1915, he developed a fermentation process to make acetone from carbohydrates such as cereal grains. Using the bacterium *Clostridium acetobutylicum* he produced acetone, butanol and ethanol in what is now known as the ABE reaction. Though not trained as a chemical engineer, he moved to London and scaled up his process to 3,000 t/y. Within a year there were also facilities in Northern Ireland and Canada.

His initial work was with maize, imported from the US, but other sources were used. In particular, children were encouraged to collect acorns and horse chestnuts for the war effort though the purpose and process were secret. The Cooker House and Acetone Fermentation tank – in which he did his early work – are now historic listed buildings.

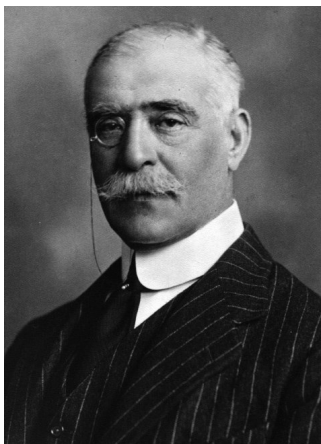
By the 1920s, Weizmann's chemical patents and wise investments were bringing him an income estimated at hundreds of thousands of pounds a year. He dedicated the rest of his life to the creation of a Jewish homeland, becoming the first President of Israel – while not entirely abandoning chemistry, by founding research institutes and helping the UK in the Second World War with improved methods for rubber and high-octane gasoline.

While these activities meant he was not directly involved in the formation of the IChemE his influence on the chemical industry is considerable, and it was because of him that biochemical engineering was a topic for the Institution from its earliest days.

It's interesting to note that after the War he became good friends with Germany's ammonia synthesis pioneer Fritz Haber, who was also a Jew and an enthusiast for a Jewish homeland.



FREDERIC Nathan



Colonel Sir Frederic Nathan was appointed Superintendent of the Royal Gunpowder and Small Arms Factories in 1909. He was also manager of the Nobel Factory in Scotland which produced propellants and cartridges, having patented a process for the nitration of glycerine and producing the first batches of cordite, based on nitroglycerine and guncotton (nitrocellulose). During the war he was appointed Director of Propellant Supplies. New factories were built with greatly-improved processes and much lower costs, as well as healthier conditions. He showed that a 15-minute break in a 4.5 hour shift improved productivity despite lost time.

Nitroglycerine of course needs glycerine, which is also used in soap, so he therefore took control of the whole of the British soap industry. After the war he made sure that modern chemical engineering was used in the peacetime production of soaps, and thus had a major influence on the industry and on recognition of chemical engineering.

He was also in charge of industrial ethanol for munitions and essential trades. After the war he did further research, resulting in a successful petrol-alcohol motor spirit, Discol.

Being well aware of the problem with acetone, it was he who introduced Weizmann to Churchill.

He worked with Macnab in advocating setting up IChemE, and was its second President. Among his many contributions were a focus on educational requirements, and the setting of its own exams.



Cordite manufacture

PEACE TECHNOLOGY, an idea for sustainable World Peace and successful businesses

Presented by

Hans Wallin

What is Peace Technology?

- It is technology for civil action that can help remove obstacles and facilitate the return to or establishment of a normally functioning, peaceful society.
- A contribution to security policy to promote World peace and labour market policies that may create jobs in Swedish and other export industries. Also useful for disaster relief!
- A new and important, innovative niche area that can bring great success to exports of goods and services while also contributing practically to the UN's work on disarmament and peace-promoting work.
- We have seen the terms Military Technology, War Technology and Defence Technology! Today it is all too clear that the most important goal is not to win a war but to conquer a lasting peace and to facilitate the return to normal conditions in troubled, affected countries and areas.

Examples of Peace Technology areas

- Technical systems and equipment for democratic development,
- Communication, reporting, reconnaissance and surveillance, administrative systems,
- Maintenance and repair of critical infrastructure and other buildings,
- Rapidly built housing and other premises,
- Protective equipment for people and buildings,
- Humanitarian clearance (Demining) of land-, sea mines and minefields,
- Detection, collection, safe storage, protection and destruction of weapons, munitions and explosives, UXO (unexploded ordnance), ammunition stores and dumps, including chemical munitions and substances, and their environmentally safe destruction

Why?

- Peace on earth must be our ultimate goal! Today we use far too many resources on military, war and defense technologies and may forget that the main goal is peace!
- Alfred Nobel realised that a Peace Prize was needed! These technologies are needed!

Read more, and contact!

Translation from The Royal Swedish Academy of Military Sciences, Transactions and Journal (KKrVA Handlingar och Tidskrift), 218 (2015)4 pp 82-105, <https://kkrva.se/peace-technology>

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UPCOMING EVENTS

- **ISEE Conference ,San Antonio ,5 to 8 February 2023**
- **CIE-IGUS Meeting , Madrid , 16 to 21 April 2023**
- **SAFEX Congress , Salzburg ,April 24 to April 28 2023**
- **EFEE Conference, Dublin ,10 to 12 September 2023**

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ARTICLES FOR NEWSLETTER

This is a reminder that through the Newsletters we share knowledge in the areas of Safety, Health, Environment and Security pertaining to the Explosives Industry. SAFEX thus call on all members to submit articles on these subjects within their own companies and countries.