*While **SAFEX International** selects the authors of articles in this Newsletter with care, the views expressed are those of the authors and do not neces-sarily represent the official position of **SAFEX International**. Furthermore, the authors and **SAFEX International** cannot accept any liability for conse-quences arising (whether directly or indirectly) from the use of any advice given or opinions expressed in this Newsletter*

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CONGRESS XIX

NEXT CONGRESS
15-20 May 2017 in
Helsinki ,Finland

MESSAGE FROM THE CHAIRMAN

One of the traditions that we have within Austin Powder is to link one of our founder's birthday with safety. Linus Austin, the youngest of the Austin brothers was born on December 15, 1817. We use this day to remind folks that we are approaching the holidays and to take extra care in their daily tasks. This is the time of year filled with holiday stress, con-cerns, travel, in-laws, money, children, etc. It is easier for folks to drift away in their thoughts from their tasks or to cut-corners in an effort to save time. Therefore we ask all of our manag-ers to take extra time before the holidays to reinforce our commitments to safety and to everyone's well-being.

This may be a tradition that can work in other companies as well…an annual event that cre-ates increased awareness and affirmation of the core value of safety. SAFEX can also play a role. Today SAFEX is on course to offer multiple on-line training programs for employees of member companies. Currently we have the first of these that focuses on the Basis of Safety (BOS). I took this recently and found it to be very use-ful as a refresher and a reminder that this is an easy way for SAFEX to become a provider of basic training and information to our industry. If you haven't taken the course yet please do so. It doesn't take that much time and after you've taken it you can pass the word to your colleagues to do the same. The link to the eLearning Portal is found on the SAFEX website.

SAFEX will continue to work with Cranfield University in the UK in helping establish these 'short courses' and are currently in dialogue with AELMS to use some of their base material for more varieties and specific, de-tailed training modules. We are really appreciative for AELMS's support and contributions here!

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One of the greatest roles that SAFEX plays in our industry is the keeper and sharer of knowledge. Specific knowledge that saves lives and minimizes injuries. As many of us know and have seen in our industry, many of our in-house experts are retiring and in today's climate of doing more with less, we run the risk of failing to capture what they know before they depart. "Loss of Corporate Memory" is the sound-bite for this discussion and you can hear it around the globe. However, at SAFEX we see this as one of our fundamental roles and our contribution back to industry – to gather, keep and provide easy access to all members.

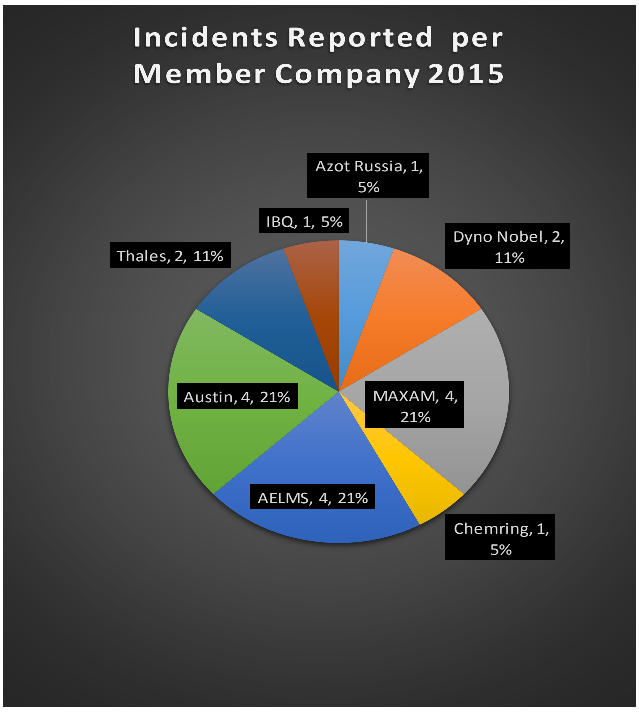
All of us at SAFEX wish you a wonderful holiday season and wish you and your families all the best in 2016!

FROM THE SECRETARY GENERAL'S DESK

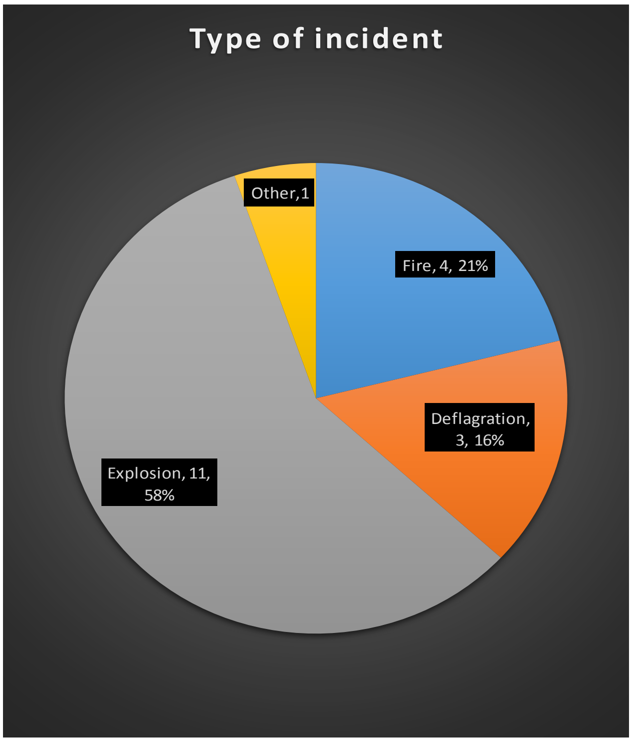
How quickly the year went by! Nearly a year since I moved into this position, but humbly thankful to still to be able to serve the best industry in the world!

It has been a difficult and stressful year for most in the industry, in spite of the important business issues that consumed members' time, the focus on Safety as illustrated by the number of incidents, has not been neglected. Thank you to every member for their efforts in keeping the explosives industry as still one of the best performing on safety, health and environment. During the last period only four additional incidents were reported, three related to pumps and one to delay powders. The pump incidents should serve as a wakeup call for all members, to ensure their safety measures for pumping and pump control are in place and regularly audited. If members require help in this area, please use the relevant expertise offered by the Expert Panel. The details of which are available on the SAFEX website.

SAFEX thanks members for supplying Incident Notifications so that the industry can learn from these and prevent future potentially fatal occurrences. The following graph gives a breakdown of Incidents reported by member companies in 2015:



The following is a breakdown by type of incident:



I again urge members to supply SAFEX with incident notifications as the learning from these assist the industry in becoming more safe and thus prevent potential catastrophic accidents .

In this edition of the Newsletter we commence with our Chairman ,John Rathbun's, traditional annual message to the industry .

Richard Turcotte reports back on the IGUS Meeting hosted very successfully in Canada . Delegates from 50 countries attended this important meeting.

The Safety Snippet in this edition is supplied by Brian Allison ,an Expert Panel Member .He highlights the learning on PETN plant design from old incidents.

News from the Second Meeting of the UN SaferGuard Technical Review Board and the UN SaferGuard Strategic Coordination Group for the development and implementation of the International Ammunition Technical Guidelines (IATG) 18-19 November 2015 is supplied by Hans Wallin. A follow up article on this subject will be published in the next Newsletter.

The series of articles on the educational framework in the European Union was concluded in the last Newsletter. In the current issue an article by Prof Heinz Schenk and Andreas de Beer gives background and describes the explosives training regime in South Africa.

The shipping of explosive samples is always a difficult issue to handle. Jack Shaver submitted an article in an attempt give guidance and clarify potential issues.

Ellina Kharatyan provided an article on the development of an underground pumpable emulsion that exhibits enhanced safety and security properties.

A tailpiece is something that appears at the end of a publication. I guess it is derived from the tail of an animal which is (normally) fixed to "the end" of it. However, we refer to this feature as a "Tale Piece". It is not a spelling mistake but a different tale. This "tale" is about telling stories. While it appears at the end of our Newsletter, it is also meant to tell a story hence the play on words. Tony's Tale Piece this time round gives a bit of history from the early days of capped fuse till the more recent electronic detonators as seen through the eyes of an ex Modderfontein employee in South Africa.

Lastly I want to take this opportunity to thank all the members for their help and inputs into the SAFEX Secretariat over the course of 2015, it was a steep learning curve for me . The coming year will see the preparations for the SAFEX Congress coming to the point of completion and will thus require all your support to be successful.

The SAFEX Board wishes everyone a very safe and happy Festive Season and a 2016 filled with success and safety focus to ensure :

"No harm to anybody ever! ".

CANADA WELCOMES IGUS by RICHARD TURCOTTE

Canada hosted the IGUS Energetic and Oxidizing Substances Working Group meeting in Ottawa in May 2015. IGUS is the International Group of Experts on the Explosion Risks of Unstable Substances. Fifty delegates from ten countries met at Natural Resources Canada's headquarters and toured the Canadian Explosives Research Laboratory (also part of Natural Resources Canada.) The Energetic and Oxidizing Substances Working Group deals with test methods, classification and safety aspects related to organic peroxides, self-reactive substances and other energetic substances, fertilizers, ammonium nitrate and oxidizers. It also concerns itself with process hazards relating to the manufacture, and the reporting and discussion of accidents and incidents involving energetic and oxidizing substances.

Besides having dealt with a full agenda, the meeting provided a forum for discussing safety issues that may lead to proposals being submitted to the United Nations Sub-Committee of Experts on the Transport of Dangerous Goods. The proposals can lead to improvement in the Model Dangerous Goods Regulations and the Manual of Tests and Criteria that are used by countries around the world as a basis of regulating explosives and other dangerous goods. The meeting also provided an ideal opportunity for delegates to meet their international counterparts and discuss problems and issues of mutual interest.

The meeting was a great success and the Explosives Safety and Security Branch of Natural Resources Canada thanks IGUS for allowing us to host the meeting.

The meetings are held annually. The next meeting will be a joint meeting between the Energetic and Oxidizing Substances and Explosives, Propellants and Pyrotechnics Working Groups. It will be held in Switzerland. The website to IGUS is http://www.igus-experts.org/index.html

SAFETY SNIPPET by BRIAN ALLISON

I fully support the initiative to review old incidents in our industry to ensure we do not lose any valuable learning.

One incident that always sticks out for me was many years ago (1979) when I was a young enthusiastic engineer just starting in the business. We were designing a new PETN plant and I had some very good mentors who were very experienced design engineers.

All the vessels on the plant were supported by legs made from pipe. This is a normal method of support but all these pipes had an inspection slot at the base and I could not understand why, until a previous incident was explained.

On a very old PETN plant which had been operating for many years, there was a vessel with mild steel pipe support legs, attached to the stainless steel vessel. The vessel was insulated and so the joint between the legs and the vessel were hidden from view. Over many years, the vessel had overflowed and was regularly washed down.
The seal around the insulation had become damaged and wash material had been trapped under the insulation leading to severe corrosion to the mild steel pipe that was hidden from view.

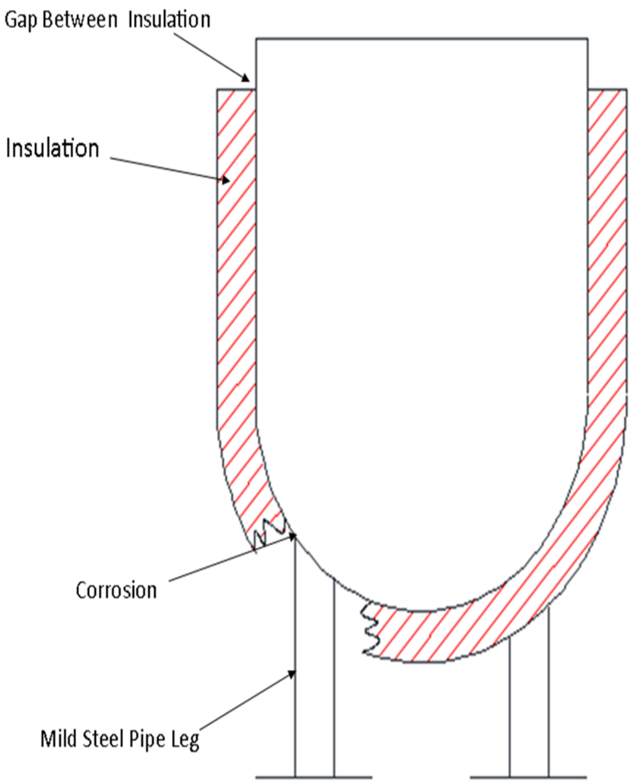
Sometime later, the plant was being modified and some piping was to be installed. To support this new pipe it was decided to weld a bracket to the supporting leg of the vessel. Over the many years of washing down, and corrosion , the pipe leg now contained PETN. Unfortunately as would be expected, this material detonated during welding.

This incident probably occurred in the 1950's or 60's, many years before databases and incident reporting. I believe there was at least one fatality but I can find no record of the actual incident, even the location or the extent of the damage.

This incident has always stuck in my mind and whenever I visit plants I am always on the look- out for enclosed spaces hidden from view and hollow sections. When designing I would always try and use angle iron or I beams which can be easily inspected rather than pipe sections. Even on our new PETN plant design using stainless steel pipe supports welded directly to the vessel, they still had inspection ports.

The use of box section is also very common now as a support structure. Again I have the same concern of confined spaces that need to be inspected.
Where mild steel box section is used, particularly if under insulation or hidden from view, I would be very wary and include some regular inspection or better use alternative materials.

Also with modern materials and welding techniques it is much easier to provide a stainless steel skin around insulation that can be seal welded direct to the vessel. There are various incidents where the seal has failed around the insulation and material has been trapped between the vessel and insulation . Particularly with oxidiser solutions and insulation contamination on emulsion plants.
Even today, I still believe this incident is a good reminder of things we need to consider when designing, operating and maintaining an explosives plant.



UN SAFERGUARD NEWS by HANS WALLIN

News from the Second Meeting of the UN SaferGuard Technical Review Board and the UN SaferGuard Strategic Coordination Group for the development and implementation of the International Ammunition Technical Guidelines (IATG) 18-19 November 2015

In over 60 countries during the last decade, poorly-stored ammunition stockpiles have inadvertently exploded. Thousands of people have died, and the livelihoods of entire communities were disrupted. Unsecured or poorly-monitored national ammunition stockpiles also lead to massive diversion into illicit markets. Diverted conventional ammunition is increasingly used to make improvised explosive devices (IEDs).
The General Assembly has requested the United Nations to develop guidelines for adequate ammunition management. In response, the UN SaferGuard Programme has been established. It oversees the dissemination of International Ammunition Technical Guidelines (IATG): detailed standards for voluntary use by countries that wish to improve the safety and security of their ammunition storage sites.

The International Ammunition Technical Guidelines are being used to support ammunition stockpile management efforts in **86 countries** world-wide:
Sweden is represented as member of EU
IATG version 2 has been launched with new modules available! Access them here http://www.un.org/disarmament/un-saferguard/guide-lines/

IATG version 2 offers more than 1800 pages of best practice for ammunition stockpile and is fundamental knowledge for all working with ammunition and explosives.
For more info contact Hans Wallin hans.wallin@cesium.se +46 725863884
Hans Wallin Member of the UN SaferGuard Strategic Coordination Group

Explosives Competence in the Southern African Context: Exploring the Training & Development Map By Heinz Schenk and Andreas de Beer

Heinz is a registered industrial psychologist and associate professor in Human Resource Management at the University of South Africa (Unisa). He is also the manager of the Centre for Blended-Learning Studies (CBS) of Unisa. The CBS is responsible for the offering of the Unisa Short Learning Programmes in Explosives Management that constitute the accredited statutory minimum competency requirements for Explosive Manager certification by the Department of Labour.

Andreas is a Senior Lecturer in the Department of Business Management at the University of South Africa. He is the Programme Leader in the Centre for Blended-Learning Studies where he has been instrumental in the re-curriculation and alignment of Unisa's Explosives Management qualifications.

Introduction

Commencing with Safex Newsletter 44 in 2013 Denise Clarke contributed a series of 10 articles addressing explosives competence in the European context. The focus fell on the UK's National Occupational Standards (NOS) in Explosive Substances and Articles (ESA), explaining its genesis, basis for developing vocational qualification, linkage to the EUExcert project and aspects of the application and use of the standards towards improving competence and career mobility in the subsectors of the explosives industry.

This article firstly aims to present a snapshot of the South African explosives industry from an education and training perspective.

Secondly, following the central theme of Denise Clarke's articles explaining how the NOS ESA standards can be used for a range of purposes, this article is providing an overview of the use of the ESA standards as a benchmarking tool in the formal and non-formal education and training of explosives management qualifications in the Southern African context.

Background to the South African explosives industry and its competence base.

In an overview of the history of the South African explosives industry, Verster[1] traces the origins of the explosives manufacturing industry back to the establishment of the "Zuid Afrikaansche Fabrieken voor Ontplofbare Stoffen Beperk" at Modderfontein, Johannesburg, through the initiation by the then President Paul Kruger and the establishment of the Cape Explosives Company in Somerset West by Cecil John Rhodes on behalf of the De Beers Company. These two manufacturers were established to serve the explosives needs of the gold mining industry in the Witwatersrand and the diamond mining industry in Kimberley respectively. From these humble foundations the commercial explosives industry in South Africa grew to its current status of being one of the largest producers of explosives in the world, comprising four major bulk explosives manufacturers and various small scale explosives manufacturers. Two of these companies domiciled in SA are listed among the "top 8 players" in the global explosives industry, i.e. AECI Group and Sasol Limited.

AEL (linked to AECI) is the third largest explosives company in the world, with a 5% global market share, and an estimated market share of 50% in Africa[ii].

A 2015 research report by Global Industry Analysts Inc. suggests that consumption of prepared explosives will reach a volume of 21.8 metric tons by 2020 with the mining industry accounting for more than 75% of the use of explosives[iii]. The report cites the following 2013 data for market share of global exports.

Table 1. Global exports of prepared explosives in 2013

Country	% share of exports
US	34.6
South Africa	7.8
Germany	7.7
Philippines	6.5
Russia	5.9
Mexico	4.8
Other	32.7

In a similar vein van Wyngaardt (2015) reports on findings by research firm Frost & Sullivan, suggesting that almost 65% of mining companies operating in the Sub-Saharan Africa region were forecasting an increase in their expenditure on explosives and chemicals in the year ahead. The research analysis indicates that the current $1.11-billion mining explosives market was expected to reach $1.67-billion by the year 2020. A growth in the volumes of mining specialty chemicals from 127 650 t in 2014 to 203 480 t in 2020 was anticipated[iv].

Explosives are used primarily in the mining industry, the civil engineering and construction industry and military industry. Whilst the use of explosives in the latter industry is quite limited (and confidentiality concerns preclude availability of statistics in the public domain regarding export volumes of military explosives), the strategic role that explosives play in the productivity of the South African and global mining sector as well as infrastructural development through the civil engineering and construction industries, demands a closer look at the human capital that drives the growth and sustainability of the commercial explosives industry.

Competence profile of the South African explosives sector

Although the commercial explosives industry in South Africa is relatively old and well-established, it constitutes a small component (5287 employees) of the entire chemical industry, contributing only 3.4% towards the total employment numbers in this sector (157 992 employees in 2014)[v].

Vocational training in SA is guided by the Skills Development Act (Act 97 of 1998) which defines the Sector Training and Education Authority (SETA) system. The Explosives industry constitutes a subsector in the Explosives and Fertiliser Chamber of the Chemical Industries Training and Education Authority (CHIETA). The CHIETA developed subsector skills plans for the first time in 2013/2014 for consultation on areas of skills development and planning, considering aspects of skills needs and skills supply.

The data provided in Table 2 provides an insight in the educational qualification competence of the human capital of employers in the explosives sub-sector and is based on the submissions of work skills plans (WSP) by skills-levy paying employers. (Reference qualifications on the National Qualifications framework NQF have been added to contextualise the 10 level framework)

Table 3 reflects a breakdown of occupational category of the 2861 employees where WSP submissions did not define their qualifications.

The data indicates the concentration of the staff complements at the operator level and the bulk of formal qualifications not reaching post-school levels. This may be indicative of the circumstance that competence in the explosives industry has a legacy of mostly in-house training practices.

Table 2: Highest qualifications of employees in the Explosives Subsector

NQF level	Number of employees	%	Qualification types in SAs NQF
10	9	0.4	Doctoral degree
9	23	0.9	Master's degree
8	82	3.4	Bachelors Honours degree Post-graduate diploma
7	25	1	Bachelor's degree Advanced diploma
6	208	8.6	Diploma Advanced certificate
5	70	2.9	Higher certificate
4	1434	59.1	National certificate
3	138	5.7	Intermediate certificate
2	166	6.8	Elementary certificate
1 and below	271	11.1	General certificate (NQF level 1)
Total	**2426**	**100**	
Undefined qualifications	**2861**		
Total employment for explosives subsector	**5287**		

Table 3: Occupational category of workers with undefined qualifications in the Explosives Subsector

Occupational category	**N**	**%**
Managers	219	7.7
Professionals	220	7.7
Technicians and associate professionals	312	10.9
Clerical support workers	150	5.3
Service and sales workers	150	5.3
Skilled craft and related trades workers	110	3.8
Plant and machine operators and assemblers	1 399	48.9
Elementary occupations	198	6.9
Learners	103	3.6
Total	**2 861**	**100**

(source: Chieta report 2014 p10)

Regulatory framework for explosives competence

In the South African context competence in the explosives field is addressed by three pieces of legislation

1. **The Explosives Act** (No. 15 of 2003) and its regulations. Draft regulations were published in 2007 for comments. The regulatory enforcing body is the office of the Chief Inspector of Explosives (CIE) of the SA Police Service.

   Competence defined: Draft regulations are largely silent on the nature of explosives competence and training requirements apart from references in Annexure "O", "T" and "W" regarding requirements for appointment as a magazine master, blaster, pyrotechnician

   "blasting adviser" *means a person, who through* ***extended study, training and experience is specialised*** *in one or more fields of blasting techniques*[vi].

2. **The Occupational Health and Safety Act** (No. 85 of 1993). The office of the Chief Inspector of Occupational Health and Safety in the Department of Labour (DOL) oversees compliance to explosives regulations in every workplace where explosives are being used, tested, manufactured or stored through the issuing of an explosives manager certificate to competent and certificated persons appointed by the employer in terms of regulation 12.1.

   Competence defined: "competent person" *means a person with sufficient training and experience in, and knowledge of, the health and safety aspects of explosives deemed appropriate by the National Explosive Council or any other organization approved by the Chief Inspector of Occupational Health and Safety*

   "Explosives manager" *means a person appointed in terms of regulation 12(1) (by the CEO of a company with the competency to manage the safety and technical aspects of explosives in the danger area)*

   Standards of training *Any accredited or approved training shall be in accordance with the South African Qualifications Authority standards*[vii].

3. The **Mining Act** and the mining safety regulations contained in the **Mine Health and Safety Act** (No. 29 of 1996). The Department of Mineral Resources (DMR) is the custodian of this legislation and the regulations govern the storage, handling, use and destruction of explosives in the mines. New Explosives Regulations came into effect in October 2015[viii]

   Competence defined: *For purposes of: 1. Regulation 4.4(1) ""competent person"" means a person who is in charge of workmen in a working place at the mine and who is the* ***holder of a certificate or qualification recognised by the Department for this purpose,*** *valid for the class of mine to which the mine belongs.*

   2. Regulation 4.4(3) ""competent person"" means a person who: (a) has been assessed and found ***competent against a skills programme recognised by the MQA*** *for this purpose; or*

   (b) (i) is ***qualified by virtue of his/her knowledge, training, skills and experience to perform the activities contemplated in regulation 4.4(3);*** *(ii) is familiar with the provisions of regulation 4 which apply to the work to be performed by the person; and (iii) has been trained to recognise any potential or actual danger to health or safety that may arise from the work to be performed by the person"*

Little is written into the regulations regarding standards of training and education and the minimum educational knowledge requirements are defined by the DOL as the set of 4 short learning programmes containing 28 modules that are linked to the curriculum content of the Explosives Management modules of the formal Explosives Management qualifications (Diploma & Bachelors of Technology) accredited by the Council for Higher Education (CHE) for this purpose.

Addressing the education and training challenges for explosives competence

In a recent presentation on training and education in explosives Prof Jackie Akhavan of Cranfield University highlighted the following challenges as a global problem to the international explosives industry[ix]:

Loss of expertise
Absence of common standards of explosives competence
Barriers to mobility
Patchy training provision
Few recognised qualifications

The South African explosives industry is not exempted from these problems and the need for coherent and integrated learning provision in the explosives area as expressed already in 2006 by inter alia Nilsson, Akhavan, Randle & Wallin[x] and which has prompted initiatives such as the EUExcert project. This discourse resonated with the University of South Africa (Unisa) and the National Institute for Explosives technology (NIXT) to find ways to counteract such negative effects and implications for explosives safety and industry competitiveness.

A draft position paper was presented to the NIXT Advisory Forum in October 2009 to solicit support and invite stakeholder participation in the proposal from Unisa to engage UK providers of explosives education and training in

- exploring synergies and collaborative learning opportunities for expanding learning/career paths for explosives practitioners/managers to enhance mobility and articulation opportunities, and
- benchmarking and aligning existing formal SA Higher Education explosives qualifications structures to UK and international standards for meeting curriculum relevance requirements in terms of the new SA Higher Education Qualifications Framework (HEQF) promulgated in 2007

It was from this broad brief that comprehensive stakeholder engagement was facilitated through focus groups to identify themes and 'burning issues' for the various explosives stakeholder groupings that were condensed and categorised into themes to be addressed for short term objectives for the joint Unisa/NIXT working group (so-called A-Agenda) and the longer term objectives that would necessitate comprehensive and industry-wide stakeholder engagement and collaboration (B-Agenda items). Details of this project and the progress to date is beyond the scope of this article and only the benchmarking initiative related to the EUExcert process and the UK National Occupational Standards (NOS) for Explosives Substances and Articles (ESA) will be covered.

Genesis of the benchmarking project

The promulgation of the new Higher Education Qualification Framework (HEQF) in 2007 necessitated the reconfiguration of the existing formal National Diploma (N Dip) and Bachelor's degree (B Tech) qualifications in explosives management. As the only university accredited by the Council for Higher Education (CHE) and SAQA to provide these formal qualifications, it was imperative to ensure continued relevance to industry education and training needs. Furthermore, with the exclusion of the B Tech qualification streams in the new HEQF and given the lack of post-graduate options in the explosives management (EM) field the need arose to explore innovative articulation avenues towards supporting and harmonising national and international life-long learning opportunities for SA explosives sector students. The 3-year National Diploma in EM and the B Tech degree in EM (fourth year) were designed and developed in close collaboration with the explosives industry stakeholders by the former Technikon SA. Technical explosives curriculum content was designed to cover all requirements for successful candidates to meet the full requirements for statutory certification as Explosives Manager in terms of national regulatory requirements. Such benchmarked curriculum content is offered as short learning programmes (SLPs) in semesterised modular form (total of 28 modules) to industry and students not intending to complete the formal 3-year N Dip curriculum, but being obliged to meet DoL certification requirements for appointment as Explosives Manager at employers in the explosives industry.

It is the content and scope of these credit-bearing SLPs that have been subjected to the benchmarking of the NOS ESA knowledge requirements related to the units and sub-units of the 13 Key Roles of the standards. A Generic benchmarking process in terms of Camp's typology[xi] i.e. *comparison of work processes to others who have innovative, exemplar work processes,* was followed for the internal Unisa curriculum analysis, considering scope and depth of learning content. For this purpose the knowledge requirements for all units were disaggregated per role and duplicate requirements common to more than one unit excluded to reduce the number of knowledge requirements for benchmarking purposes to 1051.

The SA Explosives education and training map:

Beyond the formal EM qualifications offered by Unisa in the Higher Education band, explosives related training and education in South Africa is also provided at vocational and post-graduate research levels and the following summary provides a succinct overview of the various categories of explosives training

Type of qualification or training	Credit bearing in formal explosives qualifications	NQF sub-framework *	Providers
SAQA / CHE accredited undergraduate qualifica-tions	Yes N Dip & B Tech EM** Dip. EM & Advanced Dip. EM (HEQSF aligned)	HEQSF	University of South Africa (Unisa) Unisa (from 2016)
Explosives modules in SAQA/CHE accredited un-der graduate qualifications	Yes Explosives modules in cur-riculum of B.Eng Mining Engineering	HEQSF	University of Johannesburg UJ Univ of Witwatersrand (Wits) Univ of Pretoria (UP) Unisa
SAQA / CHE accredited post -graduate qualifications	Yes MEng / MSc Explosives Science and Engineering (proposed) PG Dip ES&E(proposed)	HEQSF	North-West University (NWU) Under development[xii]
SLPs in Explosives Manage-ment credit-bearing in accredited national explo-sives qualifications	Yes 4 EM SLPs comprising 28 modules	HEQSF	Unisa Centre for Blended-Learning Studies
SLPs in Explosives field non -credit-bearing in explo-sives qualifications	No 3 EM SLPs comprising 9 modules 25 SLPs in ESE (Exp Science & Engineering)	HEQSF	Unisa Centre for Blended-Learning Studies NWU/Rheinmetall Denel Munitions
SETA provided vocational training and in-house train-ing programmes International online & be-spoke training programmes	No	OQSF N/A	SASSETA /SAPS MQA CHIETA Numerous Seta accredited providers e.g. Safex, ISEE, Cranfield, HSQ, Orica

* The HEQSF is one of three sub-frameworks in the NQF. The other two are the General and Further Education and Training Sub-Framework (GFETSF) and the Occupational Qualifications Sub-Framework (OQSF) managed by the Quality Council for Trades and Occupations (QCTO).

** phasing out in 2019

Conclusion

In Safex Newsletter 51 Denise Clarke wrote: *"When the ESA NOS were developed, great care was taken to ensure that they were constructed in such a way that they could be used outside the UK and this was validated by an earlier EUExcert project. ….., then, in the future, might we see the global recognition of explosives workers' skills and knowledge? This in turn would contribute to the certainty that everyone involved in this business worldwide is working competently and safely to the same standards."*(p.20).

With the increasing globalisation trends, mergers and collaboration of stakeholders in the explosives manufacturing, defence and mining industries, the human capital in these industries remains key for future growth and sustainability. Hence, talent management strategies focussing on imperatives such as skills development and retention, career mobility, regular deploy-ment of talent across international borders and employee safety and well-being, increasingly demand that competence levels in the industry should transcend narrowly-defined or non-relevant quality standards in expressing commonly understood explosives competence levels. Benchmarking of qualifications and skills development to some commonly recognised minimum standard such as the ESA NOS should thus make eminent sense to any providers of training and skills development in the various sub-sectors of the international explosives industry. In the South African context we foresee that the NOS will remain a relevant frame of reference for a competency framework in explosives occupations for referencing functional knowledge requirements for training explosives managers and responsible persons in the explosives sector.

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SHIPPING EXPLOSIVES SAMPLES by DR JACKSON SHAVER

Introduction:

Explosive manufacturers and researchers have viable options for the shipment of new explosives when transportation to a government ministry, customer or laboratory is required for evaluation. The general rule is that explosive samples shall be packaged and shipped in accordance with dangerous goods regulations and in a manner that will ensure the sample integrity is protected in transit. Placing a potentially reactive material, new explosive or waste energetic material in transit can present a much different challenge.

The shipper will need to consider the amount of material, physical state of the material and other factors that may not be known before the energetic material is shipped to a laboratory for analysis. It is not uncommon for laboratories and manufacturers to encounter entities that make curious decisions when packaging and shipping reactive, explosive and waste energetic material samples. This article briefly examines two strategies to manage the analysis of new explosive samples and field samples that contain reactive, explosive or waste energetic materials. Each strategy has merit and based on circumstances may present the most viable option for managing the analysis of sample energetic materials.

The Strategy of Shipment:

After conducting an occupational hygiene assessment in a remote work area, my supervisor instructed me to decontaminate the sampling equipment and then package the sample collection media for shipment to the laboratory. It was obvious to me that the sample media contained at least a residual quantity of energetic material, but why the samples were not sent to the laboratory as usual and all the extra packaging bewildered me. The response was that transport off-site on a public highway would be necessary to reach the company laboratory from that building. The energetic samples could not be transported legally on a public highway without special training and the use of a special shipping container, both of which I lacked.

This situation involved only the use of anti-static bags and cellulose packaging material to secure the sample media in the center of the shipping container for transit. Examples of packaging material that may be applied to the transit of solid energetic materials are presented below:







The dangerous goods regulations provide some options for the transportation of reactive and energetic material samples. Some examples in the US regulations follow:

1) A small-quantity exemption is provided for non-air shipment of 30 milliliters or 30 grams or less per package is available for many hazard categories including Class 4 (see 49 CFR 173.4 – Small quantities for highway and rail). *Note: This exemption does not apply to explosives but may apply to energetic materials that can be characterized as a flammable solid.*

2) Special exemptions are available when shipping methods involve alternative technologies and robust containers designed to safely and legally ship limited quantities of liquid or solid explosive material without prior examination or testing. The USDOT Special Permit 8451 authorizes transport of not more than 25 grams of solid explosive or pyrotechnic material, including waste containing explosives (with an energy density not significantly greater than pentaerythritol tetranitrate [PETN]) when packaged in a special shipping container. USDOT Special Permit 13481 authorizes the transport of not more than 25 grams of liquid explosive substances (with an energy density not greater than pure nitroglycerin [NG]) pack-

aged in a special shipping container. Both special permits require the following hazardous material description for transit:

Hazardous Material Description			
Proper Shipping Name	Hazard Class / Division	Identification Number	Packing Group
Articles, explosive, n.o.s. *	1.4E	UN0471	II

**Technical name of the material being shipped*

Photo - Special Permit 8451 Shipping Pipe

Institute of Makers of Explosives

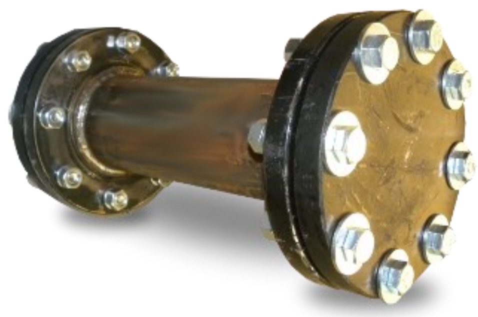

Photo – Special Permit 13481 Shipping Pipe

SMS Energetics

There are limitations for the authorized modes of transport provided by these special permits and the special permit must be renewed every three years. However, the special permits allow the sample energetic material to be offered for transportation without being examination and testing. ThE USDOT shipping containers and packaging for solid and liquid explosive materials are only two of the variety of options available.

Laboratories are generally aware of the potential issues that may accompany the shipment of energetic material samples and develop criteria for acceptance and rejection of energetic material samples. Criteria for acceptance by a laboratory may include cautions to the shipper, such as:

- Explosive samples must shipped in compliance with dangerous goods regulations or exemptions based on the quantity and type of material shipped
- Explosive sample packaging must not show signs of abuse or compromise from transit
- Explosive samples must be totally consumed or returned to the institution with prior concurrence of the laboratory manager or laboratory safety officer to arrange repackaging for transport

Laboratory Technicians have also expressed concerns about the receipt of packaging and the securing of energetic material samples, such as:

- metal and conductive containers mask the material condition
- overzealous packaging or securing of the samples requiring lengthy disassembly or removal
- twist or screw cap lids

Development of a sound strategy for the packaging and shipment of energetic material samples should not be overlooked as part of the operational best practices.

<u>The Strategy of Avoidance:</u>

Occupational hygienists examining energetic processing hazards and environmental engineers addressing remediation of explosive contaminated sites can provide a model for avoiding transportation of energetic material samples. When there are viable options available for laboratory analysis without shipping the energetic material, it is prudent to avoid transportation altogether. It is often best to conduct the analysis and consume the energetic material sample on-site. Transportation of the energetic material samples to a laboratory may present the following adverse conditions:

- Sample compromised by shipment (temperature, vibration, shock)
- Additional waste (cost) generated by transit packaging
- Unauthorized persons may contact or gain access

to sensitive material or information

- Accumulation of energetic material in the laboratory
- Increased risk to public from transit of hazardous materials

Many professionals have access to qualified laboratories on-site, so transit from the field to the laboratory does not take place on public roadways and controls for transit can be determined by qualified professionals. Others bring laboratory equipment to the field with the capability to analyze energetic materials in the field which eliminates the need for transit.

Field analysis can provide advantages:

- Identification of samples for treatment studies
- Real-time data for risk assessments
- Real-time assessment of the potential reactive or explosive hazards
- Assessment of potential employee exposure
- Analysis to assess soil contamination and guide excavation (vertical/horizontal)
- Assess the effectiveness of treatment or remediation activity

Field analysis may present potential disadvantages:

- On-site laboratories may increase the potential risk to personnel
- On-site laboratories may compromise quality assurance objectives
- On-site laboratory equipment costs may be prohibitive
- On-site laboratories may require a more advanced technical skill level
- Legal guidelines may require use of rigid methods impractical for field analysis

Summary:

It is unlikely that an occupational or environmental field sample will contain a sufficient quantity of energetic material to present a serious threat when packaged properly for transit. The sample material may be correctly characterized as a flammable solid and be appropriately packaged and shipped as a flammable solid. However, the dangerous goods regulations do not provide quantity exemptions for suspect or known Class 1 materials. The same rules apply to the transit of new explosive samples for analysis. Dangerous goods professional and many laboratories offer a variety of services and options that provide safe, legal means to place reactive, explosive or waste energetic materials in transit when on-site analysis does not provide a viable option.

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Mechanical Sensitization with the Safety and Security of Chemical Sensitization

Ellina Kharatyan

Abstract

Conventionally, base emulsion explosives must be sensitized in order to become detonable. These emulsions can be sensitized either chemically or mechanically. Mechanical sensitization involves the addition of microballoons (plastic or glass) to the base emulsion, in order to create hot spots. This is usually done at manufacturing sites and poses a safety risk in terms of the storage, transportation and handling of 1.1 type explosives (detonable products). Chemical sensitization is a method whereby a small amount of a chemical compound solution is added to the base emulsion. The chemical component generates a chemical reaction with oxidizer phase of the emulsion and results in the formation of gas bubbles. The main disadvantage of this method is that the base emulsion is often over-gassed or the blast hole is charged with too little gassing agent. This scenario results in poor blast performance. A mini-bulk, non-detonable, mechanically pumpable sensitizer was researched and developed to eliminate the disadvantages of the aforementioned conventional methods of sensitizing emulsion explosives. The new mechanical sensitizer (non-detonable), when mixed with base emulsion (non-detonable), is applicable for small diameter long holes, due to improved sensitivity of the emulsion explosive. A Unique cost-effective pumping system was developed to pump and mix base emulsion explosives with the new mechanical sensitizer at a 50/50 volume ratio. The emulsion is mixed with this sensitizer by means of a static mixer just before it is charged in the blast holes. No waiting period is required for the emulsion explosives to reach a certain density before initiation. The described method also improves density control in the blast hole in terms of the uniformity of the density along a blast hole, drastically reducing the human factor, especially when working in the harsh environment of deep level underground stoping applications.

Introduction

Emulsion explosives (EEs) were developed decades ago and still remain the most used mining explosives [1-3] today. Base EE is a water-in-oil type of emulsion. The water phase of the base EE consists of a water solution of an oxidizer or a mixture of oxidizers and therefore is often referred to as the oxidizer phase. The oil phase is comprised of fuel(s), surfactant(s), emulsifier(s), stabilizer(s), etc. and usually is referred to as fuel phase of the EE. Base emulsion (matrix) is not sensitive to initiating systems before it is sensitized. The sensitizer role is to introduce gas into the EE. The presence of "hot spots" (compressed by shock wave gas bubbles) accelerates the reaction of the deflagration-to-detonation. The sensitization can be performed by a mechanical or chemical method. There are advantages and disadvantages for both methods of base emulsion sensitization. Mechanical sensitization involves the addition of micro-spheres (plastic or glass) to the EE. This type of sensitization conventionally takes place at manufacturing site where product (base EE) then becomes detonable (1.1 type explosive) before it is transported to the mines. As such, as a result of mechanical sensitization, the end user receives better emulsion density control in terms of uniform density distribution along a blast hole, resulting in better performance of the EE. On the other hand, during chemical sensitization of the EE bubbles are created as a result of a chemical reaction between the sensitizer and the oxidizer phase of the EE. Chemical sensitization happens just before the loading of the emulsion into a blast hole. The method enables safe transportation, handling and storage. Nevertheless, the method has a lack of accurate density control due to various factors.

The research presented in this paper intends to introduce benefits of mechanical sensitization with the safety and security of chemical sensitization. It includes a novel sensitizer and a simple dual pumping system. The main area of application is small diameter long holes. Secondary blasting, on-site packaging of cartridged explosives can be also added to the areas of application.

Material and Methods

A pumpable sensitizer was the main objective of the investigation. It consists of a base EE with the added Expancel® plastic microspheres [4]. The formulation must remain "non-detonable" as per UN test series (8 a-c) [5]. The water-in-oil highly concentrated emulsion was used as the base emulsion. Such emulsions have been described in detail elsewhere [6-9]. The dispersed phase droplets consist of an ammonium and/or metal nitrate solution. The continuous phase contains standard industrial fuels with dissolved surfactants.

The base EE sample used for this investigation was manufactured by AEL Mining Services and classified as part of the underground bulk emulsion.

Microscopy was performed using the OLYMPUS BX41 polarized microscope at 100x magnification (lens + camera).

Sensitivity testing of final product was performed using 25 mm inside diameter plastic pipes of 1 m length. The emulsion matrix sensitized with the pumpable sensitizer was transferred into the pipes. All pipes were transported to a testing range and detonated using a Uni-Delay LP shock tube (base charge – PETN 700 to 860mg). Two methods of measuring velocity of detonation (VoD) were used: point-to point and continuous system. The point-to point technique determines the time taken for the shockwave to travel a distance of 15cm using an AECE VOD Timer (model VOD-3). The VoD was calculated based on the results of these measurements. The continuous MREL MicroTrap method is done by measuring a probe cable resistance along a pipe. Since the resistance of the probe/cable is known, MicroTrap can convert the data into distance against time and the slope of the dependence is a VoD.

UN Test Series 8 testing was done based on "Recommendations on the Transport of Dangerous Goods Manual of Tests and Criteria" [5].

Minimum Burning Pressure was determined based on the following procedure: nitrogen gas was used to purge the system and to operate the pressure relief valve which was set to open at 85 bar. The vessel contained a bursting disc which was set at 142 bar. The sample is heated by a Ni/Cr wire placed in the sample and a 10A current is passed through the wire. All tests were performed at ambient temperature and at the maximum testing lim-

Results and Discussion

In order to understand the advantages and disadvantages of chemical and mechanical methods of EE sensitization the following question must be answered: "What happens in a bore hole during chemical and mechanical sensitization?"

With chemical sensitization, the final density of the EE (amount of bubbles generated) is controlled by the amount of sensitizer added. This involves a human factor because an addition of a small amount of chemical sensitizer is required compared to the base EE portion (Figure 1). Chemical sensitizer must be mixed with the base EE at, for example, a 3:97 mass ratio. So, the final density control is important, as well as operation and maintenance of an expensive pump. The chemical reaction happens after the hole is charged with a mixture of the chemical sensitizer and the base EE (Figure 2). The following is seen as a result of the chemical reaction:

- The volume of EE in bore hole increase (Figure 3),
- Pressure gradient generates along the bore hole length (lower pressure at the face and higher pressure at the back of blast hole) and
- Gas bubbles start to travel to the face (bigger bubbles travel faster than smaller; bubbles travel faster than emulsion).

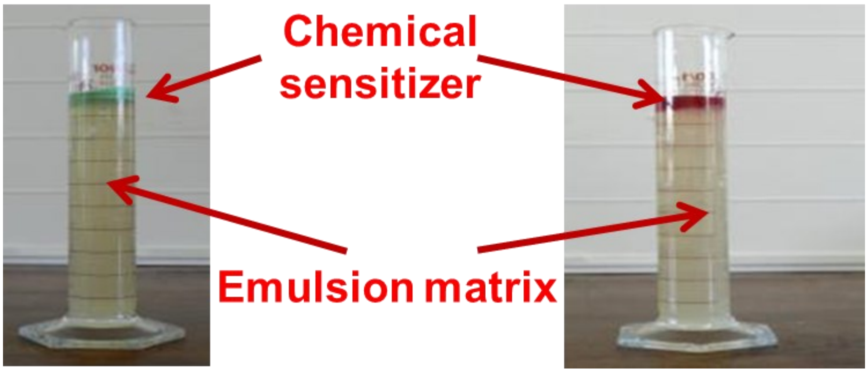


Figure 1. Example of chemical gasser amount added to base EE.

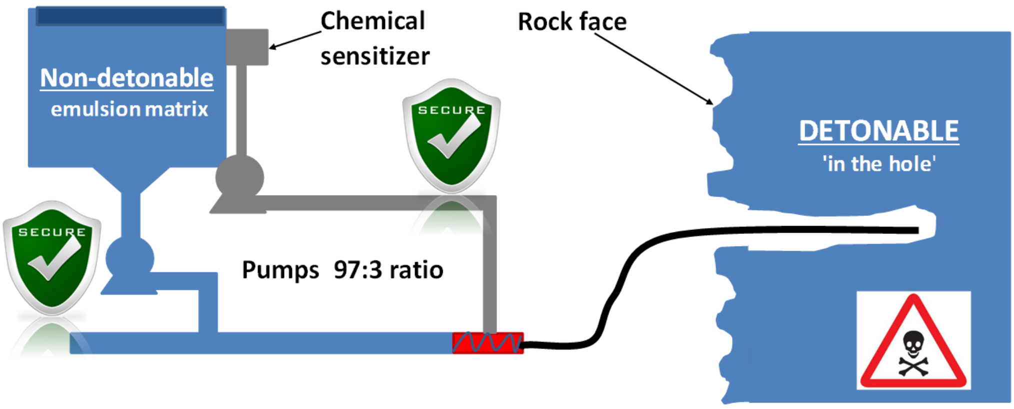


Figure 2. Schematic representation of chemical sensitization on the mining site.

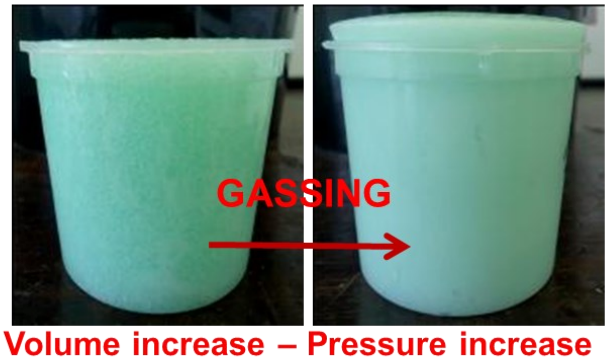
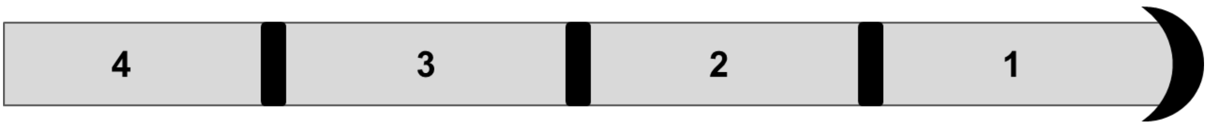
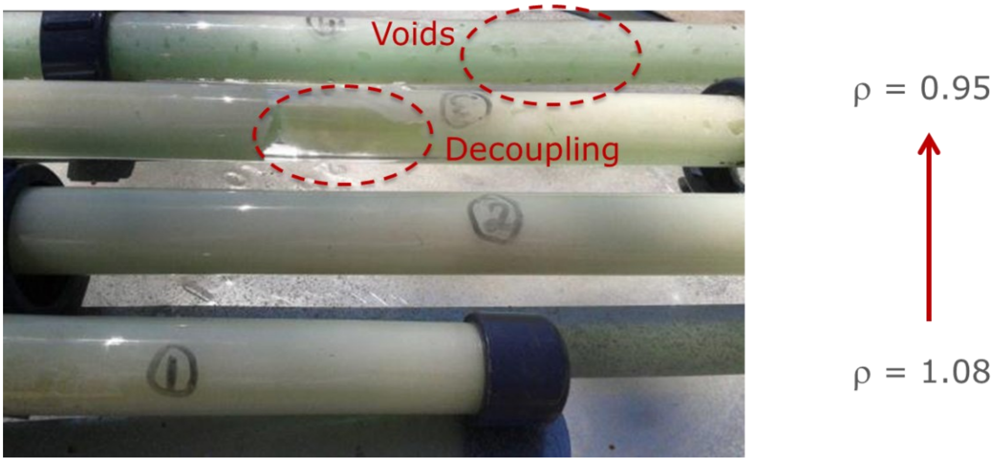


Figure 3. Increase of EE volume as a function of density drop during chemical sensitization.

In order to understand the results of the above mentioned processes, the following experiment was performed. A 2 meter 34mm inside diameter transparent plastic pipe was charged with an EE mixed with chemical gasser. To simulate borehole conditions, the pipe was divided into four parts. One end of the pipe was blocked and another was open. Four parts of the pipe were connected by seals (Figure 4a). In 30 minutes the emulsion had fully reacted with chemical gasser. Due to the pressure gradient or pressure difference created between closed and open ends of the pipe, (borehole) the bubbles were distributed non-uniformly along the pipe (borehole) resulting in a difference in density along the pipe (borehole) and even the formation of voids (Figure 4b). The same effect is apparent in the boreholes on the underground mines.



(a)



(b)

Figure 4. Live experiment of the results of chemical gassing inside of the pipe (blast hole): (a) schematic representation of the experiment; (b) results of experiment.

In addition the above mentioned chemical reaction between the base EE and chemical gasser is temperature dependent. The EE might be under-gassed or over-gassed due to the temperature effect on the sensitization rate (Figure 5). All of these factors can affect the blast performance.

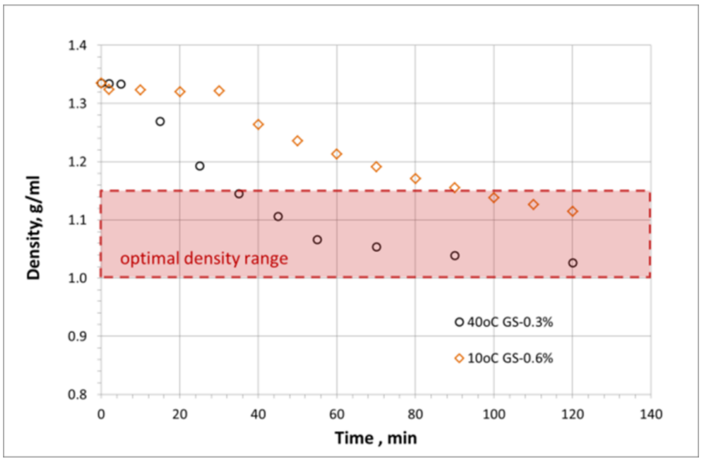


Figure 5. Effect of temperature on EE sensitization rate.

In the case of mechanical sensitization no chemical reaction takes place during sensitization. As a result, there is no pressure generated inside of the borehole, no gas balloons travel along the borehole and there is no temperature dependence of the final gassed emulsion explosives density. Also, the sensitivity of emulsion explosives sensitized by means of mechanical gasser is expected to be higher, due to the very small balloon size of mechanically sensitized emulsion in comparison to chemical gassing (Figure 6). However, sensitized emulsion/detonable product is transported to the mine, stored and pumped into a blast hole (Figure 7).

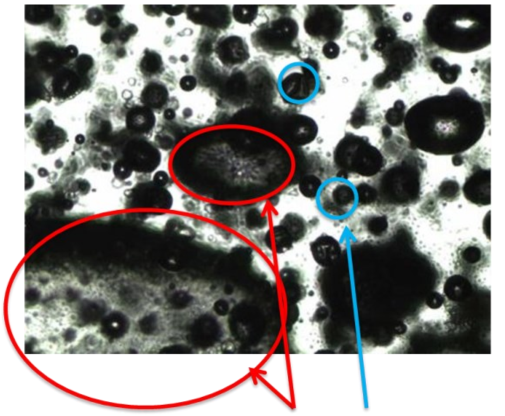


Figure 6. Comparison of mechanical and chemical bubbles/balloons

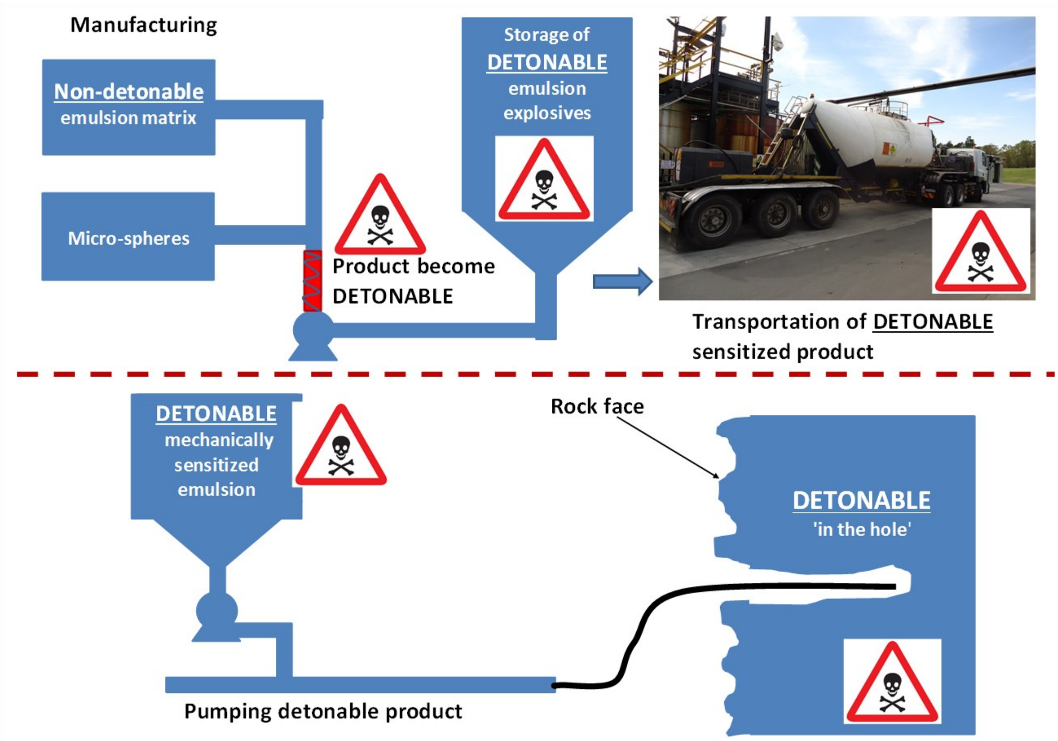


Figure 7. Schematic representation of mechanically sensitized emulsion being delivered to the blast hole.

As such, it was required to combine the benefits of both methods of sensitization in order to perform sensitization just before loading the blast hole while transporting, handling, storing safe material (5.1 oxidizer) and reducing the human factor associated with the sensitization of emulsion explosives or the control of the density. Emulsion explosives sensitized with the novel mechanical sensitizer need to be transferred into a blast hole (surface or underground) and perform acceptably in terms of blast results. Such a solution was developed by AEL Mining Services research team and consists of a novel pumpable non-detonable sensitizer, where micro-spheres are encapsulated into a non-detonable liquid (Figure 8).

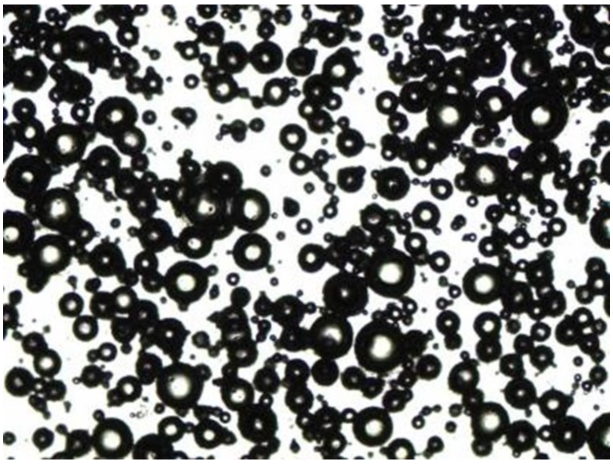


Figure 8. Microscopic image of novel non-detonable sensitizer.

The proposed method of mechanical sensitization (with safety and security of chemical sensitization)involves the addition of a non-detonable sensitizer to base emulsion at a 50:50 volume ratio just before charging a bore hole (Figure 9 a-b).

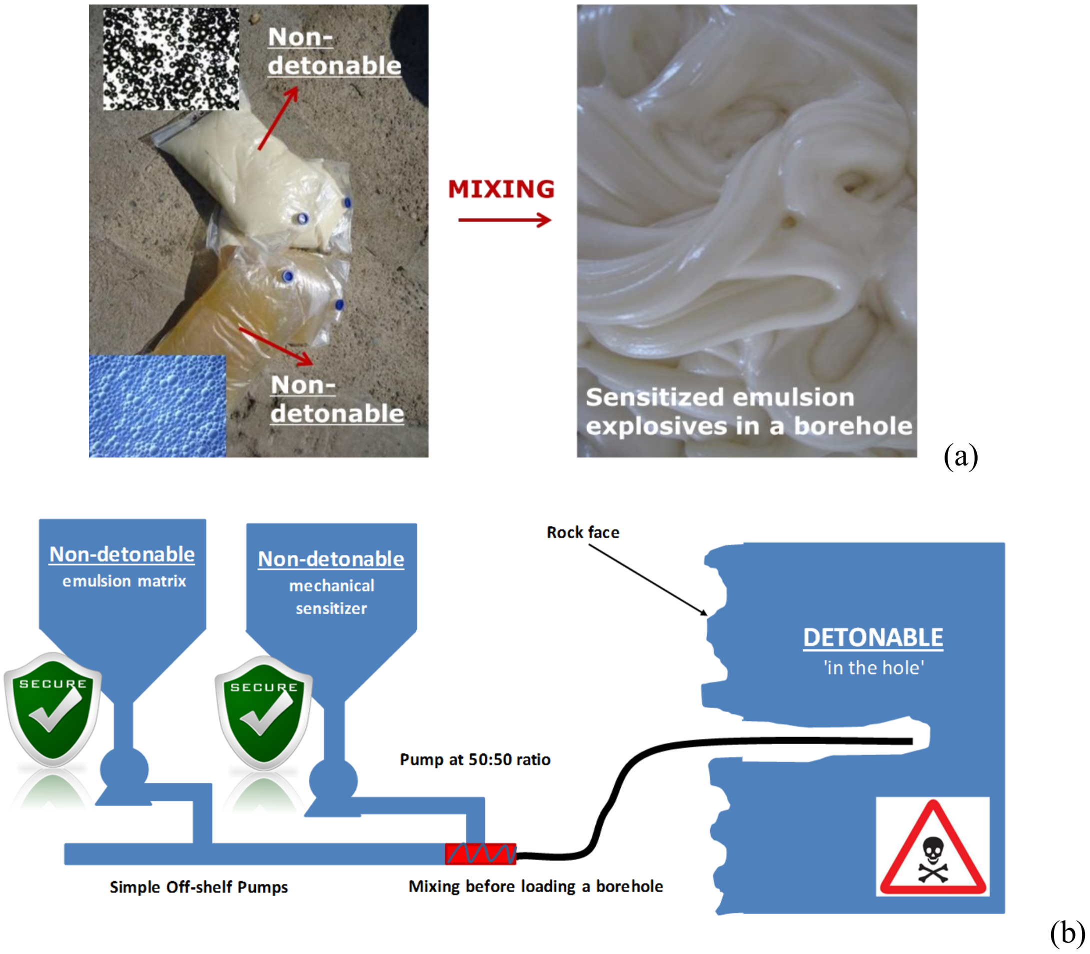
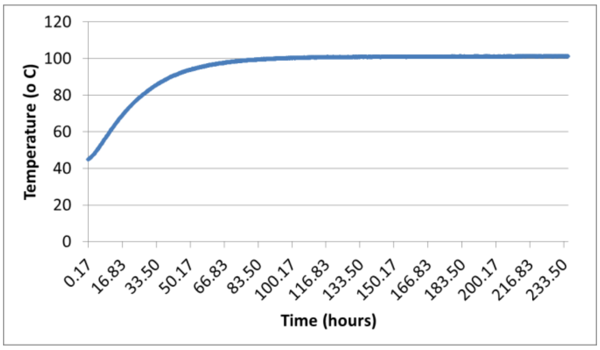


Figure 9. Proposed method of use of non-detonable mechanical sensitizer: (a) sensitization and (b) safety and security concepts.

Novel pumpable sensitizer was subjected to UN series 8 (a-c) testing as well as minimum burning pressure testing before any qualification work on its performance was done. The UN series 8 (a-c) results are presented in Figure 10 a-c below. The witness plate in the GAP test (Figure 10a) remained intact and tube was not fragmented. The test tube used for the Koenen test stayed unchanged (Figure 10b) and there was no temperature rise during thermal stability testing (Figure 10c). As can be seen, the pumpable sensitizer fulfilled the UN requirements for classification in division 5.1 (oxidizer). Also it can be safely pumped at pressures below 70 Bars (Figure 10d).


(a)


(b)



(c)


(d)

Figure 10. Results of pumpable testing on detonability: (a) GAP test; (b) Koenen test; (c) Thermal stability test; (d) minimum burning pressure test.

Implementation of a novel mechanical sensitizer such as this involves the development of a pumping system where the base EE and mechanical sensitizer are pumped separately but simultaneously (parallel pumping) at a 50:50 volume ratio. Such a pumping system was developed and trialed underground (Figure 11). It is worth mentioning that the dual pumping system is not limited to underground mining. It can cover applications such as open-pit, quarrying and construction work. Also, it can be extended to secondary blasting and packaged explosives manufacturing on the mining site (Figure 12).

The base EE and non-detonable mechanical sensitizer were pumped, mixed and charged into plastic pipes/sleeves to be detonated at AEL Mining Services' Research and Development testing facilities (Figure 13). The results of testing were compared to blast performance of EEs sensitized with chemical gasser. As can be seen from Table 1, the sensitivity is higher for emulsion sensitized with mechanical sensitizer.

Figure 11. Dual pumps for develoment (up) and stoping (down) applications.

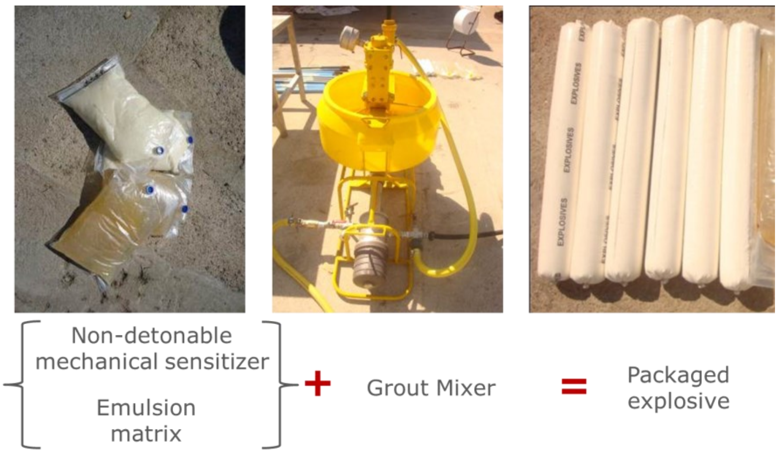


Figure 12. Packaged explosives manufactured on a mining site.

Figure 13. Pumping, mixing and charging of base emulsion explosives and non-detonable mechanical sensitizer.

Table 1. Results of blast performance of emulsion sensitized by both methods of sensitization.

Sensitizer type	*Final emulsion density, kg/l (lb/l)*	*VoD, km/s (ft/s)*
Chemical	1.10 (2.43)	4.0 – 4.2 (2.5 – 2.6)
Pumpable non-detonable	1.10 (2.43)	5.2 – 5.3 (3.2 – 3.3)

In order to evaluate the product performance and the efficiency of the pumping system, the mechanical sensitizer and the system were trialed underground at Bokoni Mine. The blast design is presented in Table 2. As per the mine report, the chemically gassed product was unable to break the burden. In contrast, the blasts conducted with mechanically sensitized emulsion resulted in minimal sockets and maximum advance under identical conditions.

Table 2. Blast design

Rock type	Norite
Tunnel dimensions	4m wide × 3m high
Holes	5 rows × 6 columns + 9 hole burn cut and 2 easers
Hole length	2.1m (average)
Hole diameter	36 mm
Burden and spacing	50 cm × 50 cm
Initiating system	Uni-delays and 15 g stinger booster
Pump	Dual PC pump
Air Pressure	5 Bar maximum

Conclusions

As shown in the publication, mechanical sensitization with the safety and security of chemical sensitization is possible. The novel non-detonable pumpable mechanical sensitizer and the pumping system was designed to be used in small diameter long blast holes but can cover all applications in the field including surface and underground applications, as well as construction work. The application of the entire system can be extended to secondary blasting and manufacturing of packaged explosives on site.

Acknowledgements

The author would like to gratefully acknowledge AEL Mining Services, the company which provided the financial support and permission to publish the results of these studies as well as all R&D colleagues for assistance and hard working in order for this research and development to happen.

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TONY'S TALE PIECE BY ANTHONY ROWE

THE WALRUS AND THE FACTORY

(**With sincerest apologies to Lewis Carrol)**

The time has come the Walrus said
To talk of many things:
Of shoes - and ships
And sealing wax…………………………
And whether pigs have wings.

You couldn't see a cloud
No cloud was in the sky,
Just a gently rolling pageantry
So pleasing to the eye
We couldn't find a better place,
Not you, not he, Nor I.

My wife and I retired a couple of years ago. If we were furniture, we'd probably now qualify as antiques. I'd be an overstuffed and rather threadbare old sofa, the missus an elegant baroque chair.

Now everybody knows that minds become less reliable as the years drift on by. The horrors of Parkinson's, Alzheimer's or Lewy body disease - all various forms of dementia – stalk our mental wellbeing as we make our uncertain journey through the autumn of our lives. To escape possible enslavement we took the decision to maintain a pace of life in our dotage that was somewhat slower than that generally served up in Johannesburg. With less going on we assumed that our brains would last a bit longer. In pursuit of this ambition we chose to take up residence on the south coast of far-away Kwa-Zulu Natal. Nothing much happens here; the winds blow and the ocean rolls in relentlessly. Whales and dolphins regularly wave greetings from the briny deep while a whole variety of ships and boats sail right on by.

Now I say that nothing much happens here, but in an astonishing innovation the local municipality has provided seawater on tap. You can now bathe, shower and/or drink the warm salty waters of the Indian Ocean directly from the house taps (faucets). It may though be unwise though to wash your car. Stainless steel cutlery rusts, our dishwasher has started to rust and glassware dries white. To tell the truth, I don't know if I am getting a tan or if I am also going rusty. To be on the safe side I have sprayed myself all over with WD40. The lawnmower, I suspect, now finds me attractive.

We are not alone in being blessed with this salty new privilege. The whole of the local population also shares in this great new social experiment. We nevertheless remain somewhat concerned. Sea snakes could end up in our bath or jellyfish rain down from a showerhead. I've deployed the shark nets just in case.

Back now on terra-firma we might see the odd automobile or more rarely, a pedestrian. A black-faced monkey might get into the house or a green tree snake shimmy on up behind the TV stand. The odd, horrifyingly large cockroach may create a few moments of mild panic or a mosquito large enough to braai (once shot down) can suddenly appear out of the surrounding undergrowth. I know, I know, it sounds so boring, but believe me, time flies, (they're a sort of rainbow red and much faster than ordinary flies) so there is never a dull moment.

I still put together short articles here and there and trust that they prove useful to those who trouble to read them, but by far the worst thing about retirement is that there are no days off, no weekends and no holidays. It's such a shame. I really do miss them.

***

More than 100 years or so ago, an emerging business was seeking a site for its new factory complex. Much was made of a location where the summers were long, predictably warm and the nights pleasantly cool. Detractors pointed to the high incidence of lightning storms. Supporters drew attention to the short and generally dry winters. The critics countered aggressively stating that because of the high elevation the short winters were often also bitterly cold. In the end though, shrewd commonsense would prevail. Success, although never assured, would come in the fullness of time. This broomstick would fly……..

The site chosen wasn't particularly alluring, but there was clearly some magic there. Parts of it were also quite beautiful. This though was of little consequence to its prospective developers who, after all, were all hard-nosed businessmen to a fault.

There were no giants, no pixies or wee folk, no enchanted castles and not a wicked witch for miles, but surrounded as it was by seemingly endless grasslands, this place - far from human habitation - offered the vital prerequisite of isolation.

What was to be built here would require the skills of workers from more than seventeen different European nationalities. It would also provide employment for an unknown number of the indigenous peoples drawn from the length and breadth of the Dark Continent itself. Their combined efforts would spawn an industrial powerhouse, a true giant, in real - not fairytale terms.

In the years to come, the products of this single enterprise would contribute massively to the enrichment of the country and its peoples. It would fulfil the dreams of some and contribute to the nightmares of others.

Our part of the story begins some 30 years later. The dreamed-of enterprise has become a reality. A brand new century has arrived and a world war has redefined the map of Europe. It is a period that in some parts of the world would come to be called "The Roaring Twenties." Young women with bobbed hair and short skirts might occasionally be seen drinking and most shockingly, even smoking in public. Such behavior, at the time, verged on the scandalous.

It was a period of sustained economic growth and in those halcyon days there seemed to be money to burn. As for myself, I was still a glint in my Daddy's eye. He was then a teenager working in a chip shop, six days a week, ten hours per day. Most of that time was spent up to his knees in dirty dishwater peeling potatoes - or so he used to claim.

In those days, air travel was the preserve of the rich and famous or perhaps the daringly foolhardy. Movies (if you were lucky enough to see one) were silent and shown only in black and white. They featured names like Charlie Chaplin and Buster Keaton, Colleen Moore and Mary Pickford. Because the movies themselves offered no spoken dialogue or synchronized music, the provision in the theatre of a piano played by a live pianist to set the mood was essential. Just like today the subtleties of the chosen music could significantly enhance or detract from the quality of the overall performance.

In America, climate control in cinemas (air-conditioning) will make its first tentative appearance during 1929. Cool baby!

TV too was available in 1928, just not in South Africa. Wireless (radio) though <u>was</u> here. In fact, a station not that far away from the factory site had transmitted an experimental broadcast (a concert) during 1923. The transmission footprint was exceedingly small. Who was listening anyway? The cost of a wireless receiver was highly prohibitive and a truly portable device remained for now, mere fantasy. A typical receiver weighed in at about 30 kg and in the absence of a reliable power supply, a lead/acid battery would weigh about the same again. In the absence of any electrical outlets built into the walls, the problem of recharging the battery would have been an overwhelming one. Remember this was a time when most homes used candles or oil lamps for lighting purposes. Whale oil remained the preferred fuel for lamps. Although more expensive, it gave a purer, whiter light. Coal oil and/or candles were far, far cheaper, but produced an inferior yellow and smoky flame.

Beyond the city limits, most cooking took place over open fires or wood-burning stoves. '**Defy**,' a well-known South African appliance manufacture came into being during the 1920's and would manufacture and market its first electric stove during 1932. For now though, hot water for personal hygiene purposes was luxury indeed. Most folk still made their own soap using a mixture of fatty scraps, axle grease and a few old bones. They were all boiled together with a strong solution of caustic soda.

Ivory Soap ***"so pure it floats"*** was still an exotic (or perhaps erotic) dream for most folk.

If wireless wasn't an option and you wanted the luxury of music, you got yourself a piano, a pedal organ or some other musical instrument. Bagpipes, violins and squeezeboxes were especially popular. Once acquired, you either learned to play or married someone who could.

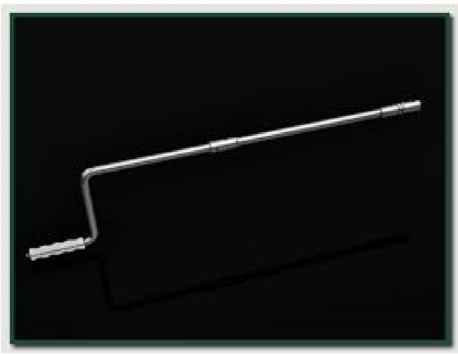
For the musically challenged like myself there were drums, cymbals and tambourines. I can still shake a tambourine with the best of them and I'm the very devil with castanets. Other musical alternatives included whistling or singing. If you were especially fortunate, you might own or have access to a wind-up gramophone (phonograph). Such a machine was entirely mechanical and so didn't need electricity or batteries. This was fortunate because they weren't included.

A gramophone featured a round and flat, baize covered turntable. In the centre of the turntable was a protruding central spindle upon which a record could be located and played. Records in those days revolved at around 78 rpm. They were usually made from shellac. They were black in colour, flat and circular and around about 3 mm thick, although really early versions employed a hollow cylinder instead. A typical record was about the size of a very large dinner plate, but much more brittle. They would play from 3 to 5 minutes per side.

Unlike the CD of today, records, (78's) were never adopted as ornaments although I have seen a few dropped into boiling water.

No, you can't eat them. They're not lobsters, crabs or crayfish. They were softened by the boiling water and then reshaped to become flowerpots and other less luxurious items. An ignominious end perhaps for an operatic recording featuring the Great Caruso!

There were cars too. Unlike those we see today, many automobiles of the period sported solid rubber tyres. Pneumatic versions were, however, theoretically at least, available. There was no "press button" starter. Starting handles, also known as crank handles, - long steel rods usually featuring two 90^0 bends and requiring some serious manual input - were the order of the day.



They were necessary to turn over the engine and start the car. However, an engine "backfiring" or "kicking back" during the starting phase could totally ruin your day. To reduce the risk of injury, a wise motorist therefore always kept his thumb parallel to the cranking handles' grip section, not wrapped around it.

Car headlamps were either oil-fired or fed by self-generating, acetylene gas. The phrase, "wicks in the headlamps" was rooted in fact and a "real" driver always lit his own.

One of the first cars to arrive in South Africa was a 1903, Model 'A' Ford. It was the first Ford to be sold outside North America. It was delivered in 1904.

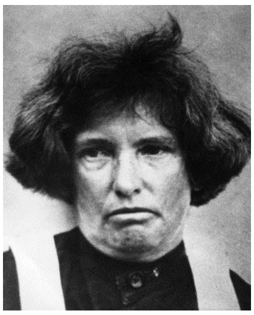
The vehicle was off-loaded at a small coastal seaport on the eastern seaboard named Port Elizabeth and then transported by train to its final destination.

By the end of 1924, things had changed somewhat. An old wool packing shed at the same coastal town where the first Ford had been landed had been converted into an assembly plant. Inside the erstwhile packing shed, the soon to be phenomenally successful Ford, Model T was assembled for sale. "You can have it any colour you like just as long as it is black" (apparently black paint dried faster). Models were available in light black or dark black. It didn't matter which shade a customer chose, it was the same shade of black.

This car was put together using kits sourced from Canada. By the way, during the same period, a good woollen worsted suit cost one shilling and nine pence. A not so good one, "Yours sir" for only sixpence.

The Medical Association (MASA) will be founded during 1927 and some 5 years later, during 1932, a certain Daisy de Melker will be charged with poisoning a couple of husbands and later her own son Rhodes, who had apparently become a disappointment to her.

DAISY



But for now, we are content. We soar up high and drift over the undeveloped grasslands as they pass unrelentingly beneath us.

What's that?

Where?

There, you can see it. See What?

Just follow my finger, There! Poking out of the tall grass.

There's nothing there! Oh I see, but it's just a signboard.

Yeah, Yeah! But read it. What does it say?

M .. ….

MO………..

MOD…..

MOD E FO TE N

The burgeoning township of Johannesburg lies to the south.

The town of Johannesburg has actually existed since 1886. A contemporary account, however, described a hellhole, "a treeless and despairingly bare sandy plain; a virtual dustbowl with little water." With the drought conditions prevailing at the time of writing the city of today appears to be returning to its roots.

It all began, however, on land once belonging to the farm Randjeslaagte. By 1889 it was the largest town in South Africa and proceeded to found its own Stock Exchange in that year.

Johannesburg will be granted city status only in 1928.

The company using the site was originally named Zuit Afrikaansche Fabrieken voor Ontplofbare Stoffen Beperkt. After the Boer War it would fall under the control of the British and be administered by The British South African Explosives Company. It would change its name again during 1924.

It is now the middle of December in the year 1926 and 1927 waits impatiently.

We look down upon a hive of activity. The guiding hand of the Detonator Factory's Site Supervisor Mr. Wood is clearly apparent.

Immediately underneath us we can see that the construction and reconstruction of buildings intended for the manufacture of the new-fangled Briska detonators are well underway. The Factory Manager by the way is Mr. W A Schleiss.

As the fates will have it, some months later, on the 4th July, an explosion in Sifting House U8 will occur. The European operator will not survive. As a direct consequence of this event, alterations to some of the new buildings will be carried out. U8 will be made larger to allow the operator more elbow room and a solid floor will be installed. U9, the original brick built expense magazine will be demolished to be replaced by 2 smaller cupboards.

Later on in the same year, U1, previously used for (Hg) fulminate manufacture will be converted to styphnic acid production. The first nitration will be carried out on the 6 April 1927. It will be unsuccessful.

A detonation in a rumbling house will take place during November 1927 when a sack containing contaminated rumbling sawdust will explode during handling.

Press houses U10 and U11 will also be modified. After some small alterations U10 will start up on 9th May 1927.

U11 will follow a couple of weeks later, coming on line on the 28th May.

Maintenance on compensating plungers was reportedly very high and there were serious problems with the leather seals used in the compensating heads themselves. They apparently only lasted for about 2 months or so.

Unfortunately, more modifications proved necessary. The control rooms turned out to be too dark and roof lights had to be installed.

Despite all the problems, by the end of 1927, over 7,6 million 6D and some 400,000 8D plain aluminium detonators had been produced. This required around 4,309 lbs of lead styphnate and some 3,675 lbs of lead azide.

The first press explosion (which reportedly occurred as the punches were being withdrawn) took place in U10 on the 23 May 1927. Tipper explosions began a year later during 1928.

Additional Briska presses were installed in 1930.

Press and tipper explosions will continue to plague detonator production for years to come. One analysis, prepared from data faithfully recorded over 13 years of production provided a fairly depressing picture. The statistics indicated 1 press explosion per 16 million detonators and 1 tipper explosion per 43 million.

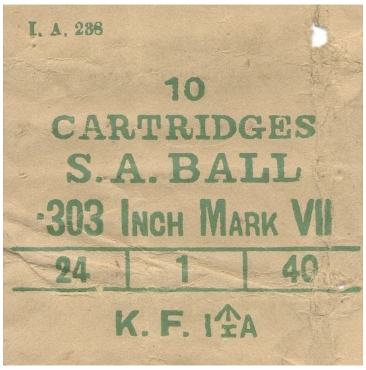
Detonator production steadily increased.

There was a massive scale up during the war years of 1939 –1945. Output more than doubled growing from a mere 58 million a year at the start of the war, to a staggering 125 million per annum at the end.

During the period 1938 - 1939, the sabre rattling that always seems to preclude any major act of war was well underway. During this time, the factory complex managed to churn out around 110,000 percussion caps (primers) of the sort intended for .303 small arms ammunition.

War broke out and South Africa was dragged into the carnage.

In the year 1942-43, production of .303 primers reached 245,969,000, that's nearly two hundred and forty-six million primers per year. That number was for .303 primers alone! The factories produced other types as well. The sabres - metaphorically at least – were no longer being rattled, they were being applied with a will!



Production of .303 primers peaked in 1944 when more than 258,170,000 units were manufactured.

The company manufactures none today.

By 1951 the detonator side of the business had also scaled up. Production of Briska detonators reached around 138 million per annum.

Today, detonator production is well down from its peak. The wheel has turned full circle and production has fallen significantly.

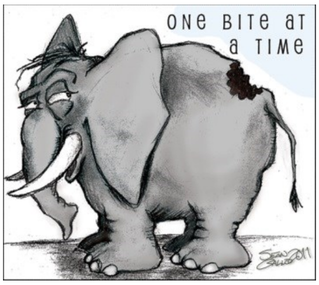
The factory still produces a lot of detonators, but the glory days of mass detonator production are probably over. The environment nevertheless remains a dynamic and challenging one.

Today, we are well into the computer age. Both the rate of change and its emphasis are constantly increasing and being re-focused. Customers too are becoming more sophisticated. The number of computers in use and their range of applications continue to grow almost exponentially.

The application of computer technology has an ever-increasing effect on both our personal and business lives. Soon each tiny facet of our existence will be available for processing. Governments will soon be demanding access to your browsing history. Nothing will be secret or sacred any more.

In the mining industry, the adoption of concentrated mining techniques has placed more demands upon ore extraction and development systems than ever before. The existing rock blasting systems were unable to provide what the customer wanted. Clients wanted accurate, real-time information, around the control and reporting of daily blasting operations. They called for the economics of advance and production – to be presented on demand - using a palette of 500 glorious colours.

To meet these needs effectively necessitated a whole new approach – it didn't come easily, but was rather accomplished in the same way that a rather small person eats a very large elephant - slowly, one bite at a time while remaining patient, persistent and practical.



For instance, silicon, an element present in the sun and most other stars is also a vital ingredient in the formulation of many delay and sealer compositions. Unfortunately, silicon whilst common throughout the solar system is not found free in nature, it must be extracted – usually as the oxide - and prepared. That is not the end of the process, however. Particle size distribution is just one of the critical factors in final performance and that's a characteristic that can only be achieved by trial and error around a lengthy process of attrition milling. Not exciting stuff, just big, noisy machines and an endless daily grind. The resulting silicon powder must then be wet mixed and blended with the perfect amount of a suitable oxidizing salt. Hours of chanting follow. Acolytes dressed in dark blue robes perform ritualistic movements. Bells are rung. Horns are sounded. Pulse quickening drum rhythms escalate the process towards the grand finale when - under the light of the full moon, the mixers are finally thrown open and the freshly completed slurry released. It must be dried and granulated before midnight on the third day. The granules so formed are then exposed to natural starlight before being dosed into rigid, thick-walled metal tubes called elements and pressed to the precise density necessary to achieve the correct burning speed. It's more like black magic than technology - an art more than a science. It's not easy at all.

I like this simple statement. It sums up the whole issue. "Our job is to give the client, on time and on cost, not what he wants, but what he never dreamed he wanted and when he gets it he recognises it as what he wanted all the time" (Dewys Lasdon, Designer Extraordinaire).

Most would agree that the best outcomes occur when outdated systems and techniques can be replaced with cost effective alternatives, but the leap from connector/capped fuse to complex system architecture in a single bound can be an expensive indulgence. It is not just a technology upgrade. Potential users must take into account the increased costs associated with the skills base and entry level of the blaster, the additional training that is required and the often time consuming processes of fault detection and rectification.

OK so where are we going with all this?

Why the history lesson?

Well. It is sometimes necessary to know where you've been to better see where you are going!

The era of shock tube and electronically initiated detonators is upon us. "Times", in the words of the once popular song, they are a changin' and they're a changin' fast.

Today, the old stalwart of the underground mining industry, connector/capped fuse and ignitercord has all, but disappeared, replaced by systems based on shock tubing or electronics.

Automation was vital in ensuring that the planned metamorphosis occurred quickly and seamlessly.

The decision to use automated assembly machines in the manufacture of delay-detonators was a complete change in focus in a business model that that had both historically and traditionally relied on a series of well understood, but geographically widespread and labour intensive processes for the manufacture of its products.

The selected supplier of the production machinery was a European based company who not only manufactured, but also installed and commissioned the new detonator assembly machines.

The same company also manufactures a range of integrated assembly units and other machinery intended for the manufacture of a variety of products that include, centerfire percussion primers, detonators, pyrotechnic items and explosives.

The series of integrated delay-detonator assembly machines that were installed employed some of the latest technologies available. In accordance with modern waste and effluent policies, the new plants were designed to also deal effectively with their own waste by-products. Delay detonator testing and system timing techniques were also re-engineered from the ground up. Finally, friendly robots were introduced to assist in the various assembly processes.

So it's clear. Thanks to the efforts and far sightedness of a few, the willingness of the production and engineering people, the co-operation of the workforce and not forgetting the customers who were prepared to push the envelope, a whole new series of shock tube based initiation systems have been available for some time now. On the electronic side the networked, electronic delay detonator has become a fact. Remote blasting is possible plus a host of other electronic and Internet options, but before we grow too complacent:

Said the Walrus to the oysters

You've had a damned good run

Once held the whole monopoly

Alone had all the fun

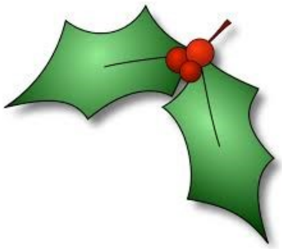
The oysters though were silent

Their metabolism slow

In a world that changes quickly

Can they still get up and go
For nature is red, the Walrus said
Blood red in tooth and claw
Now the devil takes the hindmost
The last ones through the door
But wait a bit, the oysters cried
Before we have our chat

A good long walk, a good long talk
Burns off a lot of fat
Let's shimmy on up this dry old beach
There's a storm coming in from the east
We've committed no sin, will the tide come back in
Or will salvation remain out of reach
Have we made a mistake, all our arteries ache
And we're getting so thin
That our mussels are starting to shake
So spare a backward glance
For oysters in decline
The world has gone full circle
And oysters taste divine
Most clouds have silver linings
Or so some people tell
But if you don't look after your oysters
All there'll be left is a shell
And tomorrow's an untold story
All that exists is today
Spilt milk is a state of disaster
And regret is too late; so they say.



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ARTICLES FOR NEWSLETTERS

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. **The deadline for articles for the March Newsletter is 28 February 2016 and I look forward to your support** .

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