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SAFEX CONGRESS XX
SALZBURG 2020

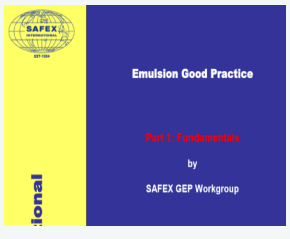
From the Secretary General's Desk

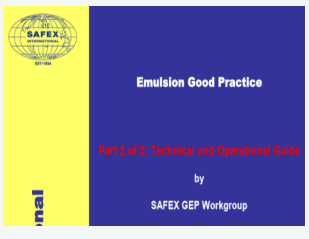
"Safety is a common denominator across all aspects of life; hence knowledge should always be shared. It is not a matter for industry it is a matter for humanity."- Doug Bourne

SAFEX's main objective is to share safety, health, environmental and security knowledge throughout our industry. In doing so we hope to achieve a much safer work environment for everybody and increase the global image of the explosives industry.

SAFEX recently published the annual safety statistics which is a valuable tool in benchmarking our performance. I implore you to partake in this annual exercise which benefits all members.

In this this issue the new Emulsion Safety Training Package is introduced. The Package was developed by Dr Martin Held and Andy Begg and is now available on the website . It can be used in conjunction with the two new GPG's developed by International Emulsion Working Group. The latter went live on the website at the end of May.





The website upgrade is nearing completion and will afford you, the member, a user friendly and technologically advanced platform to interact with all the information available on the website.

Information sharing is very important to the success of the SAFEX mission and I call again on members to let us have relevant incidents or serious incidents that could have led to a major catastrophe. Through these incidents we learn and try not to repeat mistakes made in the past, thereby building a safer working environment as time progresses. But without your input and support this cannot be achieved. As part of this I also I call on you to share even old incidents under our "Incident Recall" section -the PETN incident in the last Newsletter was received by most as very helpful in reminding them of current hazards and shortcomings.

We also continue our section on Safety Management Systems with one on Maintenance and our "Did you Know That" with a reminder of potential reactions between materials of construction and the chemicals we use.

Latest, but not least SAFEX welcomes NIOA in Australia as the latest member of SAFEX. We look forward to their input and support to advance safety in the industry.

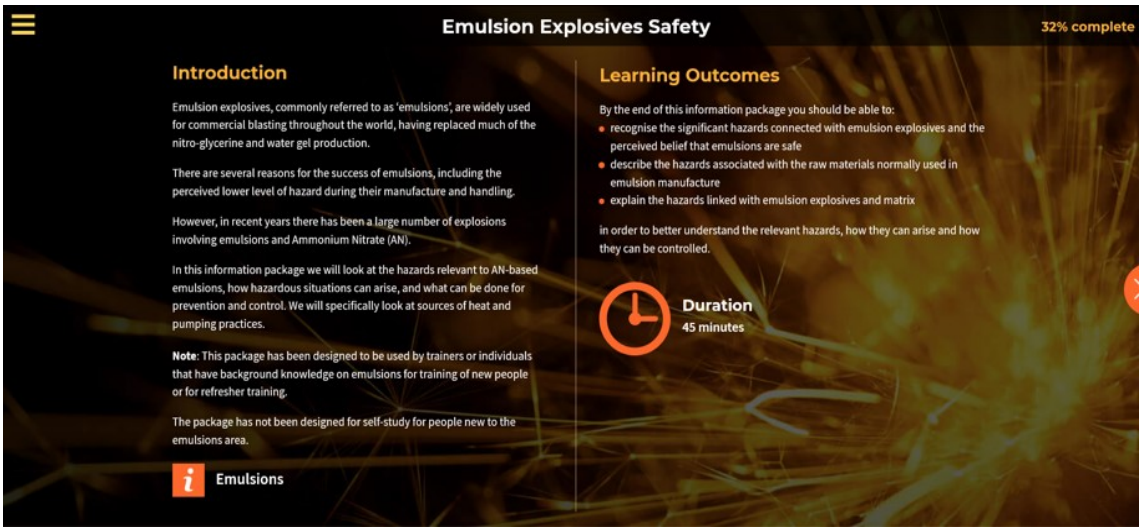
Introduction to the SAFEX Emulsion Training Package

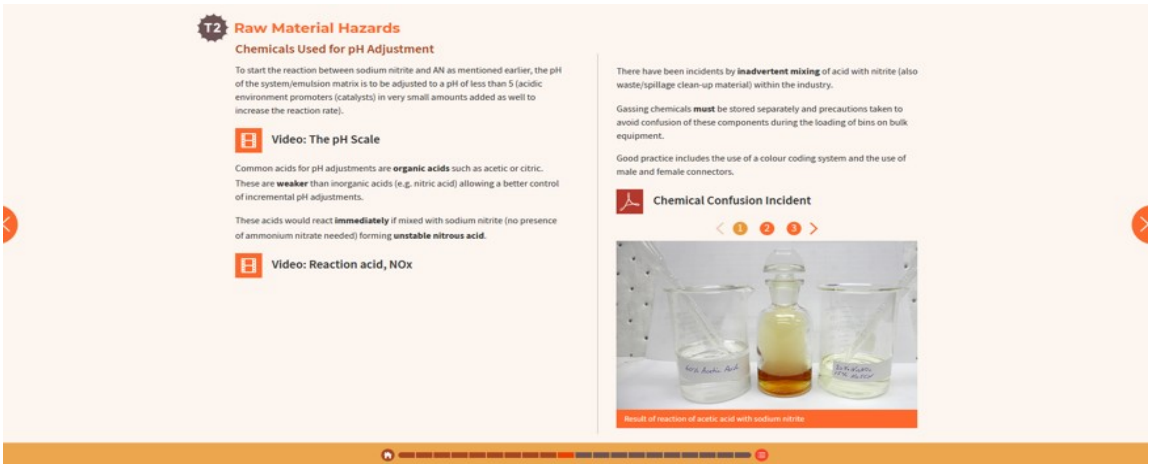
By

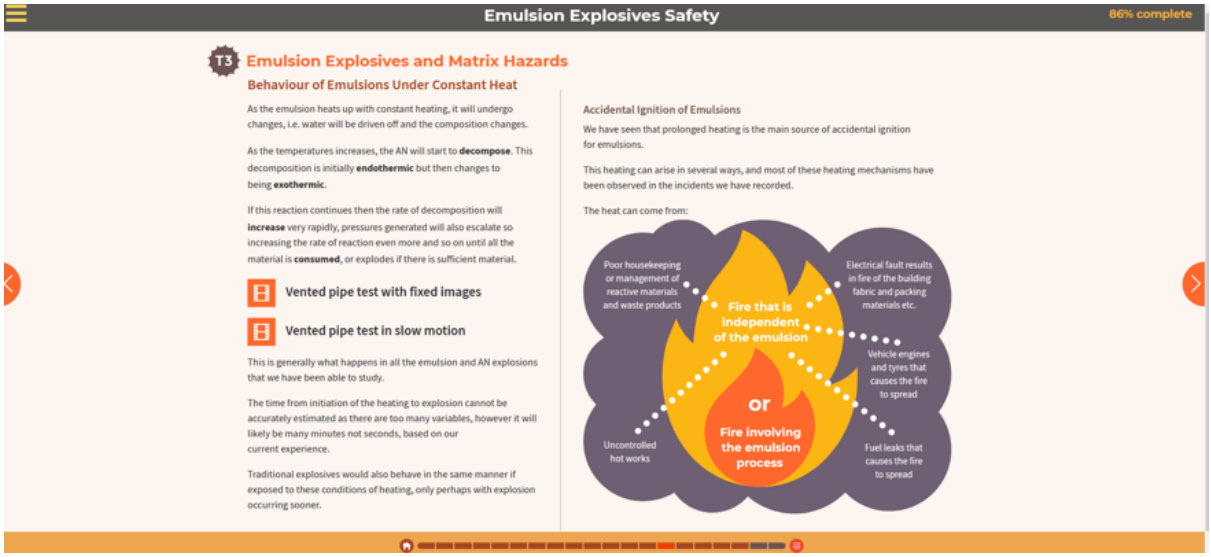
Dr Martin Held

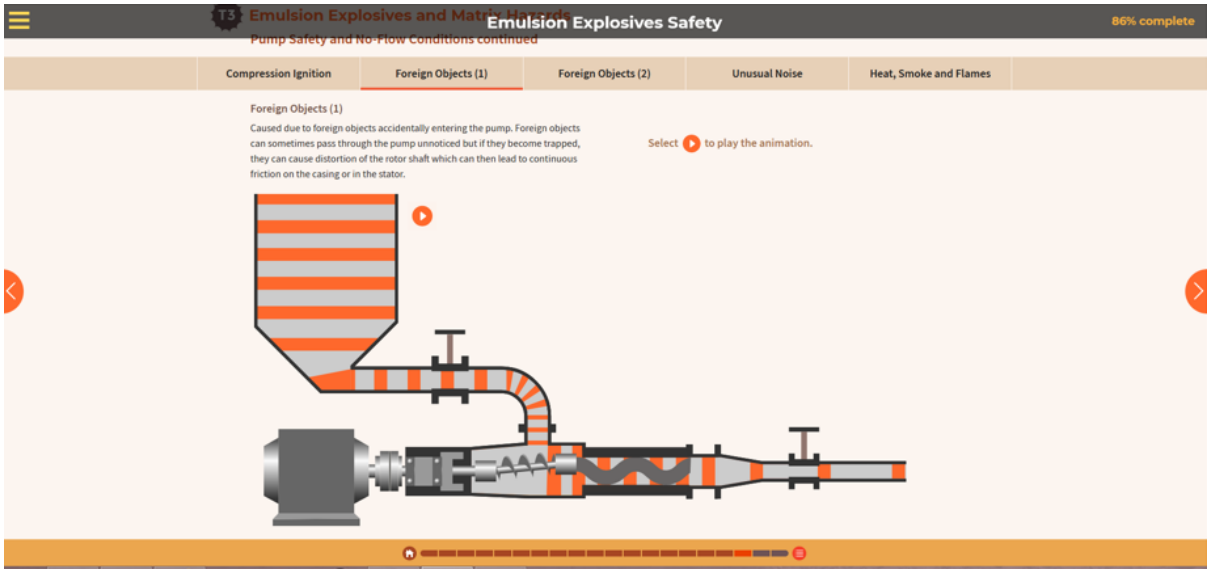
The Emulsion Training Package was developed in conjunction with the Emulsion GPG's to be used as a stand alone training tool separate from the eLearning Modules, to assist members with the training of personnel in all aspects of emulsion safety .It is to be used as a personal or classroom training tool and is now available on the homepage of the website for download by member companies.

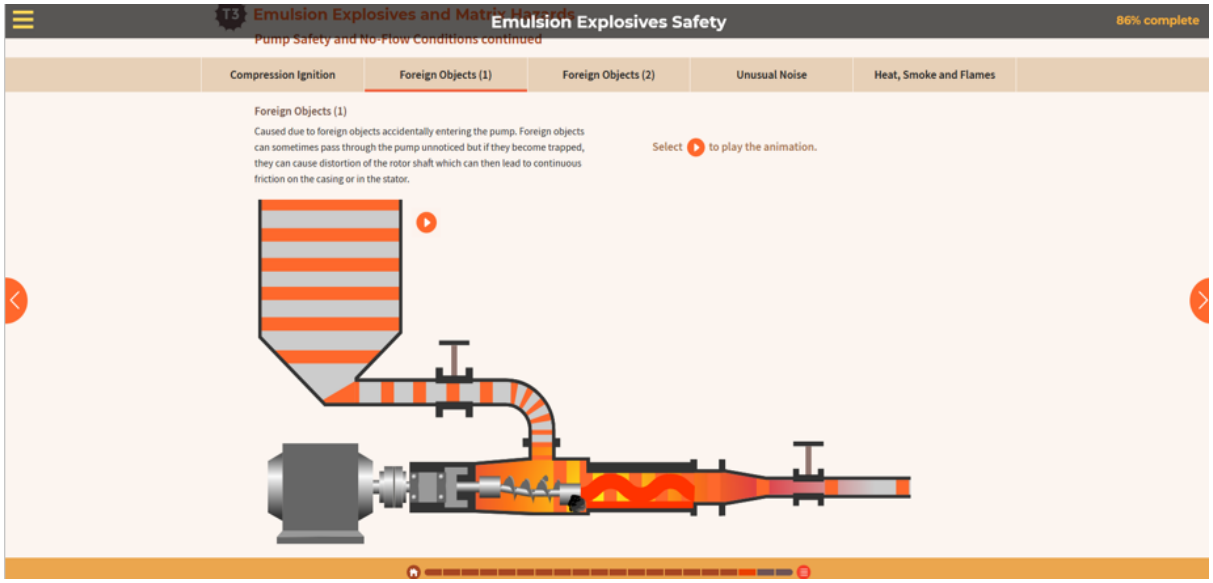
Below are a few slides drawn from the training package to illustrate the ease and clarity behind the training.











Public report on CIE Conference

By

Ken Price

A group of explosives technical and regulatory experts held their annual meeting in Swakopmund, on the coast of Namibia in March 2019 hosted by Namibian Police Force. The Explosives, Propellants and Pyrotechnics (EPP) working group of the International Group of Experts on the Explosion Risks of Unstable Substances (IGUS) and the International Conference of Chief Inspectors of Explosives met for one week and a brief summary of their discussions is set out below.

Who are these experts?

IGUS is the International Group of Experts on the explosion risks of Unstable Substances. It was originally formed as a consultative group for OECD to advise the United Nations Committee of Experts on Transport of Dangerous Goods, a role it still performs though it is no longer associated with OECD. The aim of IGUS is to exchange information on the behaviour of unstable substances, with respect to production, handling, storage and transport.

The Explosives, Propellants and Pyrotechnics (EPP) working group is one of two IGUS working groups. Its remit includes explosive properties, general test methods and thermodynamic ratings, phenomenology of explosions, safety, and regulatory aspects related to explosives, pyrotechnics and propellants.

The Chief Inspectors of Explosives aims are to provide safety and security benefits to the public and industry by promoting best practice in the field of explosives regulation. Their Conference is held annually, to increase knowledge of working practices, technical developments and incidents in the explosives industry; to establish networks for communicating information between members; to encourage the development of a harmonized approach to standards and regulation development; and to enhance the education and transfer of learning about explosives among members.

The two groups have met jointly for over ten years, jointly chaired by Mr E de Jong from TNO (EPP) and Dr J-L Arpin, Chief Inspector from Canada. The format of the meeting is different to most conferences; delegates engage in round-table discussions on issues of mutual concern with a focus on developing knowledge and understanding common problems rather than simply presenting formal papers.

The 65 delegates at the meetings were from Australia, Belgium, Canada, Chile, China, Germany, Japan, Namibia, Netherlands, South Africa, Spain, Switzerland and USA, with approximately equal representation from industry and government. Industry delegates were a mixture of testing laboratories, manufacturers, industry associations and transporters. The government delegates represented testing laboratories and inspectors.

Key points

Opening

There was a formal opening ceremony for the meeting, presided over by Inspector General S H Ndeitunga of the Namibian Police Force, after which the following subjects were discussed.

Permitted explosives

It is becoming increasingly difficult to obtain reliable Permitted explosives (suitable for dusty or gaseous coal mines) and Dr A Von Oertzen gave delegates a summary of the issues relating to safety in blasting in coal mines, particularly with respect to methane and coal dust explosions. He presented information on testing of permitted explosives in several countries, particularly Spain and eastern Europe.

During the discussion, it was added that tests in South Africa are actually done at the National Bureau (tests similar to UK or Australia, Buxton test in particular).

Nitrogen oxide gases

Marivi Ramirez from Enaex, Chile spoke about issues and management of nitrogen oxide fumes from blasting. The group identified a “hit list” of key issues to review when NOx may be a problem:

Product quality, particularly when manufacturing on site, which may affect the oxygen balance;

Product selection including density, water resistance,

loading patterns;

Geological conditions like fissures, confinement, wet holes.

In the general discussion there was extensive reference to the Australian Explosives Industry and Safety Group Inc (AEISG). *Code of Practice on Prevention and Management of Blast Generated NOx Gases in Surface Blasting*.

Reactive Ground Blasting

Pieter van Jaarsveld from BME Explosives gave a detailed presentation about ammonium nitrate based explosives in reactive ground including information about the chemistry of reactive ground, identification of reactive ground including practical tests and options for managing blasting in reactive ground. This was complemented by reference to another AEISG publication: *Code of Practice for blasting in Elevated Temperature and Reactive Ground*

Electronic detonators.

Given that the UN has recently introduced a specific Proper Shipping Name and UN Number for electronic detonators, there was a very timely presentation from Mr XIN Jin, Head of MIIT Safety Production Department in China on the usage and legal requirements for electronic detonators in China. China is planning to remove all non-electronic detonators from the market within three years. Their production of e-detonators has gone from 1.8 million in 2016 to 16 million in 2018 and continues to rise.

Delegates informed the conference of their plans to apply the new Proper Shipping Name and UN numbers: most will need to make regulatory amendments which will not commence before the next edition of the United Nations Model Regulations is published.

United Nations Issues

The IGUS and CIE forums are regularly used by delegates to develop their ideas and proposals for changes to the United Nations Model Regulations for Transport of Dangerous Goods and 2019 was no exception. Ben Barrett (SAAMI), Bob Ford (Safety Management Services, Inc (USA)) and Noel Hsu (Orica) led several discussions on proposals for change as described below.

One proposal was to modify the documentation requirements in the United Nations Model Regulations to no longer require that the Net Explosives Mass be required for Division 1.4 explosives. The information is never used and serves no useful purpose given that hazard division 1.4 explosives will not mass explode.

Another proposal was to add the term “significant” preceding “fire or explosion” to the 12-metre drop test assessment found in the UN Manual of Tests and Criteria (UNMTC). This would match the terminology used in the introduction to that test method and to harmonize the intent of the test to the assessment of results. The paper also proposes to define the term “explosion”. Several delegates expressed some reservations about the proposal as drafted, however there was some support for the principle.

A third paper proposed a review of Compatibility Groups. During the discussion it was pointed out that although most compatibility groups are assigned based upon the type of explosive represented, compatibility groups N and S are both based on tests rather than intrinsic properties. This further illustrates that fact that explosives assigned to Division 1.4 Compatibility Group S are treated almost as though there were in a separate division.

The proposal is to expand paragraph 2.1.4.3.2 of the Model Regulations to reflect wording already in the Manual of Tests and Criteria, clarifying that tests 5, 6 and 7 are used to assign classification, with test series 6 specifically used to allocate substances and articles to divisions 1.1, 1.2, 1.4, 1.4 and 1.4 Compatibility Group S (underscored text is proposed to be added to the Manual Regulations).

Still on UN issues, it was proposed to revise the assessment criteria for test 6(d) found in the UN Manual of Tests and Criteria to more accurately reflect the original intent of the test: the detection of hazardous effects outside the package due to normal functioning of an article inside.

And finally (on UN issues) in light of the introduction of

the Minimum Burning Pressure (MBP) Test into the Manual of Tests and Criteria (test 8.e) there was an opinion that substances subjected to the 8.e test should not be required to undergo the Vented Pipe Test (VPT) since the MBP is an inherent property of the substance and not subject to effects of scale, which the VPT was attempting to ascertain. Several participants at the meeting concluded that it was time Test Series 8 was reviewed to assess the value and effectiveness of the tests, particularly the 8 (d) test.

Accident investigation

The Director of the Canadian Explosives Research Laboratory (CERL), Dr Sam Maach took delegates through a copy-book investigation of an accident that occurred while performing a Time-pressure Test on a celluloid sample. It was only after carrying out this methodical and structured analysis that it became clear that the initial (most obvious) potential cause was clearly demonstrated to be erroneous and that there was a problem with the electronics in the instrumentation used in the test.

Peter Howe (Platinum Explosives) described a flyrock incident on a mine in which projectile fired approximately 1100 m. The comprehensive investigation showed failures of several of the lines of defence. The presentation then described actions in place to prevent a recurrence.

Ammonium nitrate protection issues.

Several speakers addressed the issue of safety with ammonium nitrate. Marivi Ramirez from Enaex presented her top ten safety rules for storing and transporting ammonium nitrate. Then Pieter van Jaarsveld from BME spoke on how BME manages emulsion based explosives in reactive ground. This was supplemented by several delegates referring to the AEISG Code of Practice for blasting in reactive ground, acknowledged by most to be the most informative guide on this subject.

And finally, on ammonium nitrate, Francois Ledoux from Yara presented on the use of aluminium with ammonium nitrate. Germinal to the discussion was the Norwegian research paper which concluded: "when solely considering the compatibility, we suggest that the use of aluminum tanks when transporting AN does not aggravate the already present risk of explosion in AN during fire". (Norwegian Defence Research Establishment (FFI) FFI Report 2015/02430)

The general conclusion of the paper and accepted by the group was that:

Presence of Aluminum is normally OK

It should always be part of the risk assessment. It is not one conclusion fits all.

It should also be part of the post-accident investigation in case of explosion, and the risk of H_2 potential.

In particular the risk of having a mass of hot/molten AL forming and falling at once on AN should be considered in the design. For example, any heat shield or any steel plate or flooring should not allow for that.

Regulatory issues

As usual at these events, Canada presented the latest information on their regulatory activities. The history and structure of the explosives regulatory division in Canada was explained plus the scope of the inspectorate's operations, then NRCan opened a general discussion, seeking information from delegates on the world-wide legislative controls for access explosives and precursors. Canada plans to take the information provided to develop amendments to their regulations.

Technological Developments.

Orica took the opportunity to enlighten the group about the potential for wireless initiation systems including completely robotic blasting.

Robert McClure (RAM Inc) presented a couple of case studies on render safe operations and showed a variety of specialised tools used for explosives identification and analysis currently in use

Peter Howe (Platinum Explosives) spoke on some developments available for avoiding fires in explosives vehicles including tyre pressure monitors, wheel and tyre temperature monitors and large volume water based extinguishers (the only effective

way to extinguish tyre fires). He showed one of the fire protection systems industry is using in Australia which has saved at least two heavy vehicles on Australian roads. (Quitfire. http://quitfire.com/)

Conclusion

The open forum meeting concluded on Thursday evening then industry and regulators met separately for closed session meetings on Friday.

Next meeting of the group will be in Spain late in April 2020. It will be a plenary meeting of IGUS and its two subgroups: Energetic and Oxidising Substances (EOS) and Explosives, Propellants and Pyrotechnics (EPP). That will be followed by a meeting of the Chief Inspectors of Explosives.

If you are interested in participating in these meetings contact:
EOS
Chairman Dr. K.D. (Klaus-Dieter) Wehrstedt at BAM klaus-dieter.wehrstedt@bam.de
Co-Chairman Ing. W.A. (Wim) Mak at TNO wim.mak@tno.nl

EPP
Chairman Mr. E.G. (Ed) de Jong at TNO ed.dejong@tno.nl
Co-Chairman Mr. J.L. (Jean-Luc) Arpin, Natural Resources Canada, jean-luc.arpin@canada.ca

CIE
Ken Price, Riskom International Pty Ltd, ken@riskom.com,au

Comment on SAFEX article 'AN Solution Manufacture: Product and Safety Issues for Emulsion Plant Customers', Newsletter #68

By

Dr Martin Held

Compared to sourcing AN in solid form (e.g. prill) containing organic and inorganic additives, the use of ANS is less prone for contaminants affecting emulsion quality.

However, there are sources for contamination of ANS resulting in emulsion stability issues that have occurred in the past and continue to happen.

Recently, we had identified an issue where an Austin partner reported contamination of ANS occurred by using a shared line for ANS emulsion and fertilizer grade at the supplier facility. The contamination was so significant that an emulsion would hardly form.

In my career in (emulsion) explosives manufacturing, I have observed stability/shelf life issues more than once that arose from remains of detergents (cleaning process at the supplier facility and inadequate rinsing of a transportation tank) and other contaminants carried over from precedent hauling of material other than ANS.

In an ideal world this all should not occur, but it does.

I would always encourage to carry out simple lab testing on incoming ANS – as with other raw materials - and not only rely on past experience or the supplier certificate. It may save a lot of money and headache from cleanup.

Explosives standards – getting it right

By

Geoff Downs

During my time as the explosives regulator in Queensland, Australia, I had many representations from industry on matters that affected them. This is one story,of a few more to come, where I believe that there are lessons to be learned for efficiently and effectively using standards called up in legislation to be what we actually want for the big picture.

I was in my office one day and an inspector came in and said to me there is a delegation of about 15 people in the board room wanting to see you about this matter, no appointment, no pre-warning of this happening or even prior representations. The matter was in relation to ships that were loading in New South Wales with ammonium nitrate and then the ship being further provisioned at the Port of Brisbane. The ship was to be loaded with general cargo including food stuffs, equipment and other things required under contract to be supplied to the mine for the general operationof the mines in the Pacific around Bougainville in Papua New Guinea. The matter was the ships were not allowed to berth for the general provisioning of cargo. This was a serious issue which would cost many tens of millions of dollars to the Queensland economy and it was all my fault.

There were representatives from everyone involved in the life cycle of all the goods and services being supplied, received and handled including transport companies, mining services companies (explosives suppliers), the mines, the clients etc. Not having met most of the people there before and there was no meeting agenda , I asked everyone there in order to introduce themselves, state what the purpose of their being there was and what their expectations of the meeting was.

I then introduced myself and stated my role. Firstly, the

matter of the Australian Standard AS 3846-2005 *The handling and transport of dangerous cargoes in port areas*was discussed. The problem arose because the ship did not comply with the limits imposed by the Australian Standard. The port authority sets its own limits which can be lower than the maximum allowed under codes, standards and legislation. Australian standards are prepared by committees. In this case the standard was prepared by Committee ME-081 Storage, Handling and Transport of Dangerous Cargoes in Port Areas. I then read out the list of representatives on Committee ME-081 and asked if any of their organisations were represented on the Committee. We know the answer to that. I then read out sections of the code including the preface and the section Keeping Standards up-to-date. I also pointed out that the Australian Standard was the second edition dated 2005. This standard has been updated from the original standard which was dated 1998. I then read out the list of those represented on Committee ME-081 for the drafting of the 1998 version of that standard and also highlighting that the same provisions were in the standard and they had not changed. The other points detailed in the preface were also read out.

The question was asked that if there was a problem within the standard why had it been updated without change in the relevant section particularly when there was representation on the Committee. There was the opportunity to have input and also to provide comment on the final draft. Why is there a problem now? The organisations represented and had input must have agreed with the published version.

I also pointed out that the Australian Standard and its version date are called up in the Queensland Explosives Regulation. Because the standard is called up under the Queensland explosives Act and Explosives Regulation, it is law in Queensland. My role is to administer the law, not break it. When legislation is being prepared, consultation is undertaken with industry and the community. The drafts are circulated for comment. In this case the Australian Standard together with its nominated date was included in the draft for comment. The standard was drafted with the input from industry and regulators. No comments were received during consultation.

The meeting finished with a few actions for some industry personnel. I didn't hear any more about this topic. There are some important learnings from this situation. Systems are in place for the promulgating of safety, technical and other requirements. We need to understand the systems and operate within them to achieve the outcome. We may not always be successful and this is because of the majority view. We can have personal views but that is all they are until they are included into authorised documents.

We need to make sure that when we have representatives on committees, that there is meaningful two-way communication between the representative and stakeholders within organisations. I have experienced many situations where aggrieved and well-meaning people have been unaware that they have representation in committees etc. If you do have a problem with a called up document (standard, code, etc), these issues need to be dealt with and communicated effectively and meaningfully within the organisation. We need to join the dots.

QUALITY MANAGEMENT-A TOOL FOR SAFETY IN EXPLOSIVE MANUFACTURE

by

N.V. SRINIVASA RAO

Individual Associate Member, Safex international Society

ABSTRACT

Quality assurance (QA) is concerned with examining the process that leads to the end result. A company would use quality assurance to ensure that product is manufactured in the right way, thereby reducing or eliminating potential problems with the quality of the final product. Quality control (QC) is concerned with examining the product; whether it is raw material; intermediate product or final product; to confirm its concurrence with specifications.

In general quality management will be seen as a function of the product performance. All the quality plans and systems are oriented towards product performance only. But in an explosive manufacturing unit; quality management is important for not only product performance but also safety of operations.

Quality management is required in all stages starting from raw material quality through process to finished product. They are very much important for safety of operations, storage and handling.

The paper describes quality management as a tool for safety in explosive manufacturing.

Quality

Quality is defined as 'The totality of features and characteristics of a product or service that bears its ability to satisfy stated and implied needs'. In a manufacturing environment; it is a measure of excellence or a state of being free from defects, deficiencies and significant variations, brought about by the strict and consistent adherence to measurable and verifiable standards to achieve uniformity of output that satisfies the user requirement. Quality parameters are designed in such a way that the end product performance is as

per the customer requirement. Customer delight is the aim for quality management. This is the common understanding in manufacturing industry.

To maintain the quality of the product in a manufacturing environment many systems evolved starting from inspection in olden days to companywide quality management

Quality Management

Quality Management is nothing but creating proper systems in all departments and following them in its true spirit. Quality management includes the systematic approach to all aspects of manufacturing.To achieve the customer delight, companywide quality management is followed by Organisations. It will cover quality of raw materials, process parameters, equipment design &maintenance, training needs of persons and testing. The ultimate aim of this exercise is to achieve the customer satisfaction/delight. Quality is not the job of an individual or a department, it is a team effort and each individual has to maintain quality in his work for getting the quality output. Quality management in production is a combination of quality control and quality assurance.Quality assurance (QA) is concerned with examining the process that leads to the end result. A company would use quality assurance to ensure that product is manufactured in the right way, thereby reducing or eliminating potential problems with the quality of the final product. Quality control (QC) is concerned with examining the product; whether it is raw material; intermediate product or final product; to confirm its concurrence with specifications. For quality maintenance there are processes such as management review, analysis of data, corrective action and internal audit.

Safety

In explosives industry, another key factor to be given appropriate importance is safety.

Quality is for the delight of the customer where as safety is for the delight of all stake holders that includes, working persons, management staff, statutory authorities as well as society. General tendency in a work place is to give more importance to customer satisfaction. Most of the accidents reported in the literature and their investigation reports reveal that lack of proper systems is the reason for the accident. The Quality management will have many of the processes required for safety mentioned earlier. In addition to these, by incorporating some more processes to identify new hazards and establishing processes to measure the effectiveness of safety risk controls etc. the Quality Management will become a tool for safety also.

Quality and safety relation

A few examples are discussed below to illustrate relationship between the safety & quality.

Accidents:

1. An accident in nitration of an organic intermediate was reported. An organic intermediate was dissolved in sulphuric acid. To the above nitration mixture that was a mixture of sulphuric acid and nitric acid was added at a controlled rate to maintain relatively constant temperature at 20 degrees centigrade. After nitration the batch was gradually heated to 55degrees centigrade. During this heat up cycle a violent explosion occurred. The top head of 500 gallon reactor got separated from the vessel and thrown to a distance of 500 feet.

   The accident was investigated. It was revealed that sulphuric acid quantity taken was less than the required. It has shifted the sulphuric acid and intermediate ratio forming an unstable mixture and on addition of nitration mixture and heating up an uncontrollable exothermic reaction occurred resulted in the accident.

2. An accident was reported in DNR (dinitro resorcinol) manufacturing. On investigation of this also revealed that the nitric acid taken was insufficient. A thick sticky mass formed during first nitration partially blocking the discharge line. During the next nitration material decomposed and led to explosion. One person died.

3. Another accident reported in delay composition mixing. The delay composition was being mixed in a ball mill. The batch size was 10 Kg. After getting mixed for 3 hours the composition caught fire.

   The investigation report says the balls that being used were rubber lined steel balls. The rubber coating was worn out on some of the balls.

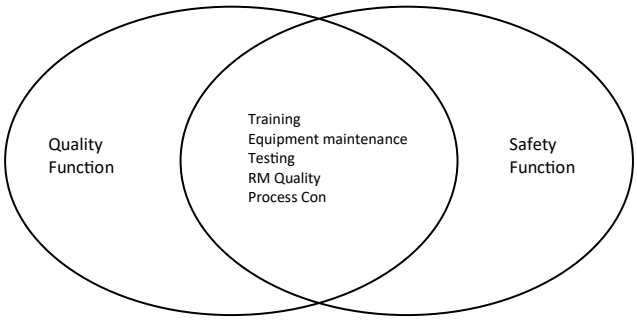
   The root cause analysis for the above cases reveals

   - Lack of proper process monitoring,
   - Lack of proper check lists
   - Lack of proper supervision
   - Lack of training

   In fact, all the above might have been incorporated in the quality management system. A well-made quality management system will address all the above issues.

   The safety of operations mainly depends on proper process control, raw material quality, proper functioning of equipment and training to personnel involved. All these parameters will be addressed in quality assurance which is an integral part of Quality Management.

   The following figure illustrates the overlap of functions for quality and safety of operations.



Raw materials

Raw material specifications are to be designed properly with clear tolerable limits of impurities which may cause unsafe condition in the process. Each and every lot of raw materials should be tested for specifications and in case of any deviation from the specifications; it should be rejected and not used. If the manufacturer doesn't have facility for testing, it should be tested at laboratories available outside. But they should not be used without testing. Manufacturer's certificate can also be used, if reliable.

To illustrate this we can take the example of sodium nitrate for explosive manufacturing. If nitrites are present in sodium nitrate; that may cause excess gassing in matrix itself which is not safe. So sodium nitrate specification should tell about allowable nitrite content and every batch of material should be tested for nitrite content before using. Nitrite content in nitrate poses both quality as well as safety problem. But nitrate content as impurity in nitrite may cause only quality problem but not safety problem

Another example can be copper content in lead nitrate used for the manufacture of lead azide by precipitation from sodium azide solution. If copper impurity is there in lead nitrate; the copper azide will be formed. Copper azide is very reactive and sensitive than lead azide and will have higher risks in handling the product.

Nitrous acid content in nitric acid for PETN manufacture is another threat for safety.

Process

During the manufacturing process parameters are to be followed as defined. The process parameters will be designed basing on the reaction so that the formed product will match the specifications. But in an explosive manufacturing the process parameters are to be designed keeping hazards involved in mind.

As an example nitration of pentaerythritol to pentaerythritol tetra nitrate can be discussed. This reaction is exothermic and lot of heat will be liberated. There are many reports about accidents in this operation from many manufacturing industries.

To have a controlled reaction; the temperature at which the reaction is to be carried out is to be fixed and should be maintained well within that temperature. The quality inspector should have temperature of the reaction also on his check list.

Nitration of PE is carried out with fuming nitric acid. The nitric acid concentration during the reaction is to be maintained as required to avoid back reaction and heat development. Nitric acid quantity and purity are to be monitored closely. Heat test is mandatory for PETN safety as presence of acidity makes PETN liable to decomposition.

Another example; is crystal shape of lead azide. Needle shaped crystals are very sensitive and there should not be formation of these crystals. Any change in the quality of raw materials or change in process parameters may lead to the formation of these crystals. Hence, during the process checking of crystal shape is very important. Hence quality checklist should contain this as a check point.

SMS Series : Maintenance

by

Andy Begg

with contributions from

Steve Caldwell and Brian Allison

Maintenance

When a plant or piece of equipment is brought into service there should be a clearly defined Basis of Safety. This BOS document will state clearly the operational, mechanical, electrical and control requirements for ongoing safe operation. Specifically, this will include the condition of the various items of plant equipment – mixers, augers, bearings, work surfaces, cartridging machines, control systems, detonation traps and so on.

Scheduled maintenance, inspection and breakdown monitoring systems are essential to ensure ongoing safe operation as defined in the Basis of Safety and Hazard Studies for the plant, equipment or system. Such systems should enhance performance and prevent a range of undesirable consequences including:

- Injury or death to personnel.
- Damage to plant and equipment.
- Pollution, damage or any other form of harm to the environment.
- Poor or unexpected product quality or performance and the impact this has on the end user or other affected parties.
- Non-conformance to statutory and company standards and the consequent liabilities.
- Poor asset performance and longevity.
- Business risks associated with all of the above.

General requirements for maintenance

All facilities and equipment will be maintained to ensure safe operation. There will be periodic routine inspections of plant, equipment and premises to ensure fitness for purpose and compliance with the company and regulatory requirements. Records will be maintained of all maintenance requirements and inspections planned and completed. There should be a plant or area equipment register that lists all specific plant items that require maintenance or inspection. Each item should be given a unique reference code. This register should be updated on a regular basis to ensure all new items – for example from a new project or modification to an existing opera-

tion – are registered for inspection and that items taken out of service are removed from the register. Changes to plant P&ID's usually will require the register to be updated.

Suppliers of equipment will often provide recommendations for maintenance and service inspections. These can form a basis for the local requirements, but they will often require to be expanded to include explosives or other process specific safety requirements. A simple example would be the clearance between a mixer blade and the sidewall of the mixer. Pumps being used for emulsions will require different maintenance regimes depending on the products being pumped, quantities being pumped, temperature and so on.

Scope

The maintenance system will apply to all process and non-process equipment, buildings and site services and infrastructure including:

- All equipment identified during basis of safety or hazard studies as defined on plant piping and instrumentation diagrams.
- All "critical equipment" the failure of which may have catastrophic consequences and any equipment in contact with or processing explosives.
- HSE and security equipment such as alarms, trips, interlocks, cameras, electric fences, effluent and gas monitors, other fail-safe devices etc.
- Key service equipment such as hydraulic power packs, refrigeration plants, compressors, steam raising plant, roads, walkways etc.
- PES (programmable electronic systems), computers, PLC's, SCADA's, DCS's (distributed control systems) etc.
- Pressure systems, hazardous chemical systems, lifting equipment, critical machines, pipe bridges and structures, drainage systems, ladders, portable tools etc, governed by statutory legislation or company standards.
- Product or system quality control and assurance procedures and equipment
- Pipe bridges, roadways, vehicles, offices etc.
- Fire Fighting Systems, Hydrants, extinguishers etc.

Some examples in addition to the obvious process items are:

1. Portable electrical tools
2. Fixed electrical items such as radios, refrigerators, microwave ovens
3. Office equipment such as computers, shredders
4. Site vehicles
5. Trolleys and carts used in explosives processing buildings
6. High pressure water washers. Safety showers
7. Forklift trucks
8. Ladders, scaffolding
9. Lifting equipment – slings, chains, hoists, beams
10. PPE – safety harnesses, SCBA sets (these may be managed under a Safety procedure)

And so on.

Special requirements

In some situations, there may be equipment where a failure due to poor or inadequate maintenance could result in catastrophic consequences such as loss of life and where it is felt that special maintenance is required. Such items as often regarded as "critical machines or items" and they will be managed as a special category in the maintenance system. Examples include emulsion pumps, dynamite mixers and cartridging machines, ammonia compressors.

The scheduled inspection system should contain the following elements, which may be generated electronically or in the form of physical charts and records etc.:

- Identification and registration for each piece of equipment to be inspected and the identification of critical equipment.
- Formalised schedules and inspections setting out frequency of inspection and content, including written and approved inspection methodologies where appropriate.
- Requirements for the qualification and training of competent personnel to carry out inspections.
- List of approved spare parts incorporating supplier recommendations and technical data sheets.
- Systems to track actions and non-conformances to the point of closure and highlight overdue items.
- Requirements for system auditing, inspection and review and formal records to prove compliance.
- Requirements for recording breakdown history and trends.

Management of the system.

Before any piece of equipment is included in a maintenance schedule it must first be approved by a competent design authority. This to ensure that it is fit for purpose and complies with all relevant design codes, BOS and hazard analysis.

A competent engineer is responsible for the scheduled maintenance and inspection system and must ensure the following:

- That a system conforming to this minimum standard is implemented and operating in his/her area.
- Where an inspection methodology is required, he/she must ensure that these are documented and available.
- That all personnel who carry out scheduled inspections are adequately qualified or trained and formally appointed to carry out the inspections.
- That formal records of all the required inspections are ~~in~~ completed, signed off and maintained for a minimum period - typically three years.
- That new, modified or obsolete equipment is reviewed to ensure compliance with this standard and all registers, inspections and monitoring requirements are updated accordingly.
- His/her area is regularly audited to ensure compliance with this standard. This should include a review of inspection content, frequency, breakdown monitoring systems, qualification and training requirements. (He/she may choose to involve functional expertise to assist in these audits).
- All actions, breakdowns and plans for close out must be recorded. Corrective action, modification or improvement must be taken for repeated defects, or equipment faults in conformance with the modification proposal system.

Audit checklist

1. Is there a plant wide register of equipment that requires scheduled maintenance? This should include plant process equipment, electrical and mechanical systems, structures, roadways, buildings and vehicles.
2. Does each item have a unique reference number?
3. Does each plant item have an appropriate maintenance schedule that may include
    a. Daily inspection checklist and record sheet
    b. Preventative maintenance checklist
    c. Monthly through to annual planned maintenance and replacement schedule.
4. Are there written maintenance procedures for each task that indicate clearly how the work should be carried out?
5. Are maintenance personnel trained in any special skills that may be required to undertake the work?
    a. Decontamination of explosives plant equipment
    b. Hot work
    c. Work on electrical systems
    d. Work at height
    e. Confined space working
    f. Use of breathing apparatus
    g. Specialist equipment training from suppliers e.g. pumps

6. Are the facilities provided for maintenance adequate and well operated?
    a. Provision of adequate working space
    b. Storage areas for tools and equipment
    c. Housekeeping
    d. Gas cylinders storage area
    e. Solvent storage
    f. Separated hot work area
    g. Provision of appropriate PPE, fire extinguishers and eyewash facilities.
    h. Condition of equipment
    i. Waste management and dedicated decontamination area and procedure

Inspection guide for the auditor

Check

- Do items have unique identification numbers and are these consistent with the register?
- Are there any new items that have not been included in the register?
- Review the current P&ID's and check that the equipment register is consistent with the items noted on the P&ID.
- Check training records or qualifications for electricians, welders, decontamination procedures etc
- Hot work area
    - ◊ Proximity of flammable materials
    - ◊ Securing the area to restrict access during welding
    - ◊ Condition of PPE – goggles, gloves, aprons etc
    - ◊ Condition of cables and gas lines
    - ◊ Securing of gas bottles
- Pressure vessels – registration and testing documents, **calibrated test equipment with records**
- Is there a "critical items" list and if so, is it adequate?
- Condition of tools - damaged electrical wiring and connections, broken or damaged tools, home-made tools etc
- Spill control for solvents and lubricants
- Disposal practices for wastes – metals, rags, solvents etc
- Presence of contaminated process equipment – in particular explosives
- Slip and trip hazards – cables and hoses on the floor, oil spills etc.

Example of routine maintenance requirement – ribbon blender for emulsion explosive

Monthly

Check shaft packing gland for tightness and overheating (*note - mechanical seals are often substituted for packing glands. Lip seals are preferred not packing glands or mechanical seals)*
Check discharge gate actuator function
Check safety interlocks and emergency stops
Oil chain drive, (if fitted)
Check integrity of screens and guards
Check pneumatic system for air leaks

6 Monthly

- Undertake monthly checks
- Check heat tracing (set points and cut outs)
- Check continuity of earthing/grounding
- Replace gearbox oil

Yearly

- Undertake 6 monthly checks
- Check for structural integrity and corrosion
- Check water jackets for leaks
- Check and re grease main bearings
- Check drive coupling bushes
- Check main shaft blade clearances along the full length, against previous records
- Check for abnormal noises when running blender in empty mode

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
M												
6M												
Year-ly												

SERVICE LOG

No. Number

Action

Parts Used

Cost

Time

Date

Did you know that - - - ? - by Wen Yu

Did you know that some chemicals are not compatible with the metals used in the manufacturing equipment, tooling? Copper or copper alloy (e.g. brass, bronze) is widely used in the explosives manufacturing processes due to its softness and non-sparking properties. However, some chemicals, such as sodium azide, lead azide and ammonium nitrate can react with copper or copper alloy under moist conditions to form highly sensitive explosives, copper azide and Tetra-amine copper nitrate (TACN), respectively. These explosives can present a hazard during normal operation and maintenance activities

The following controls are to eliminate the risk:

- Do not use copper or copper alloys where sodium azide, lead azide and ammonium nitrate prill, ammonium nitrate-based oxidizer solution or emulsion may be present, in particular under the moist conditions.

- Replace the internal components made of brass inside valves, pumps, fittings etc. with copper free materials, such as stainless steel.

- Provide training to operators and maintenance workers to identify such explosives and report immediately. . One visual indication that there could be copper present in pipework, valves etc is the green colour associated with copper salts.

Conduct a risk assessment and ensure an appropriate decontamination procedure is carried out before any maintenance work is started regardless of it being large or small.

Mobile Security Vaults - a solution for increased security requirements

by

Hans Wallin

High Security Building (HSB) For Data Centre

Mobile Security Vault (MSV) Steel Composite

Detail of Protected Lock Case

In an uncertain world, requirements for approved security systems and more secure storage are increasing. On 1 April 2019, the new Swedish Security Protection Act will come into force. This Law covers all security-sensitive activities, more than before, and applies to both public and private operations. The obligations of those who conduct business will become clearer and adapted to the threats of today.

- The great difference is that the authorities will transfer the responsibility to the companies, which must begin to make risk analyses to see what needs to be protected, says Hans Wallin, technical expert at the Cesium AB in Katrineholm. Cesium, managed by its founder and owner Jack Gustavsson, has manufactured mobile vaults for fifteen years and has become one of the leading companies of the industry. Cesium is now ready to respond to the increased demand for products for secure storage required by the new Security Protection Act.

- We began to think along these lines already 15 years ago with our Mobile Security Vaults. Perhaps we were too early then, but now reality has caught up, says Hans Wallin.

- Then fixed installations were built. Now we are building movable sections that can be relocated if better needed elsewhere. Advantages are of course economy, but also that the level of protection of our products is much higher, says Peter Adolfsson, marketing manager at Cesium.

- Fixed installations were usually built as rock constructions, says Hans, expensive to build, and today's weapons can knock out also such facilities.

Secure storage facilities

- It is about creating secure storage for valuable assets. Large companies, such as Amazon, Microsoft, Facebook and Google, must make security assessments to evaluate their need for secure storage. Also, smaller companies may want to securely store sensitive documents, expensive tools, medicines or precious metals, but of course it also concerns storage of weapons, says Peter Adolfsson.

- Precious equipment, surveying instruments and other theft-prone property can be effectively protected. Cesium can offer opportunities to store property as securely as in a bank vault. You can simply take the vault with you "into the forest", says Hans Wallin.

- In Sweden, security law has now been tightened. The EU will probably do so, too. That is of course good for us and our company, says Peter Adolfsson. Facing an increase of threats of international terrorism and advanced crime that do not care about state borders, requirements for passive security will increase.

- Secure storage in, for example, server rooms is becoming increasingly important. Criminals have begun to break in and steal the servers. In the past mostly destruction and sabotage happened. Now the threat picture looks a little different. You may also face threats of inflicted damage if you will not pay up some money. Pure extortion! says Peter Adolfsson. Cesium also delivers larger and smaller element-built server halls, etc., with the same high protection level as the Mobile Security Vaults.

Theft is costing a lot

The need for secure storage space is tightened by the new legislation but the problem with theft of valuable material has existed for a long time.

- In the construction sector in Sweden, tools and other goods are stolen annually at a worth of SEK 5.5 billion. And then we only talk about thefts reported to insurance companies. The true number maybe over 8 billion. After all, it will be the end customers who will have to pay and they have started noticing it, since it affects building cost. Something needs to be done in order to simplify for builders and make it difficult for crime, says Peter Adolfsson.

When Jack Gustavsson and Cesium started building Mobile Security Vaults 15 years ago the primary target group was the construction and industry sector. Afterwards it was found that the products also fitted an international market, where there were few offers of qualified secure storage, including for weapons and munitions.

Poor weapons control

- There are about 200 million state-owned weapons, under control. But there may be, additionally, 800 million weapons in circulation, under less or no control, says Hans Wallin, who also works within the UN SaferGuard program, which aims to reduce the huge amounts of illegal weapons and munitions "in orbit" around the world.

- Many countries have poor control, and weapons, ammunition and explosives may be kept under bad security. It is not uncommon with "losses" of state-owned weapons. In 2003 millions of small calibre weapons "disappeared" in Iraq. In 2014, 750,000 US weapons "were lost" in Afghanistan, says Hans.

- We notice an increased interest from authorities and countries concerning more secure weapons and munitions storages,

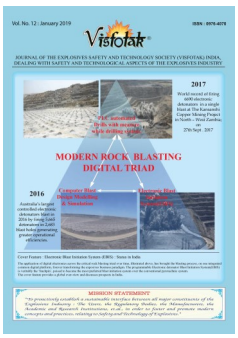
says Peter Adolfsson.

Cesium's Mobile Security Vaults are made of steel and concrete and almost 100% locally manufactured in Katrineholm. If the customer is abroad, they can also be license-built there. These are solid pieces of equipment - a 20-foot vault weighs 26 tons, but can be carried by a normal container transporter. The security vault will then be anchored to the floor or a concrete slab and equipped with alarm and satellite communication. An advantage of the Mobile Security Vaults is that they may be considered as both fixed and movable property. Different depreciation regulations will apply and the customer may choose the most suitable option.

Editing and English translation: Bo Janzon

Link to the VISFOTAK January 2019 Newsletter

VISFOTAK is a Corporate Associate of SAFEX based in India and the link is kindly supplied by Ardaman Singh.



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.

The deadline for articles for the September Newsletter is 10 September 2019 , I look forward to your support .

SAFEX BOARD OF GOVERNORS

UPCOMING EVENTS:

NIXT Conference #73 on Product Stewardship Johannesburg: 18 July 2019

ANNA Conference on Ammonium Nitrate, Vienna ,Austria : 8-13 September 2019

IME's 2019 Annual Meeting Lake Tahoe, USA: 8-10 October 2019

NIXT Conference #74 ,RDM, South Africa : 17 October 2019

ISEE 46th Annual Conference on Explosives and Blasting Technique, Denver Colorado : 26-29 January

SAFEX International Congress #20, Salzburg, Vienna : 25-26 May 2020

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